TUHH

Technische Universität Hamburg-Harburg

Module Manual

Master of Science

Environmental Engineering

Winter Term 2014

Table of Contents

Program description

Content:

Core qualification

Module: Waste Treatment Technologies

Courses:

Title	Typ	Hrs/wk
Waste and Environmental Chemistry	Laborpraktikum	2
Biological Waste Treatment	Problemorientierte Lehrveranstaltung	3

Module Responsibility:
Prof. Kerstin Kuchta

Admission Requirements:
none

Recommended Previous Knowledge:
chemical and biological basics

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
The module aims possess knowledge concerning the planning of biological waste treatment plants. Students are able to explain the design and layout of anaerobic and aerobic waste treatment plants in detail, describe different techniques for waste gas treatment plants for biological waste treatment plants and explain different methods for waste analytics.

Capabilities:
The students are able to discuss the compilation of design and layout of plants. They can critically evaluate techniques and quality control measurements. The students can recherché and evaluate literature and date connected to the tasks given in der module and plan additional tests. They are capable of reflecting and evaluating findings in the group.

Personal Competence:
Social Competence:
Students can participate in subject-specific and interdisciplinary discussions, develop cooperated solutions and defend their own work results in front of others and promote the scientific development in front of colleagues. Furthermore, they can give and accept professional constructive criticism.

Autonomy:
Students can independently tap knowledge from literature, business or test reports and transform it to the course projects. They are capable, in consultation with supervisors as well as in the interim presentation, to assess their learning level and define further steps on this basis. Furthermore, they can define targets for new application-or research-oriented duties in accordance with the potential social, economic and cultural impact.

ECTS-Credit points:
6 LP

Examination:
Projektarbeit

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Civil Engineering: Vertiefung Structural Engineering: Compulsory suffrage
Civil Engineering: Vertiefung Geotechnical Engineering: Compulsory suffrage
Civil Engineering: Vertiefung Coastal Engineering: Compulsory suffrage
Environmental Engineering: Kernqualifikation: Compulsory
International Management and Engineering: Vertiefung II. Energy and Environmental Engineering: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Energy: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Waste and Environmental Chemistry (Laborpraktikum)

Lecturer:
Prof. Kerstin Kuchta

Language:
DE/EN

Cycle:

WS

Content:

The participants are divided into groups. Each group prepares a transcript on the experiment performed, which is then used as basis for discussing the results and to evaluate the performance of the group and the individual student.
In some experiments the test procedure and the results are presented in seminar form, accompanied by discussion and results evaluation.
Experiments ar e.g.
Screening and particle size determination
Fos/Tac
AAS
Chalorific value

Literature:

Scripte

Course: Biological Waste Treatment (Problemorientierte Lehrveranstaltung)

Lecturer:

Prof. Kerstin Kuchta

Language:

EN

Cycle:

WS

Content:

1. Introduction
2. biological basics
3. determination process specific material characterization
4. aerobic degradation (Composting, stabilization)
5. anaerobic degradation (Biogas production, fermentation)
6. Technical layout and process design
7. Flue gas treatment
8. Plant design practical phase

Literature:

Module: Environmental Protection and Management

Courses:

Title	Typ	Hrs/wk
Integrated Pollution Control	Vorlesung	2
Health, Safety and Environmental Management	Vorlesung	2
Exercise Health, Safety and Environmental Management	Gruppenübung	1

Module Responsibility:
Prof. Stephan Köster

Admission Requirements:
none

Recommended Previous Knowledge:

- Environmental Technologies
- Environmental Legislation
- Environmental Assessment

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
The students are able to describe the basics of regulations, economic instruments, voluntary initiatives, fundamentals of HSE legislation ISO 14001, EMAS and Responsible Care ISO 14001 requirements. They can analyse and discuss industrial processes, substance cycles and approaches from end-of-pipe technology to eco-efficiency and eco-effectiveness, showing their sound knowledge of complex industry related problems. They are able to judge environmental issues and to widely consider, apply or carry out innovative technical solutions, remediation measures and further interventions as well as conceptual problem solving approaches in the full range of problems in different industrial sectors.

Capabilities:
Students are able to assess current problems and situations in the field of environmental protection. They can consider the best available techniques and to plan and suggest concrete actions in a company- or branch-specific context. By this means they can solve problems on a technical, administrative and legislative level.

Personal Competence:
Social Competence:
The students can work together in international groups.

Autonomy:
Students are able to organize their work flow to prepare themselves for presentations and contributions to the discussions. They can acquire appropriate knowledge by making enquiries independently.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Energy and Environmental Engineering: Vertiefung Environmental Engineering: Compulsory suffrage
Environmental Engineering: Kernqualifikation: Compulsory
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Energy: Compulsory suffrage
Product Development, Materials and Production: Vertiefung Product Development: Compulsory suffrage
Product Development, Materials and Production: Vertiefung Production: Compulsory suffrage
Product Development, Materials and Production: Vertiefung Materials: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory
Water and Environmental Engineering: Vertiefung Cities: Compulsory

Course: Integrated Pollution Control (Vorlesung)

Lecturer:
Prof. Stephan Köster

Language:
EN

Cycle:
WS

Content:
The lecture focusses on:

- The Regulatory Framework
- Pollution & Impacts, Characteristics of Pollutants
- Approaches of Integrated Pollution Control
- Sevilla Process, Best Available Technologies & BREF Documents
- Case Studies: paper industry, cement industry, automotive industry
- Field Trip

Literature:

Course: Health, Safety and Environmental Management (Vorlesung)

Lecturer:
Dr. Constantin Stephan

Language:
EN

Cycle:
WS

Content:
Objectives of and benefit from HSE management From dilution and end-of-pipe technology to eco-efficiency and eco-effectiveness Behaviour control: regulations, economic instruments and voluntary initiatives Fundamentals of HSE legislation ISO 14001, EMAS and Responsible Care ISO 14001 requirements Environmental performance evaluation Risk management: hazard, risk and safety Health and safety at the workplace Crisis management

Literature:
C. Stephan: Industrial Health, Safety and Environmental Management, MV-Verlag, Münster, 2007/2012 (can be found in the library under GTG 315)

Course: Exercise Health, Safety and Environmental Management (Übung)

Lecturer:
Dr. Constantin Stephan

Language:
EN

Cycle:
WS

Content:
Objectives of and benefit from HSE management From dilution and end-of-pipe technology to eco-efficiency and eco-effectiveness Behaviour control: regulations, economic instruments and voluntary initiatives Fundamentals of HSE legislation ISO 14001, EMAS and Responsible Care ISO 14001 requirements Environmental performance evaluation Risk management: hazard, risk and safety Health and safety at the workplace Crisis management

Literature:
C. Stephan: Industrial Health, Safety and Environmental Management, MV-Verlag, Münster, 2007/2012 (can be found in the library under GTG 315) Exercises can be downloaded from StudIP

Module: Practical Course in Water and Wastewater Technology

Courses:

Title	Typ	Hrs/wk
Practical Course in Water and Wastewater Technology I	Laborpraktikum	2
Practicle Course of Wastewater Technology II	Laborpraktikum	3

Module Responsibility:
Dr. Holger Gulyas

Admission Requirements:
none

Recommended Previous Knowledge:
Basic knowledge in chemistry and physics

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
The students know basic analytical procedures for evaluating the quality of water and wastewater. They have knowledge about fundamental process engineering features of important water and wastewater treatment technologies.
Capabilities:
The students are able to understand and to practically apply methodologies for wastewater analysis as well as descriptions of experiments and experimental setups in wastewater technology.

Personal Competence:
Social Competence:
Autonomy:
The students are able to conduct experiments following written procedures without external assistance.

ECTS-Credit points:
6 LP

Examination:
Schriftliche Ausarbeitung

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Environmental Engineering: Kernqualifikation: Compulsory
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Practical Course in Water and Wastewater Technology I (Laborpraktikum)

Lecturer:
Dr. Holger Gulyas

Language:
DE/EN

Cycle:
WS

Content:
- Impact of pretreatment of wastewater samples on analytical results
- Analysis of nutrients in wastewater samples (different methods for nitrate analysis)
- Alkalinity
- TOC, COD
- microscopic analysis of microorganisms relevant in wastewater treatment

Literature:
Skript auf StudIP

Course: Practicle Course of Wastewater Technology II (Laborpraktikum)

Lecturer:
Dr. Joachim Behrendt

Language:
DE/EN

Cycle:

WS

Content:

Experiments:
Oxygen transfer
Oxygen Uptake rate
Sludge dewatering
Tracer
Flocculation

Literature:

Skript/Script

Module: Special areas of environmental protection

Courses:

Title	Typ	Hrs/wk
Fluid Mechanics and Hydraulics	Vorlesung	3
Environmental Analysis	Vorlesung	2

Module Responsibility:
Dr. Holger Gulyas

Admission Requirements:
none

Recommended Previous Knowledge:
Fundamentals of inorganic and organic chemistry

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
After completing this module, the students know different methods for analyzing pollutants in different environmental compartments.
Capabilities:
The students are capable of selecting suitable analytical procedures for evaluating particular kinds of contamination in different environmental compartments. They are able to estimate the effort for realizing the analyses.

Personal Competence:
Social Competence:
Autonomy:
The students can make sources accessible in order to acquire special knowledge about the subject.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Environmental Engineering: Kernqualifikation: Compulsory

Course: Fluid Mechanics and Hydraulics (Vorlesung)

Lecturer:
Dr. Mohammad Hassan Nasermoaddeli

Language:
EN

Cycle:
WS

Content:
Properties of fluid, hydrostatics, Fluid kinematics, conservation equations (mass, energy and momentum), flow in pipes, boundary layer theory of laminar and turbulent flow, viscous flow (skin friction and drag forces), open channel hydraulics, flow in compound and natural channels, local energy head losses

Literature:
R.L. Street, G.Z. Watters, J.K. Vennard: Elementary Fluid Mechanics, 7th edition, 1996
Chow, V.T., Open Channel hydraulics, Ven Te Chow, 1988

Course: Environmental Analysis (Vorlesung)

Lecturer:
Dr. Holger Gulyas, Dr. Kim Karen Kleeberg

Language:
EN

Cycle:
WS

Content:
Introduction
Sampling in different environmental compartments, sample transportation, sample storage

Sample preparation
Photometry
Wastewater analysis
Introduction into chromatography
Gas chromatography
HPLC
Mass spectrometry
Optical emission spectrometry
Atom absorption spectrometry
Quality assurance in environmental analysis

Literature:

Roger Reeve, Introduction to Environmental Analysis, John Wiley & Sons Ltd., 2002 (TUB: USD-728)
Pradyot Patnaik, Handbook of environmental analysis: chemical pollutants in air, water, soil, and solid wastes, CRC Press, Boca Raton, 2010 (TUB: USD-716)
Chunlong Zhang, Fundamentals of Environmental Sampling and Analysis, John Wiley & Sons Ltd., Hoboken, New Jersey, 2007 (TUB: USD-741)
Miroslav Radojević, Vladimir N. Bashkin, Practical Environmental Analysis
RSC Publ., Cambridge, 2006 (TUB: USD-720)
Werner Funk, Vera Dammann, Gerhild Donnevert, Sarah Iannelli (Translator), Eric Iannelli (Translator), Quality Assurance in Analytical Chemistry: Applications in Environmental, Food and Materials Analysis, Biotechnology, and Medical Engineering, 2nd Edition, WILEY-VCH Verlag GmbH & Co. KGaA,Weinheim, 2007 (TUB: CHF-350)
STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, 21st Edition, Andrew D. Eaton, Leonore S. Clesceri, Eugene W. Rice, and Arnold E. Greenberg, editors, 2005 (TUB:CHF-428)

K. Robards, P. R. Haddad, P. E. Jackson, Principles and Practice of
Modern Chromatographic Methods, Academic Press

G. Schwedt, Chromatographische Trennmethoden, Thieme Verlag
H. M. McNair, J. M. Miller, Basic Gas Chromatography, Wiley

W. Gottwald, GC für Anwender, VCH
B. A. Bidlingmeyer, Practical HPLC Methodology and Applications, Wiley

K. K. Unger, Handbuch der HPLC, GIT Verlag

G. Aced, H. J. Möckel, Liquidchromatographie, VCH
Charles B. Boss and Kenneth J. Fredeen, Concepts, Instrumentation and Techniques in Inductively Coupled Plasma Optical Emission Spectrometry
Perkin-Elmer Corporation 1997, On-line available at:
http://files.instrument.com.cn/bbs/upfile/2006291448.pdf
Atomic absorption spectrometry: theory, design and applications, ed. by S. J. Haswell 1991 (TUB: 2727-5614)
Royal Society of Chemistry, Atomic absorption spectometry (http://www.kau.edu.sa/Files/130002/Files/6785_AAs.pdf)

Module: Wastewater Systems and Reuse

Courses:

Title	Typ	Hrs/wk
Wastewater Systems - Collection, Treatment and Reuse	Vorlesung	2
Wastewater Systems - Collection, Treatment and Reuse	Hörsaalübung	1
Sustainable Water Management	Problemorientierte Lehrveranstaltung	2

Module Responsibility:
Prof. Ralf Otterpohl

Admission Requirements:
Bachelor's degree

Recommended Previous Knowledge:
Knowledge of water and wastewater management and the key processes involved in water and wastewater treatment.

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students are able to outline key areas of the full range of treatment systems in water and waste water management, as well as their mutual dependence for sustainable water protection. They can describe relevant economic, environmental and social factors.
Capabilities:
Students are able to pre-design and explain the available water and wastewater treatment processes and the scope of their application in municipal and for some industrial treatment plants.

Personal Competence:
Social Competence:
Through partial PBL students have learned to research and to interact with other students on the subjects covered.
Autonomy:
Students are in a position to work on a subject and to organize their work flow independently. They can also present on this subject.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Environmental Engineering: Kernqualifikation: Compulsory
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Energy: Compulsory suffrage

Course: Wastewater Systems - Collection, Treatment and Reuse (Vorlesung)

Lecturer:
Prof. Ralf Otterpohl

Language:
EN

Cycle:
SS

Content:
•Understanding the global situation with water and wastewater
•Regional planning and decentralised systems
•Overview on innovative approaches
•In depth knowledge on advanced wastewater treatment options for different situations, for end-of-pipe and reuse
•Mathematical Modelling of Nitrogen Removal
•Exercises with calculations and design

Literature:
Henze, Mogens:
Wastewater Treatment: Biological and Chemical Processes, Springer 2002, 430 pages
George Tchobanoglous, Franklin L. Burton, H. David Stensel:
Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy
McGraw-Hill, 2004 - 1819 pages

Course: Wastewater Systems - Collection, Treatment and Reuse (Übung)

Lecturer:
Prof. Ralf Otterpohl

Language:
EN

Cycle:
SS

Content:
•Understanding the global situation with water and wastewater
•Regional planning and decentralised systems
•Overview on innovative approaches
•In depth knowledge on advanced wastewater treatment options for different situations, for end-of-pipe and reuse
•Mathematical Modelling of Nitrogen Removal
•Exercises with calculations and design

Literature:
Henze, Mogens:
Wastewater Treatment: Biological and Chemical Processes, Springer 2002, 430 pages
George Tchobanoglous, Franklin L. Burton, H. David Stensel:
Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy
McGraw-Hill, 2004 - 1819 pages

Course: Sustainable Water Management (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Mathias Ernst

Language:
EN

Cycle:
WS

Content:
The course provides knowledge on the sustainable treatment and management of the resource water. Used water is an alternative resource and can be recycled in any field of the urban water cycle after adequate treatment. The resulting water quality is the decisive issue. In the course the central quality parameters of drinking- as well as wastewater assessment will be presented and discussed. Moreover the legal frame for water reuse in the EU and examples from all over the world will be communicated. The students receive the task to develop a conceptual design study of an indirect potable reuse facility in given boundary conditions. To fulfill this task, the students will work in small groups representing a consulting firm. Later in the course the firms will present their concepts. In preparation to the team presentation further knowledge on alternative water resources and sustainable management will be provided. International case studies will be presented and discussed. Next to the communication of technical details, planning tools for the implementation of alternative water management will be given also Option for an effective public perception program of later water users.

Literature:

- Milestones in Water Reuse, V. Lazarova, T. Asano, A. Bahri, J. Anderson, IWA Publishing 2013
- Current UN World Water Development Reports
- Water Security for Better Lives, OECD Studie 2013
- PPT's provided during the course

Courses:

Title	Typ	Hrs/wk
Sociology of Work	Seminar	2
Blue Engineering – Aspects of social and ecological responsibility II	Seminar	1
German as a Foreign Language for International Master Programs	Seminar	4
European Culture: Architectural and Cultural History Course A	Seminar	2
European Culture: Architectural and Cultural History Course B	Seminar	2
European Culture: History II.	Seminar	2
European Culture: Art	Seminar	2
Engineering Education Research and Applications	Seminar	2
Human Factors in Aviation and Maritime Systems	Vorlesung	2
Foreign Language Course	Seminar	2
Management and Communication	Seminar	2
Humanities and Engineering: Intercultural Communication	Seminar	2
Humanities and Engineering: Politics	Seminar	2
Theory of Communication	Seminar	2
Creative Processes in Technology, Music and the Arts	Seminar	2
Power plays in organizations: Micro-political competence and gender competence for professional practice	Seminar	2
Socio-economic and ecological Responsability in Engineering Profession	Seminar	2
Sociology and Social Critism	Seminar	2
World Literature: Meaning and Interpretation in the Interculture Dialogue	Seminar	2
Economic Sociology	Seminar	2
Academic Writing for Engineers	Seminar	2

Module Responsibility:
Dagmar Richter

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Capabilities:

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
6 LP

Examination:

Workload in Hours:
Indipendent Study Time: 96, Study Time in Lecture: 84

Assignment for the Following Curricula:
Civil Engineering: Kernqualifikation: Compulsory
Bioprocess Engineering: Kernqualifikation: Compulsory
Chemical and Bioprocess Engineering: Kernqualifikation: Compulsory
Computer Science: Kernqualifikation: Compulsory
Electrical Engineering: Kernqualifikation: Compulsory
Energy and Environmental Engineering: Kernqualifikation: Compulsory
Energy Systems: Kernqualifikation: Compulsory
Environmental Engineering: Kernqualifikation: Compulsory
Aircraft Systems Engineering: Kernqualifikation: Compulsory
Global Innovation Management: Kernqualifikation: Compulsory suffrage
Computational Science and Engineering: Kernqualifikation: Compulsory
Information and Communication Systems: Kernqualifikation: Compulsory

International Management and Engineering: Kernqualifikation: Compulsory
Logistics, Infrastructure and Mobility: Kernqualifikation: Compulsory
Mechatronics: Kernqualifikation: Compulsory
Microelectronics and Microsystems: Kernqualifikation: Compulsory
Product Development, Materials and Production: Kernqualifikation: Compulsory
Renewable Energies: Kernqualifikation: Compulsory
Naval Architecture and Ocean Engineering: Kernqualifikation: Compulsory
Theoretical Mechanical Engineering: Kernqualifikation: Compulsory
Process Engineering: Kernqualifikation: Compulsory
Water and Environmental Engineering: Kernqualifikation: Compulsory

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Course: Sociology of Work (Seminar)

Lecturer:
Prof. Gabriele Winker

Language:
DE

Cycle:
WS

Content:
Work is a central sociological category that mediates between individual and society. Currently, it is subject to radical and diverse processes of change. In the seminar course, we will present and discuss recent findings in the field of work research. Topics include, among others, subjectivation and precarisation of labor as well as reproductive and care work.

Literature:
Fuchs, Tatjana (2006): Kurzfassung Was ist gute Arbeit? Anforderungen aus der Sicht von Erwerbstätigen In: INIFES (Hg.): Forschungsbericht an die Bundesanstalt für Arbeitsschutz und Arbeitsmedizin. Stadtbergen, 13-38
Hochschild, Arlie Russell, 2003. Love and Gold. In: femina politica, Zeitschrift für feministische Politik-Wissenschaft, 12.Jg. Heft 1/2003. S.77-9
Kratzer, Nick u.a. (2011): Leistungspolitik und Work-Life-Balance. Eine Trendanalyse des Projekts Lanceo. Institut für Sozialwissenschaftliche Forschung e. V. ISF München
Lehndorff, Steffen (2003): Marktsteuerung von Dienstleistungsarbeit. In: Dörre, Klaus; Röttger, Bernd (Hg.): Das neue Marktregime. Konturen eines nachfordistischen Produktionsmodells. Hamburg: VSAVerl., S. 153 171
Marrs, Kira (2010): Herrschaft und Kontrolle in der Arbeit. In: Böhle, Fritz/ Voß, Günter/ Wachtler, Günther (Hg.): Handbuch Arbeitssoziologie. Wiesbaden, 331-358
Bourdieu, Pierre (1998): Prekariat ist überall. In: Ders.: Gegenfeuer. Konstanz, 96-102

Course: Blue Engineering – Aspects of social and ecological responsibility II (Seminar)

Lecturer:
Robinson Peric

Language:
DE

Cycle:
WS

Content:
The seminar broaches the issue of both the connections and disparities between ecological and social responsibility in the context of engineering sciences. The underlying vision consists in a socially and ecologically sustainable development of technology, following a holistic approach in solving problems of mankind and nature. In this venue, the seminar provokes a creative immersion with questions regarding sustainable development and tries to evoke answers both on a small scale, as well as from a broader view.

Literature:
Literatur wird zu Beginn des Seminars bekanntgegeben.
References will be announced on the seminar's first appointment.

Course: German as a Foreign Language for International Master Programs (Seminar)

Lecturer:
Dagmar Richter

Language:
DE

Cycle:
WS/SS

Content:

Master's German course in cooperation with IBH e.V. – Master's German courses at different levels
In the international studies program these are obligatory for non-native speakers of German and for students without a DSH certificate or equivalent TEST-DAF result. Grading after an aptitude test. All other students must sign up for a total of 4 ECTS from the catalog of non-technical supplementary courses.

Literature:

- Will be announced in lectures -

Course: European Culture: Architectural and Cultural History Course A (Seminar)

Lecturer:
Dr. Marlis Bussacker

Language:
DE

Cycle:
WS

Content:

Literature:

- Wilfried Koch, Baustilkunde, Bertelsmann Lexikon Verlag, Gütersloh 1993
- Jacques Tullier, Geschichte der Kunst, Architektur, Skulptur, Malerei, Paris 2002
- Silvio Vietta, Europäische Kulturgeschichte – eine Einführung, München 2005

Course: European Culture: Architectural and Cultural History Course B (Seminar)

Lecturer:
Dr. Imke Hofmeister

Language:
DE

Cycle:
WS

Content:

Literature:

- Wilfried Koch, Baustilkunde, Bertelsmann Lexikon Verlag, Gütersloh 1993
- Jacques Tullier, Geschichte der Kunst, Architektur, Skulptur, Malerei, Paris 2002
- Silvio Vietta, Europäische Kulturgeschichte – eine Einführung, München 2005

Course: European Culture: History II. (Seminar)

Lecturer:
Prof. Margarete Jarchow, Dr. Martin Doerry

Language:
DE

Cycle:
WS

Content:

No event has left such deep traces on the political consciousness of the Federal Republic of Germany as the murder of millions of European Jews. With five autobiographical texts by survivors and victims of the holocaust the former historical events at that time are reconstructed. Their impact on current standards of political thought and action will be analyzed. The concentration of the individual stories facilitates the understanding of the historical context.
All titles are also available in English translation. Selected reviews as well as documentary footage are presented.

Literature:

Der Publizist Sebastian Haffner erzählt vom Entstehen des Nationalsozialismus und von seiner wachsenden Distanz zum NS-Regime („Geschichte eines Deutschen. Die Erinnerungen 1914 – 1933").
Der Historiker Saul Friedländer berichtet vom Überleben mit falscher Identität in einem französischen Internat („Wenn die Erinnerung kommt").
Der Kritiker Marcel Reich-Ranicki schreibt über seine Flucht aus dem Warschauer Ghetto und seine Liebe zur deutschen Kultur („Mein Leben").
Die Literaturwissenschaftlerin Ruth Klüger hat das KZ Auschwitz-Birkenau überlebt und wird bis heute von der eigenen Erinnerung an das Vernichtungslager verfolgt („weiter leben").
Die Ärztin Lilli Jahn schließlich wurde in Auschwitz von den Nazis umgebracht, ihr Schicksal ist in einem Briefwechsel mit ihren fünf Kindern dokumentiert (Martin Doerry: „Mein verwundetes Herz. Das Leben der Lilli Jahn. 1900 – 1944").

Course: European Culture: Art (Seminar)

Lecturer:
Dr. Gabriele Himmelmann

Language:
DE

Cycle:
WS/SS

Content:
The seminar focuses on works of painting, sculpture, arts and crafts, and design in a specific epoch of art and cultural history. By means of examples students acquire in-depth knowledge about works of art, their origins, their production conditions, their production techniques, and the societal framework conditions in their stylistic epoch. Ability to discuss and to communicate is trained by analyzing the works of art that are dealt with and eyes are opened for one's own and other cultures. The course includes excursions to museums and art museums to gain access to the customary ways in which museums present their exhibits.

Literature:
- Geschichte der Kunst in 12 Bänden, Beck'sche Reihe, München 2011
- Geschichte der bildenden Kunst in Deutschland, 8 Bände, München: Prestel 2006-
- Kunst-Epochen, Reclam-Universalbibliothek, Stuttgart 2002-
- Hans Belting / Heinrich Dilly / Wolfgang Kemp / Willibald Sauerländer / Martin Warnke, Kunstgeschichte – Eine Einführung, 7. Aufl. Berlin 2008
- Jutta Held / Norbert Schneider, Grundzüge der Kunstwissenschaft, Köln 2007
- Michael J. Gelb, How to think like Leonardo da Vinci, New York 1998
- E.H. Gombrich, The Story of Art, Phaidon Press Limited, London 1995
- Wilfried Koch, Baustilkunde, Bertelsmann Lexikon Verlag, Gütersloh 1993
- Jacques Tullier, Geschichte der Kunst, Architektur, Skulptur, Malerei, Paris 2002
- Silvio Vietta, Europäische Kulturgeschichte – eine Einführung, München 2005

Course: Engineering Education Research and Applications (Seminar)

Lecturer:
Prof. Christian Hans Gerhard Kautz

Language:
DE

Cycle:
WS/SS

Content:

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Learning scenarios, active learning methods
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Methods, results and implications of engineering education research
Conceptual understanding and misconceptions in introductory engineering courses
Research on learning behaviour, motivation, and beliefs
Preparation of Tutorials for selected lecture courses
Problem-Based Learning
Learning styles in engineering education
Assessment

Literature:
ausgewählte Artikel aus Fachzeitschriften werden an die Seminarteilnehmer verteilt, weiterführende Literatur wird zum jeweiligen Thema angegeben

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Course: Human Factors in Aviation and Maritime Systems (Vorlesung)

Lecturer:
Dr. Peter Maschke

Language:
DE

Cycle:
WS/SS

Content:
Title: Human Factor in Aviation and Maritime Systems
The human operator is both the strong and weak element within the aviation and maritime system. On the one hand, the operator increases the reliability of the technical system by a factor of ten. On the other hand, the operator him/herself induces a high error rate which is the

most critical risk in these man-machine systems: The main cause for more than 70% of accidents in aviation and maritime systems is due to human error. In this context the human operator (pilot, air traffic controller, astronaut or nautical officer) always interacts with machines or in a team of other operators.
To improve safety and efficiency, focus should be put both on designing a human oriented machine and on the operator: What are the important job requirements, how to find people who fulfil these requirements, and what can be reached by technical and non-technical training. For these options it has to be taken into account that human behavior is limited due to physiological and psychological aspects, e.g. human perception is biased due to subjectivity, and human decision making is not rational. The diversity of team situations is complicating these aspects.

Literature:

Badke-Schaub, Hofinger & Lauche (2008). Human Factors - Psychologie sicheren Handelns in Risikobranchen. Heidelberg: Springer.
Bauch, A. (2001). Ergonomie in der Flugzeugkabine - Passagierprozesse und manuelle Arbeitsablaufe. DGLR BERICHT (S. 49-56), ISSN 3932182154. Link: http://www.mp.haw-hamburg.de/pers/Scholz/dglr/bericht0101/Bauch.pdf
Goeters, K.-M. (Ed.) (2004). Aviation Psychology: Practice and Research. Aldershot: Ashgate.
Johnston,N., Fuller R., McDonald, N. (Eds.) (1994). Aviation Psychology: Training and Selection. Aldershot Hampshire: Avebury Aviation.
Sackett, P.R. & Lievens, F. (2008). Personnel Selection. Annual Review of Psychology, 59,
419-450.
Schuler, H. (2006). Lehrbuch der Personalpsychologie (2. Auflage). Göttingen: Hogrefe.
Schuler, H. (2007). Lehrbuch der Organisationpsychologie (4. Auflage). Huber: Bern.

Course: Foreign Language Course (Seminar)

Lecturer:
Dagmar Richter

Language:

Cycle:
WS/SS

Content:
In the Field of the Nontechnical Complementary Courses students are able to chose foreign language courses. Therefore the Hamburger Volkshochschule offers a special language programm on TUHH campus for TUHH Students. It includes courses in english, chinese, french, japanese, portuguese, russia, swedish, spanisch and german as a foreign language. All lectures impart common language knowledge, english courses although english for technical purposes.

Literature:
Kursspezifische Literatur / selected bibliography depending on special lecture programm.

Course: Management and Communication (Seminar)

Lecturer:
Prof. Gabriele Winker

Language:
DE

Cycle:
SS

Content:
The seminar will present basic elements of personality-promoting work organisation, motivation theories, different management concepts, communication theories and approaches to conflict and knowledge management. These subjects are applied to specific practical examples. Participants are given the opportunity to reflect on their own communicative and social behaviour.

Literature:

Große Boes, Stefanie; Kaseric, Tanja (2010): Trainer-Kit. Die wichtigsten Trainings-Theorien, ihre Anwendung im Seminar und Übungen für den Praxistransfer. 4. Aufl. Bonn: managerSeminare Verlags GmbH
Klutmann, Beate (2004): Führung: Theorie und Praxis. Hamburg: Windmühle
Laufer, Hartmut (2011): Grundlagen erfolgreicher Mitarbeiterführung. Führungspersönlichkeit, Führungsmethoden, Führungsinstrumente. 11. Auflage. Offenbach: GABAL
Neuberger, Oswald (2002): Führen und führen lassen. 6. überarb. und erw. Aufl. Stuttgart: Lucius und Lucius
Schulz von Thun, Friedemann; Ruppel, Johannes; Stratmann, Roswitha (2002): Miteinander reden: Kommunikationspsychologie für Führungskräfte. 4. Aufl. Reinbek bei Hamburg

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Course: Humanities and Engineering: Intercultural Communication (Seminar)

Lecturer:
Prof. Margarete Jarchow, Dr. Matthias Mayer

Language:

EN

Cycle:
WS/SS

Content:

As young professionals with technical background you may often tend to focus on communicating numbers and statistics in your presentations. However, facts are only one aspect of convincing others. Often, your personality, personal experience, cultural background and emotions are more important. You have to convince as a person in order to get your content across.
In this workshop you will learn how to increase and express your cultural competence. You will apply cultural knowledge and images in order to positively influence communicative situations. You will learn how to add character and interest to your talks, papers and publications by referring to your own and European Cultural background. You will find out the basics of communicating professionally and convincingly by showing personality and by referring to your own cultural knowledge. You will get hands-on experience both in preparing and in conducting such communicative situations. This course is not focussing on delivering new knowledge about European culture but helps you using existing knowledge or such that you can gain e.g. in other Humanities courses.
Content

- How to enrich the personal character of your presentations **by referring to European and your own culture**.
- How to properly arrange **content and structure.**
- How to use **PowerPoint for visualization** (you will use computers in an NIT room).
- How to be well-prepared and convincing **when delivering** your thoughts to your audience**.**

Literature:
Literaturhinweise werden zu Beginn des Seminars bekanntgegeben.
Literature will be announced at the beginning of the seminar.

Course: Humanities and Engineering: Politics (Seminar)

Lecturer:
Dr. Stephan Albrecht, Anne Katrin Finger, Gunnar Jeremias

Language:
EN

Cycle:
WS/SS

Content:
Scientists and engineers neither just strive for truths and scientific laws, nor are they working in a space far from politics. Science and engineering have contributed to what we now call the Anthropocene, the first time in the history of mankind when essential cycles of the earth system, e.g. carbon cycle, climate system, are heavily influenced or even shattered. Furthermore, Peak oil is indicating the end of cheap fossil energy thus triggering the search for alternatives such as biomass.
Systems of knowledge, science and technology in the OECD countries have since roughly 30 years increasingly become divided. On the one hand new technologies such as modern biotechnology, IT or nanotechnology are developing rapidly, bringing about many innovations for industry, agriculture, and consumers. On the other hand scientific studies from earth, environmental, climate change, agricultural and social sciences deliver increasingly robust evidence on more or less severe impacts on society, environment, global equity, and economy resulting from innovations during the last 50 years. Technological innovation thus is no longer an uncontested concept. And many protest movements demonstrate that the introduction of new or the enlargement of existing technologies (e.g. airports, railway stations, highways, high-voltage power lines surveillance) isn't at all a matter of course.
It is important to bear in mind the fact that all processes of technological innovation are made by humans, individually and collectively. Industrial, social, and political organizations as actors from the local to global level of communication, deliberation, and decision making interact in diverse arenas, struggling to promote their respective corporate and/or political agenda. So innovations are as well a problem of technology as a problem of politics. Innovation and technology policies aren't the same in all countries. We can observe conceptual and practical variations.
Since the 1992 Earth Summit in Rio de Janeiro Agenda 21 constitutes a normative umbrella, indicating Sustainable Development (SD) as core cluster of earth politics on all levels from local to global. Meanwhile other documents such as the Millennium Development Goals (MDG) have complemented the SD agenda. SD can be interpreted as operationalization of the Universal Declaration of Human Rights, adopted in 1948 by the General Assembly of the United Nations and since amended many times.
Engineers and scientists as professionals can't avoid to become confronted with many non-technical and non-disciplinary items, challenges, and dilemmas. So they have to choose between alternative options for action, as individuals and as members of organizations or employees. Therefore the seminar will address core elements of the complex interrelations between science, society and politics. Reflections on experiences of participants – e.g. from other countries as Germany – during the seminar are very welcome.
The goals of the seminar include:

- Raising awareness and increasing knowledge about the political implications of scientific work and institutions;
- Improving the understanding of different concepts and designs of innovation and technology policies;
- Increasing knowledge about the status and perspectives of sustainable development as framework concept for technological and scientific progress;
- Understanding core elements of recent arguments, conflicts, and crises on technological innovations, e.g. geo-engineering or bio-economy;

- Improving the understanding of scientists' responsibility for impacts of their professional activities;
- Embedding individual professional responsibility in social and political contexts.

The seminar will deal with current problems from areas such as innovation policy, energy, food systems, and raw materials. Issues will include the future of energy, food security and electronics. Historical issues will also be addressed.
The seminar will start with a profound overarching introduction. Issues will be introduced by a short presentation and a Q & A session, followed by group work on selected problems. All participants will have to prepare a presentation during the weekend seminar. The seminar will use inter alia interactive tools of teaching such as focus groups, simulations and presentations by students. Regular and active participation is required at all stages.

Literature:
Literatur wird zu Beginn des Seminars abgesprochen.

Course: Theory of Communication (Seminar)

Lecturer:
Dr. Michael Florian

Language:
DE

Cycle:
SS

Content:
The seminar focuses on sociological theories of communication and selected problems of practical application in the area of crisis communication. The issue of crisis communication will be analyzed on the basis of case studies.

Literature:
Habermas, Jürgen (1981): Theorie des kommunikativen Handelns. 2 Bände. Frankfurt/Main: Suhrkamp.
Luhmann, Niklas (1984): Soziale Systeme. Grundriß einer allgemeinen Theorie. Frankfurt/Main: Suhrkamp.
Malsch, Thomas (2005): Kommunikationsanschlüsse. Zur soziologischen Differenz von realer und künstlicher Sozialität. Wiesbaden: VS Verlag für Sozialwissenschaften.
Malsch, Thomas; Schmitt, Marco (Hg.) (2014): Neue Impulse für die soziologische Kommunikationstheorie. Empirische Widerstände und theoretische Verknüpfungen. Springer Fachmedien: Wiesbaden.
Meckel, Miriam; Schmid, Beat F. (Hg.) (2008): Unternehmenskommunikation. Kommunikationsmanagement aus Sicht der Unternehmensführung. 2., überarbeitete und erweiterte
Auflage. Gabler GWV Fachverlage: Wiesbaden.
Merten, Klaus (1999): Einführung in die Kommunikationswissenschaft. Bd 1/1: Grundlagen der Kommunikationswissenschaft. Münster: Lit Verlag.
Nolting, Tobias; Thießen, Ansgar (Hg.) (2008): Krisenmanagement in der Mediengesellschaft. Potenziale und Perspektiven der Krisenkommunikation. Wiesbaden: VS Verlag für Sozialwissenschaften.
Schützeichel, Rainer (2004): Soziologische Kommunikationstheorien. Konstanz: UVK Verlagsgesellschaft.
Thießen, Ansgar (2011): Organisationskommunikation in Krisen. Reputationsmanagement durch situative, integrierte und strategische Krisenkommunikation. VS Verlag für Sozialwissenschaften/Springer Fachmedien: Wiesbaden.
Thießen, Ansgar (Hg.) (2013): Handbuch Krisenmanagement. Springer Fachmedien: Wiesbaden.

Course: Creative Processes in Technology, Music and the Arts (Seminar)

Lecturer:
Prof. Hans-Joachim Braun

Language:
EN

Cycle:
WS

Content:
Creativity, which involves the generation of useful ideas and products, is an elusive term. "Inspirationalists" ,who point out spontaneous insights and "aha effects", have increasingly come under pressure from "structuralists", who emphasize hard work and expertise in creative processes, divesting creative people from supernatural gifts. In this light , a musical composition can be regarded as a piece of "cognitive engineering".In this seminar we will deal with the different concepts of creativity in their historical and cultural context. The main focus will be on investigating creative processes in invention, engineering design, architecture, the fine arts (for example Picasso`s Guernica), and in musical composition and improvisation. .Do creative processes follow a similar logic or are there vital domain-dependent differences? Two what extent have recent, particularly psychometric, studies been able to obtain empirically relevant and satisfying answers to the issue of creativity?

Literature:
H.-J. Braun, Engineering Design and Musical Composition: An Exploratory Inquiry; ICON vol.8, 2002, 1-24.
J. Kaufman &R.J. Steinberg; The Cambridge Handbook of Creativity, Cambridge U.P. 2010.
R.K. Sawyer, Explaining Creativity. The Science of Human Innovation, Oxford U.P. 2012,
R.W. Weisberg, Creativity: Understanding Innovation in Problem Solving, Science, Invention and the Arts, New York, John Wiley, 2006.

Course: Power plays in organizations: Micro-political competence and gender competence for professional practice (Seminar)

Lecturer:
Doris Cornils

Language:
DE

Cycle:
WS

Content:
folgt

Literature:
Cornils, D.; Mucha, A.; Rastetter, D. (2014): Mikropolitisches Kompetenzmodell: Erkennen, verstehen und bewerten mikropolitischer Kompetenz. In: OSC, Organisationberatung – Supervision – Coaching, 1/2014, S. 3-19
Cornils, Doris (2012): Mikropolitik und Aufstiegskompetenz von Frauen, in: CEWS-Journal, Center of Excellence Women and Science, 14.6.2012, Nr. 84, S. 23-34

Course: Socio-economic and ecological Responsability in Engineering Profession (Seminar)

Lecturer:
Dr. Wolfgang Neef

Language:
DE

Cycle:
WS

Content:

- technical science,economics and society
- sociologic and economic models of engineering in future
- engineering and technology without growth- and profit-compulsion

Literature:
Reader für die Lehrveranstaltung zu den Themen "Technik und Gesellschaft" und "Studium und Berufseinstieg"
Reader zu the topics "Technology and Society" and "Studying and Starting in Profession"

Course: Sociology and Social Critism (Seminar)

Lecturer:
Prof. Gabriele Winker

Language:
DE

Cycle:
WS

Content:
The seminar course focuses on the question of the significance and extent of social inequality. It will provide an overview of central sociological terms of analysis and findings of inequality studies.

Literature:
- Burzan, Nicole. Soziale Ungleichheit. Eine Einführung in die zentralen Theorien. 3. überarb. Aufl. Wiesbaden: VS Verlag für Sozialwissenschaften, 2007
- Hradil, Stefan: Soziale Ungleichheit in Deutschland. 8. Aufl., Nachdruck, Wiesbaden: VS Verlag für Sozialwissenschaften, 2005
- Kreckel, Reinhard: Politische Soziologie der sozialen Ungleichheit, 3., überarbeitete und erweiterte Auflage, Frankfurt/New York: Campus, 2004
- Winker, Gabriele; Nina Degele: Intersektionalität. Zur Analyse sozialer Ungleichheiten. Bielefeld: transcript Verlag, 2009

Course: World Literature: Meaning and Interpretation in the Interculture Dialogue (Seminar)

Lecturer:
Bertrand Schütz

Language:
DE

Cycle:
WS/SS

Content:
The seminar 'literature and culture' investigates the scope and possible meaning of what is commonly called European and especially German culture.
The practice of hermeneutics as basic discipline of the humanities comprises the approach to literary texts and their broader cultural context as well.
Subject matters are chosen according to their relevance for contemporary issues, particularly with regard to an intercultural dialogue.
Culture is thereby to be understood as the creative response to a given situation and the capacity to integrate inputs and influences, therefore as an ongoing process of permanent readjustment and learning, and by no means as a fixed identity in terms of an “essence”.

Literature:
Außer den unten angegebenen Referenzwerken wird je nach Thematik des Semesters eine spezifische Bibliographie erstellt.
Ernst Cassirer
Philosophie der symbolischen Formen
Hamburg 2010
Hans-Jörg Rheinberg
Experiment - Differenz - Schrift
Zur Geschichte epistemischer Dinge
Marburg 1992
Werner Heisenberg
Ordnung der Wirklichkeit
München 1989
Thomas S. Kuhn
The structure of scientific revolutions
The University of Chicago Press 1962

Course: Economic Sociology (Seminar)

Lecturer:
Dr. Michael Florian

Language:
DE

Cycle:
WS

Content:
Economic sociology means the application of sociological theories, methods, and perspectives in the analysis of economic issues. The seminar is concerned with new developments in economic sociology. Using case studies, the course will offer insights into the strengths and weaknesses of different sociological approaches.

Literature:
Baecker, Dirk: Wirtschaftssoziologie. Transcript: Bielefeld, 2006.
Bourdieu, Pierre et al.: Der Einzige und sein Eigenheim. Erweiterte Neuausgabe. Hamburg: VSA, 2002.
Beckert, Jens: Was ist soziologisch an der Wirtschaftssoziologie? Ungewißheit und die Einbettung wirtschaftlichen Handelns. In: Zeitschrift für Soziologie 25, 1996, S. 125–146.
Beckert, Jens: Grenzen des Marktes. Die sozialen Grundlagen wirtschaftlicher Effizienz. Campus: Frankfurt/New York, 1997
Beckert, Jens; Diaz-Bone, Rainer; Ganßmann, Heiner (Hg.) (2007): Märkte als soziale Strukturen. Frankfurt am Main/New York: Campus-Verlag.
Beckert, Jens; Deutschmann, Christoph (Hg.) (2010): Wirtschaftssoziologie. Sonderheft 49 der Kölner Zeitschrift für Soziologie und Sozialpsychologie: Wiesbaden: VS Verlag für Sozialwissenschaften.
Fligstein, Neil (2011): Die Architektur der Märkte. Wiesbaden: VS Verlag für Sozialwissenschaften.
Florian, Michael; Hillebrandt, Frank (Hg.): Pierre Bourdieu: Neue Perspektiven für die Soziologie der Wirtschaft. VS Verlag für Sozialwissenschaften: Wiesbaden, 2006.
Granovetter, Mark: Ökonomisches Handeln und soziale Struktur: Das Problem der Einbettung. In: Hans-Peter Müller und Steffen Sigmund (Hrsg.): Zeitgenössische amerikanische Soziologie. Leske + Budrich, Opladen 2000, S. 175-207.
Heinemann, Klaus (Hg.): Soziologie wirtschaftlichen Handelns. Sonderheft 28 der Kölner Zeitschrift für Soziologie und Sozialpsychologie. Opladen: Westdeutscher Verlag, 1987
Hirsch-Kreinsen, Hartmut: Wirtschafts- und Industriesoziologie. Grundlagen, Fragestellungen, Themenbereiche. Weinheim/München: Juventa, 2005.
Smelser, Neil J.; Swedberg, Richard (HG.): The Handbook of Economic Sociology. 2nd edition. Princeton/Oxford: Princeton University Press and New York: Russell Sage Foundation: New York, 2005.

Course: Academic Writing for Engineers (Seminar)

Lecturer:
Dr. Janina Lenger

Language:

DE

Cycle:

WS/SS

Content:

Writing is not a talent but a craft. It can only be improved if it is explicitly practiced. Students will acquire the necessary tools and knowledge to successfully write scientific texts in this seminar. Main components are brief inputs, practical exercises and knowledge sharing.
Contents are:
- the basics of writing theory
- components of scientific writing
- methods and exercises for problem solving within the writing process
- dealing with supervisors
- time management

Literature:

M. Cargill, P. O'Connor, Writing Scientific Research Articles, Wiley-Blackwell, Chichester, UK, 2009.
O. Kruse, Keine Angst vor dem leeren Blatt, Campus Verlag, Frankfurt/New York, 2000.
J. Wolfsberger, Frei Geschrieben, Mut Freiheit und Strategie für wissenschaftliche Abschlussarbeiten, UTB, Stuttgart, 2010.
W. Schneider, Deutsch für junge Profis, Rowohlt Taschenbuch Verlag, Reinbek bei Hamburg, 2011.
H.-J. Ortheil, Schreiben dicht am Leben, Dudenverlag, Mannheim – Zürich, 2012.

Module: Geochemical Engineering

Courses:

Title	Typ	Hrs/wk
Contaminated Sites and Landfilling	Vorlesung	2
Contaminated Sites and Landfilling	Hörsaalübung	1
Geochemical Engineering	Vorlesung	2

Module Responsibility:
Dr. Joachim Gerth

Admission Requirements:
none

Recommended Previous Knowledge:
Fundamentals of inorganic/organic chemistry and biology

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
With the completion of this module students acquire profound knowledge of biogeochemical processes, the fate of pollutants in soil and groundwater, and techniques to deposit contaminated waste material. They are able to describe in principle the behaviour of chemicals in the environment. Students can explain and report the approach to remediate contaminated sites.
Capabilities:
With the completion of this module students can apply the acquired theoretical knowledge to model cases of site pollution and critically assess the situation technically and conceptually. They are able to draw comparisons on different remediation strategies and techniques. Model projects can be devised and treated.

Personal Competence:
Social Competence:
Students can discuss technical and scientific tasks within a seminar subject specific and interdisciplinary .
Autonomy:
Students can independently exploit sources , acquire the particular knowledge of the subject and apply it to new problems.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Environmental Engineering: Kernqualifikation: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Contaminated Sites and Landfilling (Vorlesung)

Lecturer:
Dr. Joachim Gerth, Dr. Marco Ritzkowski

Language:
EN

Cycle:
SS

Content:
The part Contaminated Sites gives an introduction into different scales of pollution and identifies key pollutants. Geochemical attenuation mechanisms and the role of organisms are highlighted affecting the fate of pollutants in leachate and groundwater. Techniques for site characterization and remediation are discussed including economical aspects.
The part Landfilling is introduced by discussing fundamental aspects and the worldwide situation of waste management. The lecture highlights transformation processes in landfill bodies, emissions of gases and leachate, and the long-term behaviour of landfill sites with measures of aftercare.

Literature:
1) **Waste Management**. Bernd Bilitewski; Georg Härdtle; Klaus Marek (Eds.), ISBN: 9783540592105 , Springer Verlag
Lehrbuchsammlung der TUB, Signatur USH-305

2) **Solid Waste Technology and Management.** Thomas Christensen (Ed.), ISBN: 978-1-4051-7517-3 , Wiley Verlag

Lesesaal 2: US - Umweltschutz, Signatur USH-332
3) **Natural attenuation of fuels and chlorinated solvents in the subsurface.** Todd H. Wiedemeier(Ed.), ISBN: 0471197491
Lesesaal 2: US - Umweltschutz, Signatur USH-844

Course: Contaminated Sites and Landfilling (Übung)

Lecturer:
Dr. Joachim Gerth, Dr. Marco Ritzkowski

Language:
EN

Cycle:
SS

Content:
The part Contaminated Sites gives an introduction into different scales of pollution and identifies key pollutants. Geochemical attenuation mechanisms and the role of organisms are highlighted affecting the fate of pollutants in leachate and groundwater. Techniques for site characterization and remediation are discussed including economical aspects.
The part Landfilling is introduced by discussing fundamental aspects and the worldwide situation of waste management. The lecture highlights transformation processes in landfill bodies, emissions of gases and leachate, and the long-term behaviour of landfill sites with measures of aftercare.

Literature:
1) **Waste Management**. Bernd Bilitewski; Georg Härdtle; Klaus Marek (Eds.), ISBN: 9783540592105 , Springer Verlag
Lehrbuchsammlung der TUB, Signatur USH-305

2) **Solid Waste Technology and Management.** Thomas Christensen (Ed.), ISBN: 978-1-4051-7517-3 , Wiley Verlag
Lesesaal 2: US - Umweltschutz, Signatur USH-332
3) **Natural attenuation of fuels and chlorinated solvents in the subsurface.** Todd H. Wiedemeier(Ed.), ISBN: 0471197491
Lesesaal 2: US - Umweltschutz, Signatur USH-844

Course: Geochemical Engineering (Vorlesung)

Lecturer:
Dr. Joachim Gerth

Language:
EN

Cycle:
SS

Content:
As an introduction cases are presented in which geochemical engineering was used to solve environmental problems. Environmentally important minerals are discussed and methods for their detection. It is demonstrated how solution equilibria can be modified to eliminate elevated concentrations of unwanted species in solution and how carbon dioxide concentration affects pH and the dissolution of carbonate minerals. Modifications of redox conditions, pH, and electrolyte concentration are shown to be effective tools for controlling the mobility and fate of hazardous species in the environment.

Literature:

Geochemistry, groundwater and pollution. C. A. J. Appelo; D. Postma
Leiden [u.a.] Balkema 2005
Lehrbuchsammlung der TUB, Signatur GWC-515

Module: Management of Surface Water

Courses:

Title	Typ	Hrs/wk
Modelling of Flow in Rivers and Estuaries	Vorlesung	3
Nature-Oriented Hydraulic Engineering / Integrated Flood Protection	Problemorientierte Lehrveranstaltung	2

Module Responsibility:
Prof. Peter Fröhle

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students are able to define in detail the basic processes that are related to the modelling of flows in hydraulic engineering. Besides, they can describe the basic aspects of numerical modelling and actual numerical models for the simulation of flows and waves. They can also depict the concepts of nature oriented hydraulic engineering.
Capabilities:
Students are able to apply hydrodynamic-numerical models to practical hydraulic engineering tasks. Furthermore, the students are able to set up flood-risk management concepts and are able to apply basic concepts of renaturation to practical problems.

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Environmental Engineering: Kernqualifikation: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Kernqualifikation: Compulsory
Water and Environmental Engineering: Vertiefung Water: Compulsory
Water and Environmental Engineering: Vertiefung Environment: Compulsory
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Modelling of Flow in Rivers and Estuaries (Vorlesung)

Lecturer:
Prof. Peter Fröhle

Language:
DE/EN

Cycle:
SS

Content:
Basics of numerial models / application of models

- classification of models
- model concept
- modelling

1D Working Equation
Mathematical description of physical processes

- Equation of motions
  - conservation of mass
  - conservation of momentum
- Initial conditions and boundary conditions

Numerical Methods

- Time step procedure
- Finite differences

- Finite volumes

Literature:
Vorlesungsskript

Course: Nature-Oriented Hydraulic Engineering / Integrated Flood Protection (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Peter Fröhle

Language:
DE/EN

Cycle:
SS

Content:

- Regime-Theory and application for the development of environmental guiding priciples of rivers
- Engineering - biological measures for the stabilization of rivers
- Risk management in flood protection
- Design techniques in technical flood protection
- Methods for the assessment of flood caused damages

Literature:
Vorlesungsumdruck

Module: Hydrological Systems

Courses:

Title	Typ	Hrs/wk
Applied Surface Hydrology	Vorlesung	2
Applied Surface Hydrology	Problemorientierte Lehrveranstaltung	1
Interaction Water - Environment in Fluvial Areas	Problemorientierte Lehrveranstaltung	1

Module Responsibility:
Prof. Peter Fröhle

Admission Requirements:
none

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
The students are able to define the basic concepts of hydrology and water management. They are able to describe and quantify the relevant processes of the hydrological water cycle. Besides, the students know the main aspects of rainfall-run-off-models and are able to theoretically derive established reservoir / storage models and a unit-hydrograph.
Capabilities:
The students are able to use the basic hydrological concepts and approaches and are able to theoretically derive established reservoir / storage models or a unit-hydrograph as the basis for rainfall-run-off-models. The student are able to explain the basic concepts of measurements of hydrological and hydrodynamic values in nature and are able to perform, analyze and statistically assess these measurements. Furthermore, they are able to apply a hydrological model to basic hydrological problems.

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Environmental Engineering: Kernqualifikation: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Applied Surface Hydrology (Vorlesung)

Lecturer:
Prof. Peter Fröhle, Sandra Hellmers

Language:
DE/EN

Cycle:
SS

Content:
Basics of hydrology:

- Hydrological cycle
- Data acquisition
- Data analyses and statistical assessment
- Statistics of extremes
- Regionalization methods for hydrological values
- Rainfall-run-off modelling on the basis of a unit hydrograph conceps
- Application of rainfall-run-off models on the basis of Kalypso-Hydrology which is an OpenSource Software Tool.

Literature:
http://de.wikipedia.org/wiki/Kalypso_(Software)
http://kalypso.bjoernsen.de/

http://sourceforge.net/projects/kalypso/

Course: Applied Surface Hydrology (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Peter Fröhle

Language:
DE/EN

Cycle:
SS

Content:
Basics of hydrology:

- Hydrological cycle
- Data acquisition
- Data analyses and statistical assessment
- Statistics of extremes
- Regionalization methods for hydrological values
- Rainfall-run-off modelling on the basis of a unit hydrograph conceps
- Application of rainfall-run-off models on the basis of Kalypso-Hydrology which is an OpenSource Software Tool.

Literature:
http://de.wikipedia.org/wiki/Kalypso_(Software)
http://kalypso.bjoernsen.de/
http://sourceforge.net/projects/kalypso/

Course: Interaction Water - Environment in Fluvial Areas (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Peter Fröhle, Sandra Hellmers

Language:
DE/EN

Cycle:
SS

Content:
A problem based learning course. The problem will be solved by the students more or less self-contained. The topics will be introduced and elaborated over the semester.

Literature:
-

Module: Water & Wastewater Systems

Courses:

Title	Typ	Hrs/wk
Ecological Town Design - Water, Energy, Soil and Food Nexus	Vorlesung	2
Water & Wastewater Systems in a Global Context	Vorlesung	2

Module Responsibility:
Prof. Ralf Otterpohl

Admission Requirements:
Bachelor's degree

Recommended Previous Knowledge:
Basic knowledge of the global situation with rising poverty, soil degradation, migration to cities, lack of water resources and sanitation

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students can describe the facets of the global water situation. Students can judge the enormous potential of the implementation of synergistic systems in Water, Soil, Food and Energy supply.
Capabilities:
Students are able to design ecological settlements for different geographic and socio-economic conditions for the main climates around the world.

Personal Competence:
Social Competence:
Autonomy:
Students are in a position to work on a subject and to organize their work flow independently. They can also present on this subject.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Bioprocess Engineering: Vertiefung A - General Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung General Process Engineering: Compulsory suffrage
Environmental Engineering: Kernqualifikation: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Kernqualifikation: Compulsory
Process Engineering: Vertiefung Environmental Process Engineering: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Ecological Town Design - Water, Energy, Soil and Food Nexus (Vorlesung)

Lecturer:
Prof. Ralf Otterpohl

Language:
EN

Cycle:
SS

Content:

- Participants Workshop: Design of the most attractive productive Town
- Keynote lecture and video
- The limits of Urbanization / Green Cities
- The tragedy of the Rural: Soil degradation, agro chemical toxification, migration to cities
- Global Ecovillage Network: Upsides and Downsides around the World
- Visit of an Ecovillage
- Participants Workshop: Resources for thriving rural areas, Short presentations by participants, video competion
- TUHH Rural Development Toolbox
- TUHH Rural Development Toolbox (cont.)
- Integrated New Town Development
- Participants workshop: Design of New Towns: Northern, Arid and Tropical cases

- Outreach: Participants campaign
- City with the Rural: Resilience, quality of live and productive biodiversity
- Exam with color pencils: Design of a New Town

Literature:

- Ralf Otterpohl 2013: Gründer-Gruppen als Lebensentwurf: "Synergistische Wertschöpfung in erweiterten Kleinstadt- und Dorfstrukturen", in „Regionales Zukunftsmanagement Band 7: Existenzgründung unter regionalökonomischer Perspektive, Pabst Publisher, Lengerich
- http://youtu.be/9hmkgn0nBgk (Miracle Water Village, India, Integrated Rainwater Harvesting, Water Efficiency, Reforestation and Sanitation)
- TEDx New Town Ralf Otterpohl: http://youtu.be/_M0J2u9BrbU

Course: Water & Wastewater Systems in a Global Context (Vorlesung)

Lecturer:
Prof. Ralf Otterpohl

Language:
EN

Cycle:
SS

Content:

- Participants Workshop: Awareness of global water problems; role play's, theatre, pantomime, developing a song and else
- Keynote lecture and video
- Water & Soil: Water availability as a consequence of healthy soils
- Water and it's utilization, Integrated Urban Water Management
- Water & Energy, lecture and panel discussion pro and con for a specific big dam project
- Rainwater Harvesting on Catchment level, Holistic Planned Grazing, Multi-Use-Reforestation
- Sanitation and Reuse of water, nutrients and soil conditioners, Conventional and Innovative Approaches
- Video contest: Participants groups search, introduce, show and discuss excellent short water videos
- Why are there excreta in water? Public Health, Awareness Campaigns
- Seminar: Participants prepare and give 5 min presentations
- Rehearsal session, Q&A
- Exam

Literature:

- Montgomery, David R. 2007: Dirt: The Erosion of Civilizations, University of California Press
- Liu, John D.: http://eempc.org/hope-in-a-changing_climate/ (Integrated regeneration of the Loess Plateau, China, and sites in Ethiopia and Rwanda)
- http://youtu.be/9hmkgn0nBgk (Miracle Water Village, India, Integrated Rainwater Harvesting, Water Efficiency, Reforestation and Sanitation)

Module: Technical Microbiology

Courses:

Title	Typ	Hrs/wk
Applied Molecular Biology	Vorlesung	2
Technical Microbiology	Vorlesung	2
Technical Microbiology	Hörsaalübung	1

Module Responsibility:
Dr. Skander Elleuche

Admission Requirements:
none

Recommended Previous Knowledge:
Bachelor with basic knowledge in microbiology and genetics

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
After successfully finishing this module, students are able

- to give an overview of genetic processes in the cell
- to explain the application of industrial relevant biocatalysts
- to explain and prove genetic differences between pro- and eukaryotes

Capabilities:
After successfully finishing this module, students are able

- to explain and use advanced molecularbiological methods
- to recognize problems in interdisciplinary fields

Personal Competence:
Social Competence:
Students are able to

- write protocols and PBL-summaries in teams
- to lead and advise members within a PBL-unit in a group
- develop and distribute work assignments for given problems

Autonomy:
Students are able to

- search information for a given problem by themselves
- prepare summaries of their search results for the team
- make themselves familiar with new topics

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Bioprocess Engineering: Kernqualifikation: Compulsory
Chemical and Bioprocess Engineering: Kernqualifikation: Compulsory
Environmental Engineering: Kernqualifikation: Compulsory suffrage
International Management and Engineering: Vertiefung II. Process Engineering and Biotechnology: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage

Course: Applied Molecular Biology (Vorlesung)

Lecturer:

Dr. Skander Elleuche

Language:
EN

Cycle:
SS

Content:
Lecture and PBL
- Methods in genetics / molecular cloning
- Industrial relevance of microbes and their biocatalysts
- Biotransformation at extreme conditions
- Genomics
- Protein engineering techniques
- Synthetic biology

Literature:
Relevante Literatur wird im Kurs zur Verfügung gestellt.
Grundwissen in Molekularbiologie, Genetik, Mikrobiologie und Biotechnologie erforderlich.
Lehrbuch: Brock - Mikrobiologie / Microbiology (Madigan et al.)

Course: Technical Microbiology (Vorlesung)

Lecturer:
Dr. Kerstin Sahm, Prof. Garabed Antranikian

Language:
EN

Cycle:
SS

Content:

- History of microbiology and biotechnology
- Enzymes
- Molecular biology
- Fermentation
- Downstream Processing
- Industrial microbiological processes
- Technical enzyme application
- Biological Waste Water treatment

Literature:
Microbiology, 2013, Madigan, M., Martinko, J. M., Stahl, D. A., Clark, D. P. (eds.), formerly „Brock“, Pearson
Industrielle Mikrobiologie, 2012, Sahm, H., Antranikian, G., Stahmann, K.-P., Takors, R. (eds.) Springer Berlin, Heidelberg, New York, Tokyo.
Angewandte Mikrobiologie, 2005, Antranikian, G. (ed.), Springer, Berlin, Heidelberg, New York, Tokyo.

Course: Technical Microbiology (Übung)

Lecturer:
Dr. Kerstin Sahm

Language:
EN

Cycle:
SS

Content:

- History of microbiology and biotechnology
- Enzymes
- Molecular biology
- Fermentation
- Downstream Processing
- Industrial microbiological processes
- Technical enzyme application
- Biological Waste Water treatment

Literature:
Microbiology, 2013, Madigan, M., Martinko, J. M., Stahl, D. A., Clark, D. P. (eds.), formerly „Brock“, Pearson
Industrielle Mikrobiologie, 2012, Sahm, H., Antranikian, G., Stahmann, K.-P., Takors, R. (eds.) Springer Berlin, Heidelberg, New York, Tokyo.
Angewandte Mikrobiologie, 2005, Antranikian, G. (ed.), Springer, Berlin, Heidelberg, New York, Tokyo.

Module: Selected Topics in Environmental Engineering

Courses:

Title	Typ	Hrs/wk
Energy from Biomass	Vorlesung	2
Energy from Biomass	Gruppenübung	1
Hydrobiology	Vorlesung	2
Sludge Treatment	Vorlesung	2
Environmental Aquatic Chemistry	Vorlesung	2

Module Responsibility:
Prof. Mathias Ernst

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Capabilities:

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
6 LP

Examination:

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Environmental Engineering: Kernqualifikation: Compulsory suffrage

Course: Energy from Biomass (Vorlesung)

Lecturer:
Prof. Martin Kaltschmitt

Language:
DE/EN

Cycle:
WS

Content:
Goal of this course is it to discuss the physical, chemical, and biological as well as the technical, economic, and environmental basics of all options to provide energy from biomass from a German and international point of view. Additionally different system approaches to use biomass for energy, aspects to integrate bioenergy within the energy system, technical and economic development potentials, and the current and expected future use within the energy system are presented.
The course is structured as follows:

- Biomass as an energy carrier within the energy system; use of biomass in Germany and world-wide, overview on the content of the course
- Photosynthesis, composition of organic matter, plant production, energy crops, residues, organic waste
- Biomass provision chains for woody and herbaceous biomass, harvesting and provision, transport, storage, drying
- Thermo-chemical conversion of solid biofuels
  - Basics of thermo-chemical conversion
  - Direct thermo-chemical conversion through combustion: combustion technologies for small and large scale units, electricity generation technologies, flue gas treatment technologies, ashes and their use
  - Gasification: Gasification technologies, producer gas cleaning technologies, options to use the cleaned producer gas for the provision of heat, electricity and/or fuels
  - Fast and slow pyrolysis: Technologies for the provision of bio-oil and/or for the provision of charcoal, oil cleaning technologies, options to use the pyrolysis oil and charcoal as an energy carrier as well as a raw material
- Physical-chemical conversion of biomass containing oils and/or fats: Basics, oil seeds and oil fruits, vegetable oil production, production of a biofuel with standardized characteristics (trans-esterification, hydrogenation, co-processing in existing refineries), options to use this fuel, options to use the residues (i.e. meal, glycerine)
- Bio-chemical conversion of biomass
  - Basics of bio-chemical conversion

- Biogas: Process technologies for plants using agricultural feedstock, sewage sludge (sewage gas), organic waste fraction (landfill gas), technologies for the provision of bio methane, use of the digested slurry
- Ethanol production: Process technologies for feedstock containing sugar, starch or celluloses, use of ethanol as a fuel, use of the stillage

Literature:
Kaltschmitt, M.; Hartmann, H. (Hrsg.): Energie aus Biomasse; Springer, Berlin, Heidelberg, 2009, 2. Auflage

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Course: Energy from Biomass (Übung)

Lecturer:
Prof. Martin Kaltschmitt

Language:
DE

Cycle:
WS

Content:
Exercises to:

- Logistics
- Combustion calculation
- Calculation of calorific value and emission
- Gasification
- Biodiesel
- Biogas
- Bioethanol

Literature:
Kaltschmitt, M.; Hartmann, H. (Hrsg.): Energie aus Biomasse; Springer, Berlin, Heidelberg, 2009, 2. Auflage

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Course: Hydrobiology (Vorlesung)

Lecturer:
Dr. Ludwig Tent

Language:
EN

Cycle:
SS

Content:

- Running and stagnant waters with their surroundings as living sphere for plants, animals and man. Natural situation and nowadays reality
- Goals for future developments
- Demands of nature to engineering projects like city planning, constructions like e.g. brigdes, advanced waste water treatment and river maintenance
- Practical exercise to get to know characteristic organisms of running waters
- Sediments: origin, characterisation, how to get rid of problems in an environ-mentally acceptable way
- Restructuring of aquatic habitats, river restoration, rehabilitation of stagnant waters
- Diffuse immissions, erosion, soil conservation = improvement of the health of waters
- Social implications

Literature:
Script / original presentations for private use only
Tent, L. (1998): Reconstruction versus ecological maintenance - improving lowland rivers in Hamburg and Lower Saxony. - in: HANSEN, H.O. and B.L. MADSEN (eds.): River Restoration ´96;
Tent, L. (2001): Trout 2010 - Restructuring Urban Brooks with engaged Citizens. - in: Nijland, H. and M.J.R. Cals (eds.): River Restoration in Europe; Practical Approaches
Internet, e.g. River Restoration like
2011 - http://web.natur.cuni.cz/hydroeco2011/index.php?id=33h , session H and more
http://www.snaebel.dk/Konf/Pres/
2013 - http://www.naturogmiljo2013.dk/uploads/media/Spor_B2_Erfaringer_fra_udlandet_Dr.Tent.pdf

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Course: Sludge Treatment (Vorlesung)

Lecturer:
Dr. Joachim Behrendt

Language:
EN

Cycle:
SS

Content:
Sedimentation characteristic and thickening,
Centrifugation,
Flotation,
Filtration,
Aerobic sludge stabilisation,
Sludge Digestion,
Sludge Disintegration,
Sludge Dewatering,
Natural Processes for Sludge Treatment,
Nutrient Recovery from Sludge,
Thermal Processes and Incineration.

Literature:
Tchobanoglous, George (Metcalf & Eddy, Inc., ;)
Wastewater engineering : treatment and reuse
ISBN: 0070418780 (alk. paper) ISBN: 0071122508 (ISE (*pbk))
Boston [u.a.] : McGraw-Hill, 2003
TUB_HH_Katalog
Cleverson Vitorio Andreoli, Marcos von Sperling, Fernando Fernandes
Sludge Treatment and Disposal
ISBN 9781843391661
IWA Publishing, 2007

Course: Environmental Aquatic Chemistry (Vorlesung)

Lecturer:
Dr. Klaus Johannsen

Language:
EN

Cycle:
SS

Content:

- Concentration and activity
- Chemistry of acids and bases
- Gas-water interactions
- Alkalinity and acidity
- Precipitation and dissolution
- Oxidation and dissolution
- Carbon – an introduction to organicchemistry
- Nature and chemistry of pollutants
- Phase interactions – importance of sediments in aquatic systems

Literature:
Howard, A.G.: Aquatic Environmental Chemistry. University Press, Oxford, 1998
Jensen, J. N.: A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.
Morel, F. M. M., Hering, J.G.: Principles and applications of aquatic chemistry. John Wiley & Sons, Inc., New York, 1993.
Stumm, W., Morgan, J.J.: Aquatic Chemistry. John Wiley & Sons, New York, 1996.

Courses:

Title	Typ	Hrs/wk
Labour Law	Vorlesung	2
Business Model Generation & Green Technologies	Seminar	2
Corporate Entrepreneurship & Green Innovation	Seminar	2
E-Commerce	Vorlesung	2
Entrepreneurship & Green Technologies	Vorlesung	2
Intellectual Property	Vorlesung	2
Innovation Management	Vorlesung	2
International Law	Vorlesung	2
Internationalization Strategies	Vorlesung	2
Management and Leadership	Vorlesung	2
Entrepreneurial Management	Vorlesung	2
Marketing	Vorlesung	2
Project Management	Vorlesung	2
Project Management in Industrial Practice	Vorlesung	2
Risk Management	Vorlesung	2
Key Aspects of Patent Law	Seminar	2
Environmental Management and Corporate Responsibilty	Vorlesung	2
Management Consulting	Vorlesung	2
Entrepreneurial Business Creation	Problemorientierte Lehrveranstaltung	2
Managment of Trust and Reputation	Seminar	2
Methods of Systematic Product Development	Seminar	2
Public and Constitutional Law	Vorlesung	2

Module Responsibility:
Prof. Matthias Meyer

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Capabilities:

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
6 LP

Examination:

Workload in Hours:
Indipendent Study Time: 96, Study Time in Lecture: 84

Assignment for the Following Curricula:
Civil Engineering: Kernqualifikation: Compulsory
Bioprocess Engineering: Kernqualifikation: Compulsory
Chemical and Bioprocess Engineering: Kernqualifikation: Compulsory
Computer Science: Kernqualifikation: Compulsory
Electrical Engineering: Kernqualifikation: Compulsory
Energy and Environmental Engineering: Kernqualifikation: Compulsory
Energy Systems: Kernqualifikation: Compulsory
Environmental Engineering: Kernqualifikation: Compulsory
Aircraft Systems Engineering: Kernqualifikation: Compulsory
Computational Science and Engineering: Kernqualifikation: Compulsory

Information and Communication Systems: Kernqualifikation: Compulsory
Mechatronics: Kernqualifikation: Compulsory
Microelectronics and Microsystems: Kernqualifikation: Compulsory
Product Development, Materials and Production: Kernqualifikation: Compulsory
Renewable Energies: Kernqualifikation: Compulsory
Naval Architecture and Ocean Engineering: Kernqualifikation: Compulsory
Theoretical Mechanical Engineering: Kernqualifikation: Compulsory
Process Engineering: Kernqualifikation: Compulsory
Water and Environmental Engineering: Kernqualifikation: Compulsory

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Course: Labour Law (Vorlesung)

Lecturer:
Dr. Walter Wellinghausen

Language:
DE

Cycle:
SS

Content:

- Contract of employment
- Conditions of work
- Employment protection
- Termination and cancellation of employment contracts
- Legal protection in disputes
- Rules governing compensation
- Accident and social security law
- Co-determination law
- Law governing disputes
- European employment law

Literature:
- Gesetzestexte zum Arbeitsrecht
- Rechtsprechung zum Arbeitsrecht
- Schaub: Arbeitsrechtshandbuch

Course: Business Model Generation & Green Technologies (Seminar)

Lecturer:
Dr. Michael Prange

Language:
EN

Cycle:
WS

Content:

- Overview about Green Technologies
- Introduction to Business Model Generation
- Business model patterns
- Design techniques for business ideas
- Strategy development
- Value proposition architecture
- Business plan and financing
- Component based foundations
- Lean Entrepreneurship

Based on examples and case studies primarily in the field of green technologies, students learn the basics of Business Model Generation and will be able to develop business models and to evaluate start up projects.

Literature:
Präsentationsfolien, Beispiele und Fallstudien aus der Vorlesung
Presentation slides, examples and case studies from the lecture

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Course: Corporate Entrepreneurship & Green Innovation (Seminar)

Lecturer:
Dr. Michael Prange

Language:
EN

Cycle:
SS

Content:

- Overview about Green Innovation
- Introduction to Corporate Entrepreneurship
- Entrepreneurial thinking in established companies
- Entrepreneurs and managers
- Strategic innovation processes
- Corporate Venturing
- Product Service Systems
- Open Innovation
- User Innovation

Based on examples and case studies primarily in the field of green innovation, students learn the basics of corporate entrepreneurship and will be able to implement entrepreneurial thinking in established companies and to describe strategic innovation processes.

Literature:
Präsentationsfolien, Beispiele und Fallstudien aus der Vorlesung
Presentation slides, examples and case studies from the lecture

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Course: E-Commerce (Vorlesung)

Lecturer:
Prof. Michael Ceyp

Language:
DE

Cycle:
SS

Content:
This lectures starts with an overview about the broad field of e-commerce. Then the relevant e-commerce systems, processes and management tasks are explained and discussed. Afterwards necessary online marketing instruments and their strength and weaknesses are defined to get traffic to an e-commerce shop. This lectures closes with a description of necessary steps for the e-commerce-implementation.

Literature:
Ceyp, M., Scupin, J-P. (2013), Erfolgreiches Social Media Marketing - Konzepte und Maßnahmen, Wiesbaden.
Fritz, W. (2004): Internet-Marketing und Electronic Commerce - Grundlagen-Rahmenbedingungen-Instrumente. 3. Aufl., Wiesbaden.
Heinemann, G. (2014), Der neue Online-Handel - Geschäftsmodell und Kanalexzellenz im E-Commerce, 5. Aufl, Wiesbaden.
Heinemann, G., (2012) Der neue Mobile-Commerce – Erfolgsfaktoren und Best Practices, Wiesbaden.
Kollmann, T. (2013): E-Business, 5. Aufl., Berlin.
Kreutzer, R. (2012), Praxisorientiertes Online-Marketing , Wiesbaden.
Meier, A./ Stormer, H.(2012): eBusiness &eCommerce - Management der digitalen Wertschöpfungskette, 3. Aufl., Berlin / Heidelberg.
Schwarze, J. (Hrsg) (2002): Electronic Commerce - Grundlagen und praktische Umsetzung, Herne /Berlin.
Wirtz, B.W.(2013): Electronic Business, 4. Aufl., Wiesbaden.

Course: Entrepreneurship & Green Technologies (Vorlesung)

Lecturer:
Dr. Michael Prange

Language:
DE/EN

Cycle:
WS/SS

Content:
The lecture "Entrepreneurship & Green Technologies" is offerend as an elective course for all master's programs at TUHH.
Based on examples and case studies primarily in the field of green technologies, students learn the basics of entrepreneurship and will be able to develop business models and to evaluate start-up projects.

Literature:
Präsentationsfolien, Beispiele und Fallstudien aus der Vorlesung
Presentation slides, examples and case studies from the lecture

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Course: Intellectual Property (Vorlesung)

Lecturer:
Dr. Frederik Thiering

Language:
DE

Cycle:
WS

Content:

- Trademark law
- Copyright
- Patent law
- Know-how, supplementary performance protection, et al.
- Enforcement of intellectual property rights
- Licensing of intellectual property rights
- Hypothecation, security assignment and evaluation of intellectual property rights

Literature:
Quellen und Materialen wird im Internet zur Verfügung gestellt

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Course: Innovation Management (Vorlesung)

Lecturer:
Prof. Cornelius Herstatt

Language:
DE

Cycle:
SS

Content:
Innovation is key to corporate growth and sustainibility. In this lecture Prof. Herstatt presents a systematic way from generating ideas to the successful implementation of innovations. **The lecture is presented in German language only**

Literature:

- Goffin, K., Herstatt, C. and Mitchell, R. (2009): Innovationsmanagement: Strategie und effektive Umsetzung von Innovationsprozessen mit dem Pentathlon-Prinzip, München: Finanzbuch Verlag

Weiterführende Literatur

- Innovationsmanagement
  Juergen Hauschildt
- F + E Management
  Specht, G. / Beckmann, Chr.
- Management der frühen Innovationsphasen
  Cornelius Herstatt, Birgit Verworn
  (im TUHH-Intranet auch als E-Book verfügbar)
- Bringing Technology and Innovation Into the Boardroom
- weitere Literaturempfehlungen auf Anfrage

Course: International Law (Vorlesung)

Lecturer:
Dr. Frederik Thiering

Language:
EN

Cycle:
SS

Content:

- What is International Law?
- Bidding on International Tenders
- Drafting the International Project Contract
- International Dispute Resolution
- Mergers and Acquisitions
- Obtaining worldwide protection for Intellectual Property
- International product launch
- International taxation
- Import Restrictions and Antidumping

Literature:
Quellen und Materialen wird im Internet zur Verfügung gestellt

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Course: Internationalization Strategies (Vorlesung)

Lecturer:
Prof. Thomas Wrona

Language:
EN

Cycle:
SS

Content:
- Introduction
- Internationalization of markets
- Measuring internationalization of firms
- Target market strategies
- Market entry strategies
- Timing strategies
- Allocation strategies
- Case Studies

Literature:
Bartlett/Ghoshal (2002): Managing Across Borders, The Transnational Solution, 2nd edition, Boston

- Buckley, P.J./Ghauri, P.N. (1998), The Internationalization of the Firm, 2nd edition
- Czinkota, Ronkainen, Moffett, Marinova, Marinov (2009), International Business, Hoboken
- Dunning, J.H. (1993), The Globalization of Business: The Challenge of the 1990s, London
- Ghoshal, S. (1987), Global Strategy: An Organizing Framework, Strategic Management Journal, p. 425-440
- Praveen Parboteeah, K.,Cullen, J.B. (2011) , Strategic International Management, International 5th Edition
- Rugman, A.M./Collinson, S. (2012): International Business, 6th Edition, Essex 2012

Course: Management and Leadership (Vorlesung)

Lecturer:
Prof. Christian Ringle

Language:
DE

Cycle:
SS

Content:

- definitions and foundations of strategic management
- strategic planning
- strategic analysis and forecast
- development of strategic options
- strategy evaluaton, implementation and strategic control

Literature:
- Bea, F.X.; Haas, J.: Strategisches Management, 5. Auflage, Stuttgart 2009.
- Dess, G. G.; Lumpkin, G. T.; Eisner, A. B.: Strategic management: Creating competitive advantages, Boston 2010
- Hahn, D.; Taylor, B.: Strategische Unternehmensplanung: Strategische Unternehmensführung, 9. Auflage, Heidelberg 2006.
- Hinterhuber, H.H.: Strategische Unternehmensführung Bd. 1: Strategisches Denken, 7. Aufl., Berlin u. a. 2004
- Hinterhuber, H.H.: Strategische Unternehmensführung Bd. 2: Strategisches Handeln, 7. Aufl., Berlin u. a. 2004
- Hungenberg, H.: Strategisches Management in Unternehmen, 6. Auflage, Wiesbaden 2011
- Johnson, G.; Scholes, K.; Whittington, R.: Strategisches Management. Eine Einführung, 9. Auflage, München 2011
- Macharzina, K.: Unternehmensführung: Das internationale Managementwissen, 7. Auflage, Wiesbaden 2010.
- Porter, M.E.: Competitive strategy, New York 1980 (deutsche Ausgabe: Wettbewerbsstrategie, 10. Aufl., Frankfurt am Main 1999)
- Welge, M. K.; Al-Laham, A.: Strategisches Management, 5. Auflage, Wiesbaden 2008.

Course: Entrepreneurial Management (Vorlesung)

Lecturer:
Prof. Christoph Ihl

Language:

EN

Cycle:
WS

Content:
This course introduces the fundamentals of technology entrepreneurship including its economic and cultural underpinnings. It highlights the differences between mere business ideas and scalable and repeatable business opportunities. It is designed to familiarize students with the process and all relevant entrepreneurial tools and concepts that technology entrepreneurs use to create business opportunities and to start companies. It involves taking a technology idea and finding a high-potential commercial opportunity, gathering resources such as talent and capital, figuring out how to sell and market the idea, and managing rapid growth. The course also discusses relevant concepts and tools from entrepreneurial strategy, such as disruptive innovations, technology adoption cycles and intellectual property, as well as from entrepreneurial marketing, such as product positioning and differentiation, distribution, promotion and pricing. Particular emphasis will be put on business model design and customer development proposed in the lean startup approach. Participants will learn a systematic process that technology entrepreneurs use to identify, create and exploit business opportunities. The students will also achieve knowledge and skills in the activities related with the start and the growth of new companies. All in all, the course is supposed to create the entrepreneurial mindset of looking for technology opportunities and business solutions, where others see insurmountable problems. This mindset of turning problems into opportunities can well be generalized from startups to larger companies and other settings.

- Develop a working knowledge and understanding of the entrepreneurial perspective
- Understand the difference between a good idea and scalable business opportunity
- Understand the process of taking a technology idea and finding a high-potential commercial opportunity
- Develop understanding of major elements of business models and how they are interrelated
- Understand the components of business opportunity assessment and business plans
- Develop understanding of major elements of business models and how they are interrelated
- Knowledge about appropriate evaluation criteria for business ideas
- Understanding of the basic building blocks of promising business models
- Knowledge about the key aspects of business models and planning:
  value proposition and target customer analysis
  market and competitive analysis, IP protection
  production, sourcing and partners
  legal form, cooperation contracts, liability issues
  financial planning

Literature:
Byers, T.H.; Dorf, R.C.; Nelson, A.J. (2011). Technology Ventures: From Idea to Enterprise. 3rd ed. McGraw-Hill, 2011.
Hisrich, P.; Peters, M. P.; Shepherd, D. A. (2009). Entrepreneurship, 8th ed., McGraw-Hill, 2009.
Osterwalder, A.; Yves, P. (2010). Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons, 2010.

Course: Marketing (Vorlesung)

Lecturer:
Prof. Christian Lüthje

Language:
EN

Cycle:
WS

Content:
Contents
Basics of Marketing
The philosophy and fundamental aims of marketing. Contrasting different marketing fields (e.g. business-to-consumer versus business-to-business marketing). The process of marketing planning, implementation and controlling
Strategic Marketing Planning
How to find profit opportunities? How to develop cooperation, internationalization, timing, differentiation and cost leadership strategies?
Market-oriented Design of products and services
How can companies get valuable customer input on product design and development? What is a service? How can companies design innovative services supporting the products?
Pricing
What are the underlying determinants of pricing decision? Which pricing strategies should companies choose over the life cycle of products? What are special forms of pricing on business-to-business markets (e.g. competitive bidding, auctions)?
Marketing Communication
What is the role of communication and advertising in business-to-business markets? Why advertise? How can companies manage communication over advertisement, exhibitions and public relations?
Sales and Distribution
How to build customer relationship? What are the major requirements of industrial selling? What is a distribution channel? How to design and manage a channel strategy on business-to-business markets?

Knowledge

Students will gain an introduction and good overview of

- Specific challenges in the marketing of innovative goods and services
- Key strategic areas in strategic marketing planning (cooperation, internationalization, timing)
- Tools for information gathering about future customer needs and requirements
- Fundamental pricing theories and pricing methods
- Main communication instruments
- Marketing channels and main organizational issues in sales management
- Basic approaches for managing customer relationship

Skills
Based on the acquired knowledge students will be able to:

- Design market timing decisions
- Make decisions for marketing-related cooperation and internationalization activities
- Manage the challenges of market-oriented development of new products and services
- Translate customer needs into concepts, prototypes and marketable offers
- Determine the perceived quality of an existing product or service using advanced elicitation and measurement techniques that fit the given situation
- Analyze the pricing alternatives for products and services
- Make strategic sales decisions for products and services (i.e. selection of sales channels)
- Analyze the value of customers and apply customer relationship management tools

Social Competence
The students will be able to

- have fruitful discussions and exchange arguments
- present results in a clear and concise way
- carry out respectful team work

Self-reliance
The students will be able to

- Acquire knowledge independently in the specific context and to map this knowledge on other new complex problem fields.
- Consider proposed business actions in the field of marketing and reflect on them.

Literature:
Homburg, C., Kuester, S., Krohmer, H. (2009). Marketing Management, McGraw-Hill Education, Berkshire, extracts p. 31-32, p. 38-53, 406-414, 427-431
Bingham, F. G., Gomes, R., Knowles, P. A. (2005). Business Marketing, McGraw-Hill Higher Education, 3rd edition, 2004, p. 106-110
Besanke, D., Dranove, D., Shanley, M., Schaefer, S. (2007), Economics of strategy, Wiley, 3rd edition, 2007, p. 149-155
Hutt, M. D., Speh, T.W. (2010), Business Marketing Management, 10th edition, South Western, Lengage Learning, p. 112-116

Course: Project Management (Vorlesung)

Lecturer:
Prof. Carlos Jahn

Language:
EN

Cycle:
WS

Content:
The lecture “project management” aims at characterizing typical phases of projects. Important contents are: possible tasks, organization, techniques and tools for initiation, definition, planning, management and finalization of projects.

Literature:
Project Management Institute (2008): A guide to the project management body of knowledge (PMBOK® Guide). 4. Aufl. Newtown Square, Pa: Project Management Institute.

Course: Project Management in Industrial Practice (Vorlesung)

Lecturer:
Wilhelm Radomsky

Language:
DE

Cycle:
WS

Content:

- Project management in a company
- Project life cycle / Project environment
- Project structuring / Project planning
- Deployment of methods / Team development
- Contract / Risk / Change management
- Multi-project management / Quality management
- Project controlling / Reporting
- Project organization / Project conclusion

Literature:

• Brown (1998): Erfolgreiches Projektmanagement in 7 Tagen
• Burghardt (2002): Einführung in Projektmanagement
• Cleland / King (1997): Project Management Handbook
• Hemmrich, Harrant (2002): Projektmanagement, In 7 Schritten zum Erfolg
• Kerzner (2003): Projektmanagement
• Litke (2004): Projektmanagement
• Madauss (2005): Handbuch Projektmanagement
• Patzak / Rattay (2004): Projektmanagement
• PMI (2004): A Guide to the Project Management Body of Knowledge
• RKW / GPM: Projektmanagement Fachmann
• Schelle / Ottmann / Pfeiffer (2005): ProjektManager

Course: Risk Management (Vorlesung)

Lecturer:
Dr. Meike Schröder

Language:
DE

Cycle:
WS

Content:

Risks are inherent in every aspect of business, and the ability of managing risks is one important aspect that differentiates successful business leaders from others. There exist various categories of risk, such as credit, country, market, liquidity, operational, supply chain and reputational. Companies are vulnerable to risks. What makes such risks even more complex and challenging to manage is that the risks are often not within the direct control of the business executive. They can exist outside of the company boundary, and yet the impact to the company can be huge. The awareness and knowledge of how to manage risks in companies, will become increasingly important.
Some of the main topics covered in this lecture include:

- Targets and legal aspects of risk management
- Risks and their impact
- Risk types (classification)
- Risk management and human resource
- Steps of the risk management process and their instruments
- Methods of risk assessment
- Implementation of risk management
- Management of specific risks

This lecture is presented in German language only.

Literature:

Brühwiler, B., Romeike, F. (2010), Praxisleitfaden Risikomanagement. ISO 31000 und ONR 49000 sicher anwenden, Berlin: Erich Schmidt.
Cottin, C., Döhler, S. (2013), Risikoanalyse. Modellierung, Beurteilung und Management von Risiken mit Praxisbeispielen, 2. überarbeitete und erweiterte Aufl., Wiesbaden: Springer.
Eller, R., Heinrich, M., Perrot, R., Reif, M. (2010), Kompaktwissen Risikomanagement. Nachschlagen, verstehen und erfolgreich umsetzen, Wiesbaden: Gabler.
Fiege, S. (2006), Risikomanagement- und Überwachungssystem nach KonTraG. Prozess, Instrumente, Träger, Wiesbaden: Deutscher Universitäts-Verlag.
Frame, D. (2003), Managing Risk in organizations. A guide for managers, San Francisco: Wiley.
Götze, U., Henselmann, K., Mikus, B. (2001), Risikomanagement, Heidelberg: Physica-Verlag.
Müller, K. (2010), Handbuch Unternehmenssicherheit. Umfassendes Sicherheits-, Kontinuitäts- und Risikomanagement mit System, 2., neu bearbeitete Auflage, Wiesbaden: Springer.
Rosenkranz, F., Missler-Behr, M. (2005), Unternehmensrisiken erkennen und managen. Einführung in die quantitative Planung, Berlin u.a.: Springer.
Wengert, H., Schittenhelm F. A. (2013), Coporate Risk Mangement, Berlin: Springer.

Course: Key Aspects of Patent Law (Seminar)

Lecturer:
Prof. Christian Rohnke

Language:
DE

Cycle:
SS

Content:
Mayor Issues in Patent Law:
The seminar covers five mayor issues in german patent law, namely patentatbility, prosecution, ownership and employee inventions, infringement and licensing and other commercila uses.
The lecturer will give an introduction to each issue which will be followed by in-depth inquiry by the participants through group work, presentation of results and moderated discussion.

Literature:
wird noch bekannt gegeben

Course: Environmental Management and Corporate Responsibilty (Vorlesung)

Lecturer:
Prof. Heike Flämig

Language:
DE

Cycle:
SS

Content:

- Imparting knowledge on EMAS and ISO 14.001 as important methodological approaches for the integration of environmental and sustainability management in business companies
- Explaination of theoretical concepts of corporate sustainability management
- Imparting pracitical knowledge from different stakeholder views: consulting company, trading enterprise, NGO, financial market

Literature:
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Course: Management Consulting (Vorlesung)

Lecturer:
Gerald Schwetje

Language:
DE

Cycle:
SS

Content:
The Management Consulting lecture teaches students knowledge that is complementary to their technical and business administration studies. They learn the basics of consulting and agent-principal theory and are given an overview of the consulting market. They are also shown how management consulting works and which methodical building blocks (processes) are needed to deal with a client's concerns and to undertake a consulting process. By means of practical examples students gain an insight into the extensive range of management consultancy services and of functional consulting.

Literature:
Bamberger, Ingolf (Hrsg.): Strategische Unternehmensberatung: Konzeptionen – Prozesse – Methoden, Gabler Verlag, Wiesbaden 2008
Bansbach, Schübel, Brötzel & Partner (Hrsg.): Consulting: Analyse – Konzepte – Gestaltung, Stollfuß Verlag, Bonn 2008
Fink, Dietmar (Hrsg.): Strategische Unternehmensberatung, Vahlens Handbücher, München, Verlag Vahlen, 2009
Heuermann, R./Herrmann, F.: Unternehmensberatung: Anatomie und Perspektiven einer Dienstleistungselite, Fakten und Meinungen für Kunden, Berater und Beobachter der Branche, Verlag Vahlen, München 2003
Kubr, Milan: Management consulting: A guide to the profession, 3. Auflage, Geneva, International Labour Office, 1992
Küting, Karlheinz (Hrsg.): Saarbrücker Handbuch der Betriebswirtschaftlichen Beratung; 4. Aufl., NWB Verlag, Herne 2008
Nagel, Kurt: 200 Strategien, Prinzipien und Systeme für den persönlichen und unternehmerischen Erfolg, 4. Aufl., Landsberg/Lech, mi-Verlag, 1991
Niedereichholz, Christel: Unternehmensberatung: Beratungsmarketing und Auftragsakquisition, Band 1, 2. Aufl., Oldenburg Verlag, 1996
Niedereichholz; Christel: Unternehmensberatung: Auftragsdurchführung und Qualitätssicherung, Band 2, Oldenburg Verlag, 1997
Quiring, Andreas: Rechtshandbuch für Unternehmensberater: Eine praxisorientierte Darstellung der typischen Risiken und der zweckmäßigen Strategien zum Risikomanagement mit Checklisten und Musterverträgen, Vahlen Verlag, München 2005
Schwetje, Gerald: Ihr Weg zur effizienten Unternehmensberatung: Beratungserfolg durch eine qualifizierte Beratungsmethode, NWB Verlag, Herne 2013
Schwetje, Gerald: Wer seine Nachfolge nicht regelt, vermindert seinen Unternehmenswert, in: NWB, Betriebswirtschaftliche Beratung,

03/2011 und: Sparkassen Firmenberatung aktuell, 05/2011
Schwetje, Gerald: Strategie-Assessment mit Hilfe von Arbeitshilfen der NWB-Datenbank – Pragmatischer Beratungsansatz speziell für KMU: NWB, Betriebswirtschaftliche Beratung, 10/2011
Schwetje, Gerald: Strategie-Werkzeugkasten für kleine Unternehmen, Fachbeiträge, Excel-Berechnungsprogramme, Checklisten/Muster und Mandanten-Merkblatt: NWB, Downloadprodukte, 11/2011
Schwetje, Gerald: Die Unternehmensberatung als komplementäres Leistungsangebot der Steuerberatung - Zusätzliches Honorar bei bestehenden Klienten: NWB, Betriebswirtschaftliche Beratung, 02/2012
Schwetje, Gerald: Die Mandanten-Berater-Beziehung: Erfolgsfaktor Beziehungsmanagement, in: NWB Betriebswirtschaftliche Beratung, 08/2012
Schwetje, Gerald: Die Mandanten-Berater-Beziehung: Erfolgsfaktor Vertrauen, in: NWB Betriebswirtschaftliche Beratung, 09/2012
Wohlgemuth, Andre C.: Unternehmensberatung (Management Consulting): Dokumentation zur Vorlesung „Unternehmensberatung“, vdf Hochschulverlag, Zürich 2010

Course: Entrepreneurial Business Creation (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Christoph Ihl

Language:
EN

Cycle:
WS

Content:
This course is supposed to provide intense hands-on experiences with the entrepreneurial process, tools and concepts discussed in the lecture “Entrepreneurship Management” and additional online material. At the beginning of the class, students form teams to search for and create a scalable and repeatable business opportunity. Rather than writing a comprehensive business plan or designing the perfect product, both of which are highly difficult and risky investments in the uncertain front end of any business idea, we follow a lean startup approach. Student teams will have to think about all the parts of building a business and apply the tools of business model design and customer & agile development in order optimize the search for and creation of a business opportunity. Students will start by mapping the assumptions regarding each of the part in their business model and then devote significant time on testing these hypotheses with customers and partners outside in the field (customer development). Based on the gathered information, students should realize which of their assumptions were wrong, and figure out ways how to fix it (learning events called “pivots”). The goal is to proceed in an iterative and incremental way (agile development) to build prototypes and (minimum viable) products. Throughout the course, student teams will present their lessons-learned (pivots) and how their business models have evolved based on their most important pivots. The course provides intense hands-on experience with the objective to develop the entrepreneurial mindset. This mindset of turning problems into opportunities can well be generalized from startups to innovative challenges in established companies and other innovative settings.

- assess and validate entrepreneurial opportunities, either for new venture creation or in the context of established corporations
- create and verify a business models to exploit entrepreneurial opportunities
- create and verify plans for gathering required resources such as talent and capital (startup) or employees and budgets (established firms)
- prepare comprehensive business plans
- identify and define business opportunities
- assess and validate entrepreneurial opportunities
- create and verify a business model of how to sell and market an entrepreneurial opportunity
- formulate and test business model assumptions and hypotheses
- conduct customer and expert interviews regarding business opportunities
- prepare business opportunity assessment
- create and verify a plan for gathering resources such as talent and capital
- pitch a business opportunity to your classmates and the teaching team
- team work
- communication and presentation
- give and take critical comments
- engaging in fruitful discussions
- autonomous work and time management
- project management
- analytical skills

Literature:
Blank, Steve (2013). Why the lean start-up changes everything. Harvard Business Review 91.5 (2013): 63-72.
Blank, Steven Gary, and Bob Dorf. The startup owner's manual: the step-by-step guide for building a great company. K&S Ranch, Incorporated, 2012.
Ries, Eric (2011). The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Random House LLC, 2011.

Course: Managment of Trust and Reputation (Seminar)

Lecturer:
Dr. Michael Florian

Language:
DE

Cycle:
SS

Content:
The seminar offers a comparison and analysis of relevant theoretical concepts and practical issues in the corporate management of trust and reputation. Selected case studies will be used to discuss opportunities, problems, and limitations using trust and reputation to coordinate and control economic behavior.

Literature:
Allgäuer, Jörg E. (2009): Vertrauensmanagement: Kontrolle ist gut, Vertrauen ist besser. Ein Plädoyer für Vertrauensmanagement als zentrale Aufgabe integrierter Unternehmenskommunikation von Dienstleistungsunternehmen. München: brain script Behr.
Beckert, Jens; Metzner, André; Roehl, Heiko (1998): Vertrauenserosion als organisatorische Gefahr und wie ihr zu begegnen ist. In: Organisationsentwicklung 17 (4), S. 57-66.
Eberl, Peter (2003): Vertrauen und Management. Studien zu einer theoretischen Fundierung des Vertrauenskonstruktes in der Managementlehre. Stuttgart: Schäffer-Poeschel.
Eberl, Peter (2012): Vertrauen und Kontrolle in Organisationen. Das problematische Verhältnis der Betriebswirtschaftslehre zum Vertrauen. In: Möller, Heidi (Hg.): Vertrauen in Organisationen. Riskante Vorleistung oder hoffnungsvolle Erwartung? Wiesbaden: Springer VS, S. 93-110.
Eisenegger, Mark (2005): Reputation in der Mediengesellschaft. Konstitution Issues Monitoring Issues Management. Wiesbaden: VS Verlag für Sozialwissenschaften.
Florian, Michael (2013): Paradoxien des Vertrauensmanagements. Risiken und Chancen einer widerspenstigen immateriellen Ressource. In: Personalführung 46, Heft 2/2013, S. 40-47.
Grüninger, Stephan (2001): Vertrauensmanagement - Kooperation, Moral und Governance. Marburg: Metropolis.
Grüninger, Stephan; John, Dieter (2004): Corporate Governance und Vertrauensmanagement. In: Josef Wieland (Hg.): Handbuch Wertemanagement. Erfolgsstrategien einer modernen Corporate Governance. Hamburg: Murmann, S. 149-177.
Meifert, Matthias (2008): Ist Vertrauenskultur machbar? Vorbedingungen und Überforderungen betrieblicher Personalpolitik. In: Rainer Benthin und Ulrich Brinkmann (Hg.): Unternehmenskultur und Mitbestimmung. Betriebliche Integration zwischen Konsens und Konflikt. Frankfurt/Main, New York: Campus, S. 309-327.
Neujahr, Elke; Merten, Klaus (2012): Reputationsmanagement. Zur Kommunikation von Wertschätzung. In: PR-Magazin 06/2012, S. 60-67.
Osterloh, Margit; Weibel, Antoinette (2006): Investition Vertrauen. Prozesse der Vertrauensentwicklung in Organisationen. Wiesbaden: Gabler.
Osterloh, Margit; Weibel, Antoinette (2006): Vertrauen und Kontrolle. In: Robert J. Zaugg und Norbert Thom (Hg.): Handbuch Kompetenzmanagement. Durch Kompetenz nachhaltig Werte schaffen. Festschrift für Prof. Dr. Dr. h.c. mult. Norbert Thom zum 60. Geburtstag. Bern [u.a.]: Haupt, S. 53-63.
Osterloh, Margit; Weibel, Antoinette (2007): Vertrauensmanagement in Unternehmen: Grundlagen und Fallbeispiele. In: Manfred Piwinger und Ansgar Zerfaß (Hg.): Handbuch Unternehmenskommunikation. Wiesbaden: Gabler, S. 189-203.
Schmidt, Matthias; Beschorner, Thomas (2005): Werte- und Reputationsmanagement. München und Mering: Hampp.
Seifert, Matthias (2003): Vertrauensmanagement in Unternehmen. Eine empirische Studie über Vertrauen zwischen Angestellten und ihren Führungskräften. 2. Aufl. München und Mering: Hampp.
Sprenger, Reinhard K. (2002): Vertrauen führt. Worauf es im Unternehmen wirklich ankommt, Frankfurt/Main, New York.
Thiessen, Ansgar (2011): Organisationskommunikation in Krisen. Reputationsmanagement durch strategische, integrierte und situative Krisenkommunikation. Wiesbaden: VS Verlag für Sozialwissenschaften.
Walgenbach, Peter (2000): Das Konzept der Vertrauensorganisation. Eine theoriegeleitete Betrachtung. In: Die Betriebswirtschaft 60 (6), S. 707-720.
Walgenbach, Peter (2006): Wieso ist Vertrauen in ökonomischen Transaktionsbeziehungen so wichtig, und wie lässt es sich generieren? In: Hans H. Bauer, Marcus M. Neumann und Anja Schüle (Hg.): Konsumentenvertrauen. Konzepte und Anwendungen für ein nachhaltiges Kundenbindungsmanagement. München: Vahlen, S. 17-26.
Weibel, Antoinette (2004): Kooperation in strategischen Wissensnetzwerken. Vertrauen und Kontrolle zur Lösung des sozialen Dilemmas. Wiesbaden: Dt. Univ.-Verl.
Weinreich. Uwe (2003): Vertrauensmanagement. In: Deutscher Manager-Verband e.V. (Hg.): Die Zukunft des Managements. Perspektiven für die Unternehmensführung. Zürich: Vdf, Hochsch.-Verl. an der ETH, S. 193-201.

Course: Methods of Systematic Product Development (Seminar)

Lecturer:
Solveigh Hieber

Language:
DE/EN

Cycle:
SS

Content:
This seminar is about the basics of TRIZ and some additional creativity techniques.
Content:

- Introduction in Methods of Systematic Product Development
- Framework for the use of TRIZ and creativity techniques
- Historical background and origin of TRIZ
- TRIZ basic methods:
    - Innovation Check List

    - Ideal Final Result
    - Functional Analysis and Object Analysis
    - Contradiction Matrix and Inventive Principles
    - Physical Contradictions and Separation Principles
    - Method of Smart Little People
    - Trends of Technical Evolution
- Basics for Moderators
- The TRIZ Community today
- Additional, common Creativity Techniques

Literature:

Altschuller, S. (1984): Erfinden – Wege zur Lösung technischer Probleme. Limitierter Nachdruck 1998. VEB Verlag Technik
Koltze, K. & Souchkov, V. (2010): Systematische Innovation: TRIZ-Anwendung in der Produkt- und Prozessentwicklung. Carl Hanser Verlag
Orloff, M. A. (2006): Grundlagen der klassischen TRIZ. 3. Auflage. Springer Verlag

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Course: Public and Constitutional Law (Vorlesung)

Lecturer:

Klaus Tempke

Language:

DE

Cycle:

SS

Content:

Different areas of public law; proceedings, jurisdiction of administrative courts with stages of appeal,
members of the courts;
Court levels, organization and legal capacity;
Introduction to and structure of fundamental rights;
Human dignity: the guiding principle of the constitution;
General right of privacy and freedom of action.

Literature:

Specialisation Waste and Energy

Module: Waste and Energy

Courses:

Title	Typ	Hrs/wk
Waste Recycling Technologies	Vorlesung	2
Waste Recycling Technologies	Gruppenübung	1
Waste to Energy	Problemorientierte Lehrveranstaltung	2

Module Responsibility:
Prof. Kerstin Kuchta

Admission Requirements:
none

Recommended Previous Knowledge:
Basics of process engineering

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students are able to describe and explain in detail techniques, processes and concepts for treatment and energy recovery from wastes.

Capabilities:
The students are able to select suitable processes for the treatment and energy recovery of wastes. They can evaluate the efforts and costs for processes and select economically feasible treatment Concepts. Students are able to evaluate alternatives even with incomplete information. Students are able to prepare systematic documentation of work results in form of reports, presentations and are able to defend their findings in a group.

Personal Competence:
Social Competence:
Students can participate in subject-specific and interdisciplinary discussions, develop cooperated solutions and defend their own work results in front of others and promote the scientific development of collegues. Furthermore, they can give and accept professional constructive criticism.

Autonomy:
Students can independently tap knowledge of the subject area and transform it to new questions. They are capable, in consultation with supervisors, to assess their learning level and define further steps on this basis. Furthermore, they can define targets for new application-or research-oriented duties in accordance with the potential social, economic and cultural impact.

ECTS-Credit points:
6 LP

Examination:
Projektarbeit

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Waste and Energy: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Kernqualifikation: Compulsory
Renewable Energies: Vertiefung Bio energies: Compulsory suffrage

Course: Waste Recycling Technologies (Vorlesung)

Lecturer:
Prof. Kerstin Kuchta

Language:
EN

Cycle:
SS

Content:

- Fundamentals on primary and secondary production of raw materials (steel, aluminum, phosphorous, copper, precious metals, rare

metals)
- Use and demand of metals and minerals in industry and society
- collection systems and concepts
- quota and efficiency
- Advanced sorting technologies
- mechanical pretreatment
- advanced treatment
- Chemical analysis of Critical Materials in post-consumer products
- Analytical tools in Resource Management (Material Flow Analysis, Recycling Performance Indicators, Criticality Assessment, statistical analysis of uncertainties)

Literature:

Course: Waste Recycling Technologies (Übung)

Lecturer:
Prof. Kerstin Kuchta

Language:
EN

Cycle:
SS

Content:

- Fundamentals on primary and secondary production of raw materials (steel, aluminum, phosphorous, copper, precious metals, rare metals)
- Use and demand of metals and minerals in industry and society
- collection systems and concepts
- quota and efficiency
- Advanced sorting technologies
- mechanical pretreatment
- advanced treatment
- Chemical analysis of Critical Materials in post-consumer products
- Analytical tools in Resource Management (Material Flow Analysis, Recycling Performance Indicators, Criticality Assessment, statistical analysis of uncertainties)

Literature:

Course: Waste to Energy (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Rüdiger Siechau

Language:
EN

Cycle:
SS

Content:

- Project-based lecture
- Introduction into the " Waste to Energy " consisting of:
  - Thermal Process (incinerator , RDF combustion)
  - Biological processes (Wet-/Dryfermentation)
  - technology , energy , emissions, approval , etc.
- Group work
  - design of systems/plants for energy recovery from waste
  - The following points are to be processed :
    - Input: waste (fraction collection and transportation, current quantity , material flows , possible amount of development)
    - Plant (design, process diagram , technology, energy production)
    - Output (energy quantity / type , by-products)
    - Costs and revenues
    - Climate and resource protection (CO2 balance , substitution of primary raw materials / fossil fuels)
    - Location and approval (infrastructure , expiration authorization procedure)
    - Focus at the whole concept (advantages, disadvantages , risks and opportunities , discussion)
- Grading: No Exam , but presentation of the results of the working group

Literature:
Literatur:

Einführung in die Abfallwirtschaft; Martin Kranert, Klaus Cord-Landwehr (Hrsg.); Vieweg + Teubner Verlag; 2010
Powerpoint-Folien in Stud IP

Literature:
Introduction to Waste Management; Kranert Martin , Klaus Cord - Landwehr (Ed.), Vieweg + Teubner Verlag , 2010

PowerPoint slides in Stud IP

Module: Special Aspects of Waste Resource Management

Courses:

Title	Typ	Hrs/wk
Advanced Topics in Waste Resource Management	Problemorientierte Lehrveranstaltung	3
International Waste Management	Problemorientierte Lehrveranstaltung	2

Module Responsibility:
Prof. Kerstin Kuchta

Admission Requirements:
none

Recommended Previous Knowledge:
basics in waste treatment technologies

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
The students are able to describe waste as a resource as well as advanced technologies for recycling and recovery of resources from waste in detail. This covers collection, transport, treatment and disposal in national and international contexts.
Capabilities:
Students are able to select suitable processes for the treatment with respect to the national or cultural and developmental context. They can evaluate the ecological impact and the technical effort of different technologies and management systems.

Personal Competence:
Social Competence:
Students can work together as a team of 2-5 persons, participate in subject-specific and interdisciplinary discussions, develop cooperated solutions and defend their own work results in front of others and promote the scientific development of colleagues. Furthermore, they can give and accept professional constructive criticisms.
Autonomy:
Students can independently gain additional knowledge of the subject area and apply it in solving the given course tasks and projects.

ECTS-Credit points:
6 LP

Examination:
Projektarbeit

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Waste and Energy: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Energy: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Advanced Topics in Waste Resource Management (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Rüdiger Siechau

Language:
EN

Cycle:
WS

Content:
Focus of the course "Advanced topics of waste resource management" lies on the organisational structures in waste management – such as planning, financing and logistics. One excursion will be offered to take part in (incineration plant, vehicle fleet and waste collection systems).
The course is split into two parts:
1. part: “Conventional” lecture (development of waste management, legislation, collection, transportation and organisation of waste management, costs, fees and revenues).
2. part: Project base learning: You will get a project to work out in groups of 4 to 6 students; all tools and data you need to work out the project were given before during the conventional lecture. Course documents are published in StudIP and communication during project work takes place via StudIP.
The results of the project work are presented at the end of the semester. The final mark for the course consists of the grade for the presentation.

Literature:
Einführung in die Abfallwirtschaft; Martin Kranert, Klaus Cord-Landwehr (Hrsg.); Vieweg + Teubner Verlag; 2010
PowerPoint slides in Stud IP

Course: International Waste Management (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Kerstin Kuchta

Language:
EN

Cycle:
WS

Content:
Waste avoidance and recycling are the focus of this lecture. Additionally, waste logistics (Collection, transport, export, fees and taxes) as well as international waste shipment solutions are presented.
Other specific wastes, e.g. industrial waste, treatment concepts will be presented and developed by students themselves
Waste composition and production on international level, wast eulogistic, collection and treatment in emerging and developing countries.
Single national projects and studies will be prepared and presented by students

Literature:
Basel convention

Module: Wasterwater Treatment and Air Pollution Abatement

Courses:

Title	Typ	Hrs/wk
Biological Wastewater Treatment	Vorlesung	2
Air Pollution Abatement	Vorlesung	2

Module Responsibility:
Dr. Ernst-Ulrich Hartge

Admission Requirements:

Recommended Previous Knowledge:
Basic knowledge of biology and chemistry
basic knowledge of solids process engineering and separation technology

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
After successful completion of the module students are able to

- name and explain biological processes for waste watter treatment,
- characterize waste water and sewage sludge
- discuss legal regulations in the area of emissions and air quality
- classify off gas tretament processes and to define their area of application

Capabilities:
Students are able to

- choose and design processs steps for the biological waste water treatment
- combine processes for cleaning of off-gases depending on the pollutants contained in the gases

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Bioprocess Engineering: Vertiefung A - General Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung General Process Engineering: Compulsory suffrage
Energy and Environmental Engineering: Vertiefung Environmental Engineering: Compulsory suffrage
Environmental Engineering: Vertiefung Waste and Energy: Compulsory suffrage
International Management and Engineering: Vertiefung II. Energy and Environmental Engineering: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Process Engineering: Vertiefung Environmental Process Engineering: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory
Water and Environmental Engineering: Vertiefung Cities: Compulsory

Course: Biological Wastewater Treatment (Vorlesung)

Lecturer:
Dr. Joachim Behrendt

Language:
DE/EN

Cycle:
WS

Content:
Charaterisation of Wastewater
Metobolism of Microorganisms
Kinetic of mirobiotic processes

Calculation of bioreactor for wastewater treatment
Concepts of Wastewater treatment
Design of WWTP
Excursion to a WWTP
Biofilms
Biofim Reactors
Anaerobic Wastewater and sldge treatment
resources oriented sanitation technology
Future challenges of wastewater treatment

Literature:

Gujer, Willi
Siedlungswasserwirtschaft : mit 84 Tabellen
ISBN: 3540343296 (Gb.) URL: http://www.gbv.de/dms/bs/toc/516261924.pdf URL: http://deposit.d-nb.de/cgi-bin/dokserv?id=2842122&prov=M&dok_var=1&dok_ext=htm
Berlin [u.a.] : Springer, 2007
TUB_HH_Katalog
Henze, Mogens
Wastewater treatment : biological and chemical processes
ISBN: 3540422285 (Pp.)
Berlin [u.a.] : Springer, 2002
TUB_HH_Katalog
Imhoff, Karl (Imhoff, Klaus R.;)
Taschenbuch der Stadtentwässerung : mit 10 Tafeln
ISBN: 3486263331 ((Gb.))
München [u.a.] : Oldenbourg, 1999
TUB_HH_Katalog
Lange, Jörg (Otterpohl, Ralf; Steger-Hartmann, Thomas;)
Abwasser : Handbuch zu einer zukunftsfähigen Wasserwirtschaft
ISBN: 3980350215 (kart.) URL: http://www.gbv.de/du/services/agi/52567E5D44DA0809C12570220050BF25/000000700334
Donaueschingen-Pfohren : Mall-Beton-Verl., 2000
TUB_HH_Katalog
Mudrack, Klaus (Kunst, Sabine;)
Biologie der Abwasserreinigung : 18 Tabellen
ISBN: 382741427X URL: http://www.gbv.de/du/services/agi/94B581161B6EC747C1256E3F005A8143/420000114903
Heidelberg [u.a.] : Spektrum, Akad. Verl., 2003
TUB_HH_Katalog
Tchobanoglous, George (Metcalf & Eddy, Inc., ;)
Wastewater engineering : treatment and reuse
ISBN: 0070418780 (alk. paper) ISBN: 0071122508 (ISE (*pbk))
Boston [u.a.] : McGraw-Hill, 2003
TUB_HH_Katalog
Henze, Mogens
Activated sludge models ASM1, ASM2, ASM2d and ASM3
ISBN: 1900222248
London : IWA Publ., 2002
TUB_HH_Katalog
Kunz, Peter
Umwelt-Bioverfahrenstechnik
Vieweg, 1992
Bauhaus-Universität., Arbeitsgruppe Weiterbildendes Studium Wasser und Umwelt (Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall, ;)
Abwasserbehandlung : Gewässerbelastung, Bemessungsgrundlagen, Mechanische Verfahren, Biologische Verfahren, Reststoffe aus der Abwasserbehandlung, Kleinkläranlagen
ISBN: 3860682725 URL: http://www.gbv.de/dms/weimar/toc/513989765_toc.pdf URL: http://www.gbv.de/dms/weimar/abs/513989765_abs.pdf
Weimar : Universitätsverl, 2006
TUB_HH_Katalog
Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall
DWA-Regelwerk
Hennef : DWA, 2004
TUB_HH_Katalog
Wiesmann, Udo (Choi, In Su; Dombrowski, Eva-Maria;)
Fundamentals of biological wastewater treatment
ISBN: 3527312196 (Gb.) URL: http://deposit.ddb.de/cgi-bin/dokserv?id=2774611&prov=M&dok_var=1&dok_ext=htm
Weinheim : WILEY-VCH, 2007
TUB_HH_Katalog

Course: Air Pollution Abatement (Vorlesung)

Lecturer:

Dr. Ernst-Ulrich Hartge

Language:
EN

Cycle:
WS

Content:
In the lecture methods for the reduction of emissions from industrial plants are treated. At the beginning a short survey of the different forms of air pollutants is given. In the second part physical principals for the removal of particulate and gaseous pollutants form flue gases are treated. Industrial applications of these principles are demonstrated with examples showing the removal of specific compounds, e.g. sulfur or mercury from flue gases of incinerators.

Literature:
Handbook of air pollution prevention and control, Nicholas P. Cheremisinoff. - Amsterdam [u.a.] : Butterworth-Heinemann, 2002
Atmospheric pollution : history, science, and regulation, Mark Zachary Jacobson. - Cambridge [u.a.] : Cambridge Univ. Press, 2002
Air pollution control technology handbook, Karl B. Schnelle. - Boca Raton [u.a.] : CRC Press, c 2002
Air pollution, Jeremy Colls. - 2. ed. - London [u.a.] : Spon, 2002

Module: Bioresources and Biorefineries

Courses:

Title	Typ	Hrs/wk
Biorefinery Technology	Vorlesung	2
Biorefinery Technologie	Gruppenübung	1
Bioresource Management	Vorlesung	2
Bioresource Management	Gruppenübung	1

Module Responsibility:
Dr. Ina Körner

Admission Requirements:
Non

Recommended Previous Knowledge:
Basics on engineering;
Basics of waste and energy management

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students can give on overview on principles and theories in the field's bioresource management and biorefinery technology and can explain specialized terms and technologies.
Capabilities:
Students are capable of applying knowledge and know-how in the field's bioresource management and biorefinery technology in order to perform technical and regional-planning tasks. They are also able to discuss the links to waste management, energy management and biotechnology.

Personal Competence:
Social Competence:
Students can work goal-oriented with others and communicate and document their interests and knowledge in acceptable way.
Autonomy:
Students are able to solve independently, with the aid of pointers, practice-related tasks bearing in mind possible societal consequences.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 96, Study Time in Lecture: 84

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Waste and Energy: Compulsory suffrage
Environmental Engineering: Vertiefung Biotechnology: Compulsory suffrage
International Management and Engineering: Vertiefung II. Energy and Environmental Engineering: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Energy: Compulsory suffrage

Course: Biorefinery Technology (Vorlesung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
The Europe 2020 strategy calls for bioeconomy as the key for smart and green growth of today. Biorefineries are the fundamental part on the way to convert the use of fossil-based society to bio-based society. For this reason, agriculture and forestry sectors are increasingly deliver bioresources. It is not only for their traditional applications in the food and feed sectors such as pulp or paper and construction material productions, but also to produce bioenergy and bio-based products such as bio-plastics. However although bioresources are renewable, they are considered as limited resources as well. The bioeconomy's limitation factor is the availability land on our world. In the context of the development of the bioeconomy, the sustainable and reliable supply of noon-food biomass feedstock is a critical success factor for the long-term perspective of bioenergy and other bio-based products production. Biorefineries are complex of technologies and process cascades using the available primary, secondary and tertiary bioresources to produce a multitude of products - a product mix from material and energy products.
The lecture gives an overview on biorefinery technology and shall contribute to promotion of international biorefinery developments.

Lectures:

- What is a biorefinery: Overview on basic organic substrates and processes which lead to material and energy products
- The way from a fossil based to a biobased economy in the 21st century
- The worlds most advanced biorefinery
- Presentation of various biorefinery systems and their products (e.g. lignocellulose biorefinery, green biorefinery, whole plant biorefinery, civilization biorefinery)
- Example projects (e.g. combination of anaerobic digestion and composting in practice; demonstration project in Hamburgs city quarter Jenfelder Au)

The lectures will be accompanied by technical tours. Optional it is also possible to visit more biorefinery lectures in the University of Hamburg (lectures in German only).
In the exercise students have the possibility to work in groups on a biorefinery project or to work on a student-specific task.

Literature:
Biorefineries - Industrial Process and Products - Status Qua and Future directions by Kamm, Gruber and Kamm (2010); Wiley VCH, available on-line in TUHH-library
Powerpoint-Präsentations / selected Publications / further recommendations depending on the actual developments
Industrial Biorefineries and White Biorefinery, by Pandey, Höfer, Larroche, Taherzadeh, Nampoothiri (Eds.); (2014 book development in progress)

Course: Biorefinery Technologie (Übung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
1.) Selection of a topic within the thematic area "Biorefinery Technologie" from a given list or self-selected.
2.) Self-dependent recherches to the topic.
3.) Preparation of a written elaboration.
4.) Presentation of the results in the group.

Literature:
Vom Thema abhängig. Eigene Recherchen nötig.
Depending on the topic. Own recheches necassary.

Course: Bioresource Management (Vorlesung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
In the context of limited fossil resources, climate change mitigation and increasing population growth, Bioresources has a special role. They have to feed the population and in the same time they are important for material production such as pulp and paper or construction materials. Moreover they become more and more important in chemical industry and in energy provision as fossil substitution. Although Bioresources are renewable, they are also considered as limited resources. The availability of land on our planet is the main limitation factor. The sustainable and reliable supply of non-food biomass feedstock is a critical for successful and long term perspective on production of bioenergy and other bio-based products. As the consequence, the increasing competition and shortages continue to happen at the traditional sectors. On the other side, huge unused but potentials residue on waste and wastewater sector exist. Nowadays, a lot of activities to develop better processes, to create new bio-based products in order to become more efficient, the inclusion of secondary and tertiary bio-resources in the valorisation chain are going on.
The lecture deals with the current state-of-the-art of bioresource management. It shows deficits and potentials for improvement especially in the sector of utilization of organic residues for material and energy generation:
Lectures on:

- Bioresource generation and utilization including lost potentials today
- Basic biological, mechanical, physico-chemical and logistical processes
- The conflict of material vs. energy generation from wood / waste wood
- The basics of pulp & paper production including waste paper recycling
- The Pros and Cons from biogas and compost production

Special lectures by invited guests from research and practice:

- Pathways of waste organics on the example of Hamburg`s City Cleaning Company
- Utilization options of landscaping materials on the example of grass

- Increase of process efficiency of anaerobic digestions
- Decision support tools on the example of an municipality in Indonesia

Optional: Technical visits

Literature:
Power-Point presentations in STUD-IP

Course: Bioresource Management (Übung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
In the context of limited fossil resources, climate change mitigation and increasing population growth, Bioresources has a special role. They have to feed the population and in the same time they are important for material production such as pulp and paper or construction materials. Moreover they become more and more important in chemical industry and in energy provision as fossil substitution. Although Bioresources are renewable, they are also considered as limited resources. The availability of land on our planet is the main limitation factor. The sustainable and reliable supply of non-food biomass feedstock is a critical for successful and long term perspective on production of bioenergy and other bio-based products. As the consequence, the increasing competition and shortages continue to happen at the traditional sectors. On the other side, huge unused but potentials residue on waste and wastewater sector exist. Nowadays, a lot of activities to develop better processes, to create new bio-based products in order to become more efficient, the inclusion of secondary and tertiary bio-resources in the valorisation chain are going on.
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- Utilization options of landscaping materials on the example of grass
- Increase of process efficiency of anaerobic digestions
- Decision support tools on the example of an municipality in Indonesia

Optional: Technical visits

Literature:
Power-Point presentations in STUD-IP

Module: Project Work Waste and Energy

Courses:

Title	Typ	Hrs/wk
Project Work Waste and Energy	Projektseminar	2

Module Responsibility:
Dozenten des SD B

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Capabilities:

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
12 LP

Examination:
Projektarbeit

Workload in Hours:
Indipendent Study Time: 332, Study Time in Lecture: 28

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Waste and Energy: Compulsory

Course: Project Work Waste and Energy (Projektseminar)

Lecturer:
Dozenten des SD B

Language:
EN

Cycle:
WS

Content:

Literature:

Specialisation Biotechnology

Module: Bioprocess and Biosystems Engineering

Courses:

Title	Typ	Hrs/wk
Bioreactor Design and Operation	Vorlesung	2
Bioreactor Design and Operation	Laborpraktikum	1
Biosystems Engineering	Vorlesung	2
Biosystems Engineering	Problemorientierte Lehrveranstaltung	1

Module Responsibility:
Prof. An-Ping Zeng

Admission Requirements:
Bachelor VT, BVT or equivalent

Recommended Previous Knowledge:
Knowledge of bioprocess engineering and process engineering at bachelor level

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
After completion of this module, participants will be able to:

- differentiate between different kinds of bioreactors and describe their key features
- identify and characterize the peripheral and control systems of bioreactors
- depict integrated biosystems (bioprocesses including up- and downstream processing)
- name different sterilization methods and evaluate those in terms of different applications
- recall and define the advanced methods of modern systems-biological approaches
- connect the multiple "omics"-methods and evaluate their application for biological questions
- recall the fundamentals of modeling and simulation of biological networks and biotechnological processes and to discuss their methods
- assess and apply methods and theories of genomics, transcriptomics, proteomics and metabolomics in order to quantify and optimize biological processes at molecular and process levels.

Capabilities:
After completion of this module, participants will be able to:

- describe different process control strategies for bioreactors and chose them after analysis of characteristics of a given bioprocess
- plan and construct a bioreactor system including peripherals from lab to pilot plant scale
- adapt a present bioreactor system to a new process and optimize it
- develop concepts for integration of bioreactors into bioproduction processes
- combine the different modeling methods into an overall modeling approach, to apply these methods to specific problems and to evaluate the achieved results critically
- connect all process components of biotechnological processes for a holistic system view.

Personal Competence:
Social Competence:
After completion of this module, participants will be able to debate technical questions in small teams to enhance the ability to take position to their own opinions and increase their capacity for teamwork.
Autonomy:
After completion of this module, participants will be able to solve a technical problem in teams of approx. 8-12 persons independently including a presentation of the results.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:

Indipendent Study Time: 96, Study Time in Lecture: 84

Assignment for the Following Curricula:
Bioprocess Engineering: Kernqualifikation: Compulsory
Chemical and Bioprocess Engineering: Kernqualifikation: Compulsory
Environmental Engineering: Vertiefung Biotechnology: Compulsory suffrage
International Management and Engineering: Vertiefung II. Process Engineering and Biotechnology: Compulsory suffrage
Process Engineering: Kernqualifikation: Compulsory

Course: Bioreactor Design and Operation (Vorlesung)

Lecturer:
Prof. An-Ping Zeng

Language:
EN

Cycle:
SS

Content:

Design of bioreactors and peripheries:

- reactor types and geometry
- materials and surface treatment
- agitation system design
- insertion of stirrer
- sealings
- fittings and valves
- peripherals
- materials
- standardization
- demonstration in laboratory and pilot plant

Sterile operation:

- theory of sterilisation processes
- different sterilisation methods
- sterilisation of reactor and probes
- industrial sterile test, automated sterilisation
- introduction of biological material
- autoclaves
- continuous sterilisation of fluids
- deep bed filters, tangential flow filters
- demonstration and practice in pilot plant

Instrumentation and control:

- temperature control and heat exchange
- dissolved oxygen control and mass transfer
- aeration and mixing
- used gassing units and gassing strategies
- control of agitation and power input
- pH and reactor volume, foaming, membrane gassing

Bioreactor selection and scale-up:

- selection criteria
- scale-up and scale-down
- reactors for mammalian cell culture

Integrated biosystem:

- interactions and integration of microorganisms, bioreactor and downstream processing
- Miniplant technologies

Team work with presentation:

- Operation mode of selected bioprocesses (e.g. fundamentals of batch, fed-batch and continuous cultivation)

Literature:

- Storhas, Winfried, Bioreaktoren und periphere Einrichtungen, Braunschweig: Vieweg, 1994
- Chmiel, Horst, Bioprozeßtechnik; Springer 2011
- Krahe, Martin, Biochemical Engineering, Ullmann‘s Encyclopedia of Industrial Chemistry

- Pauline M. Doran, Bioprocess Engineering Principles, Second Edition, Academic Press, 2013
- Other lecture materials to be distributed

Course: Bioreactor Design and Operation (Laborpraktikum)

Lecturer:
Prof. An-Ping Zeng

Language:
EN

Cycle:
SS

Content:

Design of bioreactors and peripheries (Exercise/Practical):

- reactor types and geometry
- materials and surface treatment
- agitation system design
- insertion of stirrer
- sealings
- fittings and valves
- peripherals
- materials
- standardization
- demonstration in laboratory and pilot plant

Sterile operation:

- theory of sterilisation processes
- different sterilisation methods
- sterilisation of reactor and probes
- industrial sterile test, automated sterilisation
- introduction of biological material
- autoclaves
- continuous sterilisation of fluids
- deep bed filters, tangential flow filters
- demonstration and practice in pilot plant

Instrumentation and control:

- temperature control and heat exchange
- dissolved oxygen control and mass transfer
- aeration and mixing
- used gassing units and gassing strategies
- control of agitation and power input
- pH and reactor volume, foaming, membrane gassing

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- scale-up and scale-down
- reactors for mammalian cell culture

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- Storhas, Winfried, Bioreaktoren und periphere Einrichtungen, Braunschweig: Vieweg, 1994
- Chmiel, Horst, Bioprozeßtechnik; Springer 2011
- Krahe, Martin, Biochemical Engineering, Ullmann‘s Encyclopedia of Industrial Chemistry
- Pauline M. Doran, Bioprocess Engineering Principles, Second Edition, Academic Press, 2013
- Other lecture materials to be distributed

Course: Biosystems Engineering (Vorlesung)

Lecturer:

Prof. An-Ping Zeng

Language:
EN

Cycle:
SS

Content:
Introduction to Biosystems Engineering

Experimental basis and methods for biosystems analysis

- Introduction to genomics, transcriptomics and proteomics
- More detailed treatment of metabolomics
- Determination of in-vivo kinetics
- Techniques for rapid sampling
- Quenching and extraction
- Analytical methods for determination of metabolite concentrations

Analysis, modelling and simulation of biological networks

- Metabolic flux analysis
- Introduction
- Isotope labelling
- Elementary flux modes
- Mechanistic and structural network models
- Regulatory networks
- Systems analysis
- Structural network analysis
- Linear and non-linear dynamic systems
- Sensitivity analysis (metabolic control analysis)

Modelling and simulation for bioprocess engineering

- Modelling of bioreactors
- Dynamic behaviour of bioprocesses

Selected projects for biosystems engineering

- Miniaturisation of bioreaction systems
- Miniplant technology for the integration of biosynthesis and downstream processin
- Technical and economic overall assessment of bioproduction processes

Literature:
E. Klipp et al. Systems Biology in Practice, Wiley-VCH, 2006
R. Dohrn: Miniplant-Technik, Wiley-VCH, 2006
G.N. Stephanopoulos et. al.: Metabolic Engineering, Academic Press, 1998
I.J. Dunn et. al.: Biological Reaction Engineering, Wiley-VCH, 2003
Lecture materials to be distributed

Course: Biosystems Engineering (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. An-Ping Zeng

Language:
EN

Cycle:
SS

Content:
Introduction to Biosystems Engineering (Exercise)

Experimental basis and methods for biosystems analysis

- Introduction to genomics, transcriptomics and proteomics
- More detailed treatment of metabolomics
- Determination of in-vivo kinetics
- Techniques for rapid sampling

- Quenching and extraction
- Analytical methods for determination of metabolite concentrations

Analysis, modelling and simulation of biological networks

- Metabolic flux analysis
- Introduction
- Isotope labelling
- Elementary flux modes
- Mechanistic and structural network models
- Regulatory networks
- Systems analysis
- Structural network analysis
- Linear and non-linear dynamic systems
- Sensitivity analysis (metabolic control analysis)

Modelling and simulation for bioprocess engineering

- Modelling of bioreactors
- Dynamic behaviour of bioprocesses

Selected projects for biosystems engineering

- Miniaturisation of bioreaction systems
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Literature:

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R. Dohrn: Miniplant-Technik, Wiley-VCH, 2006
G.N. Stephanopoulos et. al.: Metabolic Engineering, Academic Press, 1998
I.J. Dunn et. al.: Biological Reaction Engineering, Wiley-VCH, 2003
Lecture materials to be distributed

Module: Environmental Biotechnology

Courses:

Title	Typ	Hrs/wk
Technical and Environmental Microbiology	Laborpraktikum	3
Environmental Microbiology	Vorlesung	2

Module Responsibility:
Prof. Rudolf Müller

Admission Requirements:
none

Recommended Previous Knowledge:
basic knowledge in organic chemistry and microbiology

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
At the end of this module the students are able to:
- explain methods for the detection of microorganisms in the environment
- explain the mechanisms that exist for the biological degradation of pollutants

Capabilities:
At the end of this module the students are able:
- to judge, in which technical processes microbially mediated problems may occur
- to propose methods for the elimination of microorganisms from the environment
- to evaluate environmental problems derived from pollutants and their consequences,
- to isolate bacteria from water and soil samples,
- to perform and document experiments concerning biological degradation of pollutants,

to use modern molecular biology methods for the characterization of mixed bacterial communities,
to transfer the mechanisms for the degradation of environmental pollutants to new chemicals whose degradation is not known yet.

Personal Competence:
Social Competence:
The students can:
- perform experiments in teams of 4 students

Autonomy:
The students are able:
- to extract new knowledge from scientific articles, summarize them and compare it to the contents of the lecture

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Bioprocess Engineering: Vertiefung A - General Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung General Process Engineering: Compulsory suffrage
Environmental Engineering: Vertiefung Biotechnology: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Energy: Compulsory suffrage

Course: Technical and Environmental Microbiology (Laborpraktikum)

Lecturer:
Prof. Rudolf Müller, Prof. Garabed Antranikian, Dr. Kerstin Sahm

Language:
EN

Cycle:
WS

Content:
Working with Microorganisms under aerob and anaerob conditions,
Detection of microorganisms in the ground, water and air
Cultivation of monocultures
Growth curves

Production and detection of enzymes

Literature:

Süßmuth, R.; Eberspächer, J.; Haag, R.; Springer, W.: Biochemisch- mikrobiologisches Praktikum. Thieme Verlag, Stuttgart.
Schlegel, H. G.: Allgemeine Mikrobiologie. Georg Thieme Verlag, Stuttgart, New York, 5. Auflage, 1981.
Drews, D.: Mikrobiologisches Praktikum. Springer Verlag, Berlin, Heidelberg, New York, 3. Auflage, 1976.
Gottschalk, G.: Bacterial Metabolism. Springer Verlag, New York, Berlin, Heidelberg, Tokyo, 2nd Edition, 1988.
(sowie Literatur zu den entsprechenden Vorlesungen)

Course: Environmental Microbiology (Vorlesung)

Lecturer:

Prof. Rudolf Müller

Language:

EN

Cycle:

WS

Content:

1. Microbial Ecology
2. Detection of microorganisms
3. Disinfection and sterilisation
4. Sources for environmental pollutants
5. Biodegradability tests
6. Toxicity, use and degradation of pollutants:
- Alkanes, alkenes, alkines
- Benzene, toluene, xylenes, cresols
- Polycyclic aromatic compounds
- Chlorinated aliphatic and aromatic compounds
- Sulfonated compounds
- Nitrated compounds, amines, azo-dyes
- Herbicides, Pharmaceuticals
7. Enzymes involved in the degradation of pollutants
8. Plasmids involved in the degradation of pollutants
9. Construction of novel strains for the degradation of pollutants

Literature:

Brock Biology of Microorganisms,
M.T. Madigan, J.M.Martinko, J.Parker, Prontice Hall International, Inc.•Antisepsis, Disinfection, and Sterilization: Types, Action, and Resistance,
Gerald E. McDonnell, ASM Press, ISBN: 978-1-55581-392-5•Bioremediation Engineering
J.T. Cookson•Biodegradation and Bioremediation, Martin Alexander, Academic Press•Handbook on Biodegradation and Biological Treatment of Hazardous Organic Compounds, Martin H. van Agteren, Sytze Keuning and Dick B. Janssen, Kluwer Academic Publishers

Module: Biocatalysis

Courses:

Title	Typ	Hrs/wk
Biocatalysis and Enzyme Technology	Vorlesung	2
Technical Biocatalysis	Vorlesung	2

Module Responsibility:
Prof. Andreas Liese

Admission Requirements:
Bachelor VT, BVT or equivalent

Recommended Previous Knowledge:
Knowledge of bioprocess engineering and process engineering at bachelor level

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
After successful completion of this course, students will be able to

- reflect a broad knowledge about enzymes and their applications in academia and industry
- have an overview of relevant biotransformations und name the general definitions

Capabilities:
After successful completion of this course, students will be able to

- understand the fundamentals of biocatalysis and enzyme processes and transfer this to new tasks
- know the several enzyme reactors and the important parameters of enzyme processes
- use their gained knowledge about the realisation of processes. Transfer this to new tasks
- analyse and discuss special tasks of processes in plenum and give solutions
- communicate and discuss in English

Personal Competence:
Social Competence:
After completion of this module, participants will be able to debate technical and biocatalytical questions in small teams to enhance the ability to take position to their own opinions and increase their capacity for teamwork.
Autonomy:
After completion of this module, participants will be able to solve a technical problem independently including a presentation of the results.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Bioprocess Engineering: Kernqualifikation: Compulsory
Chemical and Bioprocess Engineering: Kernqualifikation: Compulsory
Environmental Engineering: Vertiefung Biotechnology: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage

Course: Biocatalysis and Enzyme Technology (Vorlesung)

Lecturer:
Prof. Andreas Liese

Language:
EN

Cycle:
WS

Content:
1. Introduction: Impact and potential of enzyme-catalysed processes in biotechnology.
2. History of microbial and enzymatic biotransformations.
3. Chirality - definition & measurement
4. Basic biochemical reactions, structure and function of enzymes.

5. Biocatalytic retrosynthesis of asymmetric molecules
6. Enzyme kinetics: mechanisms, calculations, multisubstrate reactions.
7. Reactors for biotransformations.

Literature:

- K. Faber: Biotransformations in Organic Chemistry, Springer, 5th Ed., 2004
- A. Liese, K. Seelbach, C. Wandrey: Industrial Biotransformations, Wiley-VCH, 2006
- R. B. Silverman: The Organic Chemistry of Enzyme-Catalysed Reactions, Academic Press, 2000
- K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology. VCH, 2005.
- R. D. Schmidt: Pocket Guide to Biotechnology and Genetic Engineering, Woley-VCH, 2003

Course: Technical Biocatalysis (Vorlesung)

Lecturer:
Prof. Andreas Liese

Language:
EN

Cycle:
WS

Content:

1. Introduction
2. Production and Down Stream Processing of Biocatalysts
3. Analytics (offline/online)
4. Reaction Engineering & Process Control
   - Definitions
   - Reactors
   - Membrane Processes
   - Immobilization
5. Process Optimization
   - Simplex / DOE / GA
6. Examples of Industrial Processes
   - food / feed
   - fine chemicals
7. Non-Aqueous Solvents as Reaction Media
   - ionic liquids
   - scCO2
   - solvent free

Literature:

- A. Liese, K. Seelbach, C. Wandrey: Industrial Biotransformations, Wiley-VCH, 2006
- H. Chmiel: Bioprozeßtechnik, Elsevier, 2005
- K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology, VCH, 2005
- R. D. Schmidt: Pocket Guide to Biotechnology and Genetic Engineering, Woley-VCH, 2003

Module: Industrial Biotransformations

Courses:

Title	Typ	Hrs/wk
Trends in Biotechnology	Seminar	2
Trends in Industrial Biocatalysis	Seminar	2

Module Responsibility:
Prof. Andreas Liese

Admission Requirements:
Bachelor VT, BVT or equivalent

Recommended Previous Knowledge:
Knowledge of bioprocess engineering and process engineering at bachelor level

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
After successful completion of the module

- the students can outline the current status of research on the specific topics discussed
- the students can explain the basic underlying principles of the respective industrial biotransformations

Capabilities:
After successful completion of the module students are able to

- analyze and evaluate current research approaches
- plan industrial biotransformations basically

Personal Competence:
Social Competence:
Students are able to work together as a team with several students to solve given tasks and discuss their results in the plenary and to defend them.
Autonomy:
The students are able independently to present the results of their subtasks in a presentation

ECTS-Credit points:
6 LP

Examination:
Referat

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Bioprocess Engineering: Vertiefung A - General Bioprocess Engineering: Compulsory suffrage
Bioprocess Engineering: Vertiefung B - Industrial Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung General Process Engineering: Compulsory suffrage
Environmental Engineering: Vertiefung Biotechnology: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage

Course: Trends in Biotechnology (Seminar)

Lecturer:
Prof. Rudolf Müller

Language:
EN

Cycle:
WS

Content:
At the beginning of the semester a recent review article from the journal Trends in Biotechnologie is distributed to the students. The contents of this article shall be presented, evaluated and discussed with the fellow students.

Literature:
Artikel aus der Zeitschrift Trends in Biotechnology, die an die Studenten zu Beginn des Semesters verteilt werden.

Course: Trends in Industrial Biocatalysis (Seminar)

Lecturer:
Prof. Andreas Liese

Language:
EN

Cycle:
WS

Content:

- Presentation and evaluation of 20-minute student lectures discussing a case study of an industrial biotransformation
- The contents of this article shall be presented, evaluated and discussed with the fellow students.

Literature:

- A. Liese, K. Seelbach, C. Wandrey: Industrial Biotransformations, Wiley-VCH, 2006
- selected scientific papers, that will be distributed during the course of the lecture

Module: Bioresources and Biorefineries

Courses:

Title	Typ	Hrs/wk
Biorefinery Technology	Vorlesung	2
Biorefinery Technologie	Gruppenübung	1
Bioresource Management	Vorlesung	2
Bioresource Management	Gruppenübung	1

Module Responsibility:
Dr. Ina Körner

Admission Requirements:
Non

Recommended Previous Knowledge:
Basics on engineering;
Basics of waste and energy management

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students can give on overview on principles and theories in the field's bioresource management and biorefinery technology and can explain specialized terms and technologies.
Capabilities:
Students are capable of applying knowledge and know-how in the field's bioresource management and biorefinery technology in order to perform technical and regional-planning tasks. They are also able to discuss the links to waste management, energy management and biotechnology.

Personal Competence:
Social Competence:
Students can work goal-oriented with others and communicate and document their interests and knowledge in acceptable way.
Autonomy:
Students are able to solve independently, with the aid of pointers, practice-related tasks bearing in mind possible societal consequences.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 96, Study Time in Lecture: 84

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Waste and Energy: Compulsory suffrage
Environmental Engineering: Vertiefung Biotechnology: Compulsory suffrage
International Management and Engineering: Vertiefung II. Energy and Environmental Engineering: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Energy: Compulsory suffrage

Course: Biorefinery Technology (Vorlesung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
The Europe 2020 strategy calls for bioeconomy as the key for smart and green growth of today. Biorefineries are the fundamental part on the way to convert the use of fossil-based society to bio-based society. For this reason, agriculture and forestry sectors are increasingly deliver bioresources. It is not only for their traditional applications in the food and feed sectors such as pulp or paper and construction material productions, but also to produce bioenergy and bio-based products such as bio-plastics. However although bioresources are renewable, they are considered as limited resources as well. The bioeconomy's limitation factor is the availability land on our world. In the context of the development of the bioeconomy, the sustainable and reliable supply of noon-food biomass feedstock is a critical success factor for the long-term perspective of bioenergy and other bio-based products production. Biorefineries are complex of technologies and process cascades using the available primary, secondary and tertiary bioresources to produce a multitude of products - a product mix from material and energy products.
The lecture gives an overview on biorefinery technology and shall contribute to promotion of international biorefinery developments.

Lectures:

- What is a biorefinery: Overview on basic organic substrates and processes which lead to material and energy products
- The way from a fossil based to a biobased economy in the 21st century
- The worlds most advanced biorefinery
- Presentation of various biorefinery systems and their products (e.g. lignocellulose biorefinery, green biorefinery, whole plant biorefinery, civilization biorefinery)
- Example projects (e.g. combination of anaerobic digestion and composting in practice; demonstration project in Hamburgs city quarter Jenfelder Au)

The lectures will be accompanied by technical tours. Optional it is also possible to visit more biorefinery lectures in the University of Hamburg (lectures in German only).
In the exercise students have the possibility to work in groups on a biorefinery project or to work on a student-specific task.

Literature:
Biorefineries - Industrial Process and Products - Status Qua and Future directions by Kamm, Gruber and Kamm (2010); Wiley VCH, available on-line in TUHH-library
Powerpoint-Präsentations / selected Publications / further recommendations depending on the actual developments
Industrial Biorefineries and White Biorefinery, by Pandey, Höfer, Larroche, Taherzadeh, Nampoothiri (Eds.); (2014 book development in progress)

Course: Biorefinery Technologie (Übung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
1.) Selection of a topic within the thematic area "Biorefinery Technologie" from a given list or self-selected.
2.) Self-dependent recherches to the topic.
3.) Preparation of a written elaboration.
4.) Presentation of the results in the group.

Literature:
Vom Thema abhängig. Eigene Recherchen nötig.
Depending on the topic. Own recheches necassary.

Course: Bioresource Management (Vorlesung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
In the context of limited fossil resources, climate change mitigation and increasing population growth, Bioresources has a special role. They have to feed the population and in the same time they are important for material production such as pulp and paper or construction materials. Moreover they become more and more important in chemical industry and in energy provision as fossil substitution. Although Bioresources are renewable, they are also considered as limited resources. The availability of land on our planet is the main limitation factor. The sustainable and reliable supply of non-food biomass feedstock is a critical for successful and long term perspective on production of bioenergy and other bio-based products. As the consequence, the increasing competition and shortages continue to happen at the traditional sectors. On the other side, huge unused but potentials residue on waste and wastewater sector exist. Nowadays, a lot of activities to develop better processes, to create new bio-based products in order to become more efficient, the inclusion of secondary and tertiary bio-resources in the valorisation chain are going on.
The lecture deals with the current state-of-the-art of bioresource management. It shows deficits and potentials for improvement especially in the sector of utilization of organic residues for material and energy generation:
Lectures on:

- Bioresource generation and utilization including lost potentials today
- Basic biological, mechanical, physico-chemical and logistical processes
- The conflict of material vs. energy generation from wood / waste wood
- The basics of pulp & paper production including waste paper recycling
- The Pros and Cons from biogas and compost production

Special lectures by invited guests from research and practice:

- Pathways of waste organics on the example of Hamburg`s City Cleaning Company
- Utilization options of landscaping materials on the example of grass

- Increase of process efficiency of anaerobic digestions
- Decision support tools on the example of an municipality in Indonesia

Optional: Technical visits

Literature:
Power-Point presentations in STUD-IP

Course: Bioresource Management (Übung)

Lecturer:
Dr. Ina Körner

Language:
EN

Cycle:
WS

Content:
In the context of limited fossil resources, climate change mitigation and increasing population growth, Bioresources has a special role. They have to feed the population and in the same time they are important for material production such as pulp and paper or construction materials. Moreover they become more and more important in chemical industry and in energy provision as fossil substitution. Although Bioresources are renewable, they are also considered as limited resources. The availability of land on our planet is the main limitation factor. The sustainable and reliable supply of non-food biomass feedstock is a critical for successful and long term perspective on production of bioenergy and other bio-based products. As the consequence, the increasing competition and shortages continue to happen at the traditional sectors. On the other side, huge unused but potentials residue on waste and wastewater sector exist. Nowadays, a lot of activities to develop better processes, to create new bio-based products in order to become more efficient, the inclusion of secondary and tertiary bio-resources in the valorisation chain are going on.
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- Increase of process efficiency of anaerobic digestions
- Decision support tools on the example of an municipality in Indonesia

Optional: Technical visits

Literature:
Power-Point presentations in STUD-IP

Module: Project Work Biotechnology

Courses:

Title	Typ	Hrs/wk
Project Work Biotechnology	Projektseminar	2

Module Responsibility:
Dozenten des SD B

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Capabilities:

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
12 LP

Examination:
Projektarbeit

Workload in Hours:
Indipendent Study Time: 332, Study Time in Lecture: 28

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Biotechnology: Compulsory

Course: Project Work Biotechnology (Projektseminar)

Lecturer:
Dozenten des SD B

Language:
EN

Cycle:
WS

Content:

Literature:

Specialisation Water

Module: Groundwater Modeling

Courses:

Title	Typ	Hrs/wk
Applied Groundwater Modeling (IMPEE)	Problemorientierte Lehrveranstaltung	2
Groundwater Engineering	Vorlesung	1
Groundwater Engineering	Gruppenübung	1

Module Responsibility:
Prof. Wilfried Schneider

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Capabilities:

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Water: Compulsory suffrage

Course: Applied Groundwater Modeling (IMPEE) (Problemorientierte Lehrveranstaltung)

Lecturer:
Prof. Wilfried Schneider

Language:
EN

Cycle:
SS

Content:

Literature:

Course: Groundwater Engineering (Vorlesung)

Lecturer:
Prof. Wilfried Schneider

Language:
EN

Cycle:
SS

Content:

Literature:

Course: Groundwater Engineering (Übung)

Lecturer:
Prof. Wilfried Schneider

Language:

EN

Cycle:
SS

Content:

Literature:

Module: Water Protection

Courses:

Title	Typ	Hrs/wk
Geo-Information-Systems in Water Management and Hydraulic Engineering	Problemorientierte Lehrveranstaltung	1
Water Protection and Wastewater Management	Vorlesung	2
Water Protection and Wastewater Management	Hörsaalübung	1

Module Responsibility:
Prof. Stephan Köster

Admission Requirements:
none

Recommended Previous Knowledge:

- Basic knowledge in water management;
- Good knowledge in urban drainage;
- Good knowledge of wastewater treatment techniques;
- Good knowledge of pollutants (e.g. COD, BOD, TS, N, P) and their properties;

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
The students can describe the basic principles of the regulatory framework related to the international and European water sector. They can explain limnological processes, substance cycles and water morphology in detail. Thereby they are able to assess complex water related problems. Finally, the students can demonstrate to achieve significant improvements in the full range of existing water quality problems. They are able to judge environmental and wastewater related issues and to widely consider innovative solutions, remediation measures and further interventions as well as conceptual problem solving approaches.

Capabilities:
Students can accurately assess current problems and situations in a country-specific or local context. They can suggest concrete actions to contribute to the planning of tomorrow's urban water cycle. Furthermore, they can suggest appropriate technical, administrative and legislative solutions to solve these problems.

Personal Competence:
Social Competence:
The students can work together in international groups.

Autonomy:
Students are able to organize their work flow to prepare themselves before presentations and discussion. They can acquire appropriate knowledge by making enquiries independently.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Civil Engineering: Vertiefung Structural Engineering: Compulsory suffrage
Civil Engineering: Vertiefung Geotechnical Engineering: Compulsory suffrage
Civil Engineering: Vertiefung Coastal Engineering: Compulsory suffrage
Environmental Engineering: Vertiefung Water: Compulsory suffrage
International Management and Engineering: Vertiefung II. Civil Engineering: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory
Water and Environmental Engineering: Vertiefung Environment: Compulsory
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Geo-Information-Systems in Water Management and Hydraulic Engineering (Problemorientierte Lehrveranstaltung)

Lecturer:

Prof. Peter Fröhle

Language:
DE/EN

Cycle:
WS

Content:
Theoretical basics of Geo-Information-Systems

- Data models, geographical coordinates, geo-referencing, map-views
- Data mining and – analyses of geo-data
- Analysis techniques

Literature:
None

Course: Water Protection and Wastewater Management (Vorlesung)

Lecturer:
Prof. Stephan Köster

Language:
EN

Cycle:
WS

Content:
The lecture focusses on:

- Regulatory Framework (e.g. WFD)
- Main instruments for the water management and protection
- In depth knowledge of relevant measures of water pollution control
- Urban drainage, treatment options in different regions on the world
- Rainwater management, improved management of heavy rainfalls, downpours, rainwater harvesting, rainwater infiltration
- Case Studies and Field Trips

Literature:
The literature listed below is available in the library of the TUHH.

- Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International.
- Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011). . New York, NY: McGraw-Hill.
- Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Course: Water Protection and Wastewater Management (Übung)

Lecturer:
Prof. Stephan Köster

Language:
EN

Cycle:
WS

Content:
The lecture focusses on:

- Regulatory Framework (e.g. WFD)
- Main instruments for the water management and protection
- In depth knowledge of relevant measures of water pollution control
- Urban drainage, treatment options in different regions on the world
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- Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011). . New York, NY: McGraw-Hill.
- Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Module: Membrane Technology

Courses:

Title	Typ	Hrs/wk
Membrane Technology	Vorlesung	2
Membrane Technology	Gruppenübung	1
Membrane Technology	Laborpraktikum	1

Module Responsibility:
Prof. Mathias Ernst

Admission Requirements:
Bachelor's degree

Recommended Previous Knowledge:
Basic knowledge of water chemistry. Knowledge of the core processes involved in water, gas and steam treatment

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students will be able to rank the technical applications of industrially important membrane processes. They will be able to explain the different driving forces behind existing membrane separation processes. Students will be able to name materials used in membrane filtration and their advantages and disadvantages. Students will be able to explain the key differences in the use of membranes in water, other liquid media, gases and in liquid/gas mixtures.
Capabilities:
Students will be able to prepare mathematical equations for material transport in porous and solution-diffusion membranes and calculate key parameters in the membrane separation process. They will be able to handle technical membrane processes using available boundary data and provide recommendations for the sequence of different treatment processes. Through their own experiments, students will be able to classify the separation efficiency, filtration characteristics and application of different membrane materials. Students will be able to characterise the formation of the fouling layer in different waters and apply technical measures to control this.

Personal Competence:
Social Competence:
Students will be able to work in diverse teams on tasks in the field of membrane technology. They will be able to make decisions within their group on laboratory experiments to be undertaken jointly and present these to others.
Autonomy:
Students will be in a position to solve homework on the topic of membrane technology independently. They will be capable of finding creative solutions to technical questions.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Bioprocess Engineering: Vertiefung A - General Bioprocess Engineering: Compulsory suffrage
Bioprocess Engineering: Vertiefung B - Industrial Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung Chemical Process Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung General Process Engineering: Compulsory suffrage
Energy and Environmental Engineering: Vertiefung Energy and Environmental Engineering: Compulsory suffrage
Environmental Engineering: Vertiefung Water: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Process Engineering: Vertiefung Environmental Process Engineering: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Membrane Technology (Vorlesung)

Lecturer:
Prof. Mathias Ernst

Language:
EN

Cycle:
WS

Content:

The lecture on membrane technology supply provides students with a broad understanding of existing membrane treatment processes, encompassing pressure driven membrane processes, membrane application in electrodialyis, pervaporation as well as membrane distillation. The lectures main focus is the industrial production of drinking water like particle separation or desalination; however gas separation processes as well as specific wastewater oriented applications such as membrane bioreactor systems will be discussed as well. Initially, basics in low pressure and high pressure membrane applications are presented (microfiltration, ultrafiltration, nanofiltration, reverse osmosis). Students learn about essential water quality parameter, transport equations and key parameter for pore membrane as well as solution diffusion membrane systems. The lecture sets a specific focus on fouling and scaling issues and provides knowledge on methods how to tackle with these phenomena in real water treatment application. A further part of the lecture deals with the character and manufacturing of different membrane materials and the characterization of membrane material by simple methods and advanced analysis. The functions, advantages and drawbacks of different membrane housings and modules are explained. Students learn how an industrial membrane application is designed in the succession of treatment steps like pre-treatment, water conditioning, membrane integration and post-treatment of water. Besides theory, the students will be provided with knowledge on membrane demo-site examples and insights in industrial practice.

Literature:

- T. Melin, R. Rautenbach: Membranverfahren: Grundlagen der Modul- und Anlagenauslegung (2., erweiterte Auflage), Springer-Verlag, Berlin 2004.
- Marcel Mulder, Basic Principles of Membrane Technology, Kluwer Academic Publishers, Dordrecht, The Netherlands
- Richard W. Baker, Membrane Technology and Applications, Second Edition, John Wiley & Sons, Ltd., 2004

Course: Membrane Technology (Übung)

Lecturer:
Prof. Mathias Ernst

Language:
EN

Cycle:
WS

Content:

The lecture on membrane technology supply provides students with a broad understanding of existing membrane treatment processes, encompassing pressure driven membrane processes, membrane application in electrodialyis, pervaporation as well as membrane distillation. The lectures main focus is the industrial production of drinking water like particle separation or desalination; however gas separation processes as well as specific wastewater oriented applications such as membrane bioreactor systems will be discussed as well. Initially, basics in low pressure and high pressure membrane applications are presented (microfiltration, ultrafiltration, nanofiltration, reverse osmosis). Students learn about essential water quality parameter, transport equations and key parameter for pore membrane as well as solution diffusion membrane systems. The lecture sets a specific focus on fouling and scaling issues and provides knowledge on methods how to tackle with these phenomena in real water treatment application. A further part of the lecture deals with the character and manufacturing of different membrane materials and the characterization of membrane material by simple methods and advanced analysis. The functions, advantages and drawbacks of different membrane housings and modules are explained. Students learn how an industrial membrane application is designed in the succession of treatment steps like pre-treatment, water conditioning, membrane integration and post-treatment of water. Besides theory, the students will be provided with knowledge on membrane demo-site examples and insights in industrial practice.

Literature:

- T. Melin, R. Rautenbach: Membranverfahren: Grundlagen der Modul- und Anlagenauslegung (2., erweiterte Auflage), Springer-Verlag, Berlin 2004.
- Marcel Mulder, Basic Principles of Membrane Technology, Kluwer Academic Publishers, Dordrecht, The Netherlands
- Richard W. Baker, Membrane Technology and Applications, Second Edition, John Wiley & Sons, Ltd., 2004

Course: Membrane Technology (Laborpraktikum)

Lecturer:
Prof. Mathias Ernst

Language:
EN

Cycle:
WS

Content:

The lecture on membrane technology supply provides students with a broad understanding of existing membrane treatment processes, encompassing pressure driven membrane processes, membrane application in electrodialyis, pervaporation as well as membrane distillation. The lectures main focus is the industrial production of drinking water like particle separation or desalination; however gas separation processes as well as specific wastewater oriented applications such as membrane bioreactor systems will be discussed as well. Initially, basics in low pressure and high pressure membrane applications are presented (microfiltration, ultrafiltration, nanofiltration, reverse osmosis). Students learn about essential water quality parameter, transport equations and key parameter for pore membrane as well as solution diffusion membrane systems. The lecture sets a specific focus on fouling and scaling issues and provides knowledge on methods how to tackle with these phenomena in real water treatment application. A further part of the lecture deals with the character and

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- Marcel Mulder, Basic Principles of Membrane Technology, Kluwer Academic Publishers, Dordrecht, The Netherlands
- Richard W. Baker, Membrane Technology and Applications, Second Edition, John Wiley & Sons, Ltd., 2004

Module: Process Modeling in Water Technology

Courses:

Title	Typ	Hrs/wk
Process Modelling of Wastewater Treatment	Problemorientierte Lehrveranstaltung	2
Process Modeling in Drinking Water Treatment	Problemorientierte Lehrveranstaltung	2

Module Responsibility:
Dr. Klaus Johannsen

Admission Requirements:
none

Recommended Previous Knowledge:
Knowledge of the most important processes in drinking water and waste water treatment.

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students are able to explain selected processes of drinking water and waste water treatment in detail. They are able to explain basics as well as possibilities and limitations of dynamic modeling.
Capabilities:
Students are able to use the most important features Modelica offers. They are able to transpose selected processes in drinking water and waste water treatment into a mathematical model in Modelica with respect to equilibrium, kinetics and mass balances. They are able to set up and apply models and assess their possibilities and limitations.

Personal Competence:
Social Competence:
Students are able to solve problems and document solutions in a group with members of different technical background. They are able to give appropriate feedback and can work constructively with feedback concerning their work.

Autonomy:
Students are able to define a problem, gain the required knowledge and set up a model.

ECTS-Credit points:
6 LP

Examination:
Klausur

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Water: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Process Modelling of Wastewater Treatment (Problemorientierte Lehrveranstaltung)

Lecturer:
Dr. Joachim Behrendt

Language:
DE/EN

Cycle:
WS

Content:
Mass and energy balances
Tracer modelling
Activated Sludge Model
Wastewater Treatment Plant Modelling (continously and SBR)
Sludge Treatment (ADM, aerobic autothermal)
Biofilm Modelling

Literature:
Henze, Mogens (Seminar on Activated Sludge Modelling, ; Kollekolle Seminar on Activated Sludge Modelling, ;)
Activated sludge modelling : processes in theory and practice ; selected proceedings of the 5th Kollekolle Seminar on Activated Sludge

Modelling, held in Kollekolle, Denmark, 10 - 12 September 2001
ISBN: 1843394146
[London] : IWA Publ., 2002
TUB_HH_Katalog
Henze, Mogens
Activated sludge models ASM1, ASM2, ASM2d and ASM3
ISBN: 1900222248
London : IWA Publ., 2002
TUB_HH_Katalog
Henze, Mogens
Wastewater treatment : biological and chemical processes
ISBN: 3540422285 (Pp.)
Berlin [u.a.] : Springer, 2002
TUB_HH_Katalog
Wiesmann, Udo (Choi, In Su; Dombrowski, Eva-Maria;)
Fundamentals of biological wastewater treatment
ISBN: 3527312196 (Gb.) URL: http://deposit.ddb.de/cgi-bin/dokserv?id=2774611&prov=M&dok_var=1&dok_ext=htm
Weinheim : WILEY-VCH, 2007
TUB_HH_Katalog

Course: Process Modeling in Drinking Water Treatment (Problemorientierte Lehrveranstaltung)

Lecturer:
Dr. Klaus Johannsen

Language:
DE/EN

Cycle:
WS

Content:
In this course selected drinking water treatment processes (e.g. aeration or activated carbon adsorption) are modeled dynamically using the programming language Modelica, that is increasingly used in industry. In this course OpenModelica is used, an free access frontend of the programming language Modelica.
In the beginning of the course the use of OpenModelica is explainded by means of simple examples. Together required elements and structure of the model are developed. The implementation in OpenModelica and the application of the model is done individually or in groups respectively. Students get feedback and can gain extra points for the exam.

Literature:
OpenModelica: https://openmodelica.org/index.php/download/download-windows
OpenModelica – Modelica Tutorial: https://openmodelica.org/index.php/useresresources/userdocumentation
OpenModelica – Users Guide: https://openmodelica.org/index.php/useresresources/userdocumentation
Peter Fritzson: Principles of Object-Oriented Modeling and Simulation with Modelica 2.1,Wiley-IEEE Press, ISBN 0-471-471631.
MHW (rev. by Crittenden, J. et al.): Water treatment principles and design. John Wiley & Sons, Hoboken, 2005.
Stumm, W., Morgan, J.J.: Aquatic chemistry. John Wiley & Sons, New York, 1996.
DVGW (Hrsg.): Wasseraufbereitung – Grundlagen und Verfahren. Oldenbourg Industrie Verlag, München, 2004.

Module: Analytical Methods and Treatment Technologies for Wastewaters

Courses:

Title	Typ	Hrs/wk
Low-Cost Procedures for Water and Wastewater Analysis	Vorlesung	2
Physico-Chemical Water Treatment	Vorlesung	2

Module Responsibility:
Dr. Holger Gulyas

Admission Requirements:
none

Recommended Previous Knowledge:
Fundamental knowledge in chemistry and physics

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
The students know some non-biological processes for the treatment of water and wastewater as well as the fundamentals of mass transfer which is essential for many treatment processes. They have knowledge about analytical procedures which can be applied even without the availability of a laboratory and which are useful for evaluating the performance of (waste)water treatment processes and the assessment of surface water quality in an economically feasible way.
Capabilities:
The students are able to select suitable processes for the treatment of wastewaters with respect to their characteristics. They can evaluate the efforts and costs for analytical procedures for the characterization of waters/wastewaters and select economically feasible analytical procedures.

Personal Competence:
Social Competence:
The students have the competence to plan and to perform wastewater analyses together with colleagues in small groups and to efficiently distribute the respective tasks within the group.
Autonomy:
The students are capable to make their own decisions with respect to the selection of suitable water/wastewater treatment processes as well as economically feasible analytical procedures for water/wastewater characterization.

ECTS-Credit points:
6 LP

Examination:
Mündliche Prüfung

Workload in Hours:
Indipendent Study Time: 124, Study Time in Lecture: 56

Assignment for the Following Curricula:
Bioprocess Engineering: Vertiefung A - General Bioprocess Engineering: Compulsory suffrage
Energy and Environmental Engineering: Vertiefung Energy and Environmental Engineering: Compulsory suffrage
Environmental Engineering: Vertiefung Water: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Process Engineering: Vertiefung Environmental Process Engineering: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Low-Cost Procedures for Water and Wastewater Analysis (Vorlesung)

Lecturer:
Dr. Holger Gulyas

Language:
EN

Cycle:
WS

Content:
1 Introduction
2 Costing of wastewater and water analyses
3 Parameters routinely measured in municipal wastewater effluents
4 Surrogate parameters
5 Field methods

6 Basic laboratory instruments and equipment
6.1 Balances
6.2 Volumetric dosing instruments
6.3 Photometer
6.3.1 General
6.3.2 Principle of photometry
6.3.3 Elements of a photometer
6.4 Deionised water supply
6.5 Safety equipment
7 Inorganic parameters
7.1 Inorganic parameters by probes/electrodes
7.1.1 Dissolved oxygen
7.1.1.1 Polarographic measurement of dissolved oxygen
7.1.1.2 Optical probe for measuring dissolved oxygen utilising luminescence quenching of oxygen
7.1.1.3 Titrimetric determination of dissolved oxygen
7.1.2 pH
7.1.3 Alkalinity
7.1.4 Electric conductivity/salinity
7.2 Nitrogen and phosphorus compounds (nutrients)
7.2.1 Colorimetric methods without expensive instruments
7.2.2 Reflectometric methods
7.2.3 Photometric methods
8 Particles in water and wastewater
9 Organic sum parameters
9.1 Overview
9.2 Chemical Oxygen Demand: Why to avoid COD analyses by the dichromate method?
9.3 TOC cuvette tests
9.4 Absorption of UV light (254 nm) as a surrogate parameter for COD
9.5 Volatile Solids as surrogate for COD
9.6 Biological oxygen demand
10 Microbiological parameters determined in a low-cost way
11 Toxicity toward activated sludge

Literature:
Skript auf StudIP

Course: Physico-Chemical Water Treatment (Vorlesung)

Lecturer:
Dr. Holger Gulyas

Language:
EN

Cycle:
WS

Content:
- Stripping
- Evaporation
- Wastewater Incineration
- Wet Air Oxidation
- Ozonation
- Advanced Oxidation Processes

Literature:
Physical-Chemical Treatment of Water and Wastewater, A.P. Sincero, G.A. Sincero, CRC Press, Boca Raton 2003;
Handbook of Separation Techniques for Chemical Engineers, P.A. Schweitzer, ed., McGraw-Hill, New York 1988
Perry´s Chemical Engineers´ Handbook, R.H. Perry, D.W. Green, J.O. Maloney, eds., McGraw-Hill, New York 1984
Chemical Engineering, Vol. 2, J.M. Coulson, J.F. Richardson, Pergamon Press, Oxford 1991
Ozone in Water Treatment, B. Langlais, D.A. Reckhow, D.R. Brink, eds., Lewis Publishers, Chelsea 1991

Module: Resources Oriented Sanitation Systems

Courses:

Title	Typ	Hrs/wk
Rural Development in Different Climates	Vorlesung	2
Resources Oriented Sanitation: High and Low-Tech Options	Vorlesung	2
Resources Oriented Sanitation: High - and Low - Tech Options	Laborpraktikum	1

Module Responsibility:
Prof. Ralf Otterpohl

Admission Requirements:
Bachelor's degree

Recommended Previous Knowledge:
Basic knowledge of the global situation with rising poverty, soil degradation, lack of water resources and sanitation

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Students can describe resources oriented wastewater systems mainly based on source control in detail. They can comment on techniques designed for reuse of water, nutrients and soil conditioners.
Students are able to discuss a wide range of proven approaches in Rural Development from and for many regions of the world.

Capabilities:
Students are able to design low-tech/low-cost sanitation, rural water supply, rainwater harvesting systems, measures for the rehabilitation of top soil quality combined with food and water security. Students can consult on the basics of soil building through "Holisitc Planned Grazing" as developed by Allan Savory.

Personal Competence:
Social Competence:
Autonomy:
Students are in a position to work on a subject and to organize their work flow independently. They can also present on this subject.

ECTS-Credit points:
6 LP

Examination:
Schriftliche Ausarbeitung

Workload in Hours:
Indipendent Study Time: 110, Study Time in Lecture: 70

Assignment for the Following Curricula:
Bioprocess Engineering: Vertiefung A - General Bioprocess Engineering: Compulsory suffrage
Chemical and Bioprocess Engineering: Vertiefung General Process Engineering: Compulsory suffrage
Energy and Environmental Engineering: Vertiefung Energy and Environmental Engineering: Compulsory suffrage
Environmental Engineering: Vertiefung Water: Compulsory suffrage
International Management and Engineering: Vertiefung II. Energy and Environmental Engineering: Compulsory suffrage
Joint European Master in Environmental Studies - Cities and Sustainability: Vertiefung Water: Compulsory suffrage
Process Engineering: Vertiefung Environmental Process Engineering: Compulsory suffrage
Process Engineering: Vertiefung Process Engineering : Compulsory suffrage
Water and Environmental Engineering: Vertiefung Water: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Environment: Compulsory suffrage
Water and Environmental Engineering: Vertiefung Cities: Compulsory suffrage

Course: Rural Development in Different Climates (Vorlesung)

Lecturer:
Prof. Ralf Otterpohl

Language:
EN

Cycle:
WS

Content:

- Small Breakout Groups on "Rural Development" and presentation of results
- Living Soil – THE key element of Rural Development
- Permaculture Principles of Rural Development
- Case Studies: Global Ecovillage Network, Complementary Currencies

- Going Further: The TUHH Toolbox for Rural Development
- Rainwater Harvesting, Participatory planning principles
- Participant Workshop: Video contest: Participants groups search, introduce, show and discuss excellent short water videos
- EMAS Technologies, Hand-Pump and wells
- Practical Pump/Well-Building
- Seminar: Participants prepare and give short 5 min presentations “Best Practice cases in Rural Development”
- In Depth: Rural Drinking Water Supply (Dr. Bendinger)
- cont. Rural Drinking Water Supply (Dr. Bendinger)
- cont. Rural Drinking Water Supply (Dr. Bendinger)
- Exam

Literature:

- Miracle Water Village, India, Integrated Rainwater Harvesting, Water Efficiency, Reforestation and Sanitation: http://youtu.be/9hmkgn0nBgk
- Montgomery, David R. 2007: Dirt: The Erosion of Civilizations, University of California Press

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Course: Resources Oriented Sanitation: High and Low-Tech Options (Vorlesung)

Lecturer:
Prof. Ralf Otterpohl

Language:
EN

Cycle:
WS

Content:

- Small Breakout Groups on “The horrific global situation in Sanitation ” and presentation of results
- Keynote lecture: Resources Oriented Sanitation around the World
- Participant Workshop: Video contest: Participants groups search, introduce, show and discuss excellent short water videos
- In Depth: Terra Preta Sanitation, an emerging concept based on historic global best practice in the Amazon Region
- Seminar: All participants prepare and give 10 min presentations (choice of topics)
- cont.
- cont.
- cont.
- Rehearsal and final panel discussion
- Exam

Literature:

- J. Lange, R. Otterpohl 2000: Abwasser - Handbuch zu einer zukunftsfähigen Abwasserwirtschaft. Mallbeton Verlag (TUHH Bibliothek)
- Winblad, Uno and Simpson-Hébert, Mayling 2004: Ecological Sanitation, EcoSanRes, Sweden (free download)
- Schober, Sabine: WTO/TUHH Award winning Terra Preta Toilet Design: http://youtu.be/w_R09cYq6ys

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Course: Resources Oriented Sanitation: High - and Low - Tech Options (Laborpraktikum)

Lecturer:
Dr. Holger Gulyas

Language:
EN

Cycle:
WS

Content:
- Construction of urine-diverting toilets
- Comparison of stored and fresh urine: ammonia concentration
- Comparison of stored and fresh urine: alkalinity

Literature:
Skript
Steven A. Esrey, Jean Gough, Dave Rapaport, Ron Sawyer, Mayling Simpson-Hébert, Jorge Vargas and Uno Winblad: Ecological Sanitation, SIDA, Stockholm 1998, http://www.ecosanres.org/pdf_files/Ecological_Sanitation.pdf

Module: Project Work Water

Courses:

Title	Typ	Hrs/wk
Project Work Water	Projektseminar	2

Module Responsibility:
Dozenten des SD B

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:
Capabilities:

Personal Competence:
Social Competence:
Autonomy:

ECTS-Credit points:
12 LP

Examination:
Projektarbeit

Workload in Hours:
Indipendent Study Time: 332, Study Time in Lecture: 28

Assignment for the Following Curricula:
Environmental Engineering: Vertiefung Water: Compulsory

Course: Project Work Water (Projektseminar)

Lecturer:
Dozenten des SD B

Language:
EN

Cycle:
WS

Content:

Literature:

Thesis

Module: Master Thesis

Courses:

Title	Typ	Hrs/wk

Module Responsibility:
Professoren der TUHH

Admission Requirements:

Recommended Previous Knowledge:

Educational Objectives:
After taking part successfully, students have reached the following learning results:

Professional Competence:
Theoretical Knowledge:

- The students can use specialized knowledge (facts, theories, and methods) of their subject competently on specialized issues.
- The students can explain in depth the relevant approaches and terminologies in one or more areas of their subject, describing current developments and taking up a critical position on them.
- The students can place a research task in their subject area in its context and describe and critically assess the state of research.

Capabilities:
The students are able:

- To select, apply and, if necessary, develop further methods that are suitable for solving the specialized problem in question.
- To apply knowledge they have acquired and methods they have learnt in the course of their studies to complex and/or incompletely defined problems in a solution-oriented way.
- To develop new scientific findings in their subject area and subject them to a critical assessment.

Personal Competence:
Social Competence:
Students can

- Both in writing and orally outline a scientific issue for an expert audience accurately, understandably and in a structured way.
- Deal with issues competently in an expert discussion and answer them in a manner that is appropriate to the addressees while upholding their own assessments and viewpoints convincingly.

Autonomy:
Students are able:

- To structure a project of their own in work packages and to work them off accordingly.
- To work their way in depth into a largely unknown subject and to access the information required for them to do so.
- To apply the techniques of scientific work comprehensively in research of their own.

ECTS-Credit points:
30 LP

Examination:
lt. FSPO

Workload in Hours:
Indipendent Study Time: 900, Study Time in Lecture: 0

Assignment for the Following Curricula:
Civil Engineering: Abschlussarbeit: Compulsory
Bioprocess Engineering: Abschlussarbeit: Compulsory
Chemical and Bioprocess Engineering: Abschlussarbeit: Compulsory
Computer Science: Abschlussarbeit: Compulsory
Electrical Engineering: Abschlussarbeit: Compulsory
Energy and Environmental Engineering: Abschlussarbeit: Compulsory
Energy Systems: Abschlussarbeit: Compulsory
Environmental Engineering: Abschlussarbeit: Compulsory
Aircraft Systems Engineering: Abschlussarbeit: Compulsory
Global Innovation Management: Abschlussarbeit: Compulsory
Computational Science and Engineering: Abschlussarbeit: Compulsory
Information and Communication Systems: Abschlussarbeit: Compulsory
International Management and Engineering: Abschlussarbeit: Compulsory
Joint European Master in Environmental Studies - Cities and Sustainability: Abschlussarbeit: Compulsory

Logistics, Infrastructure and Mobility: Abschlussarbeit: Compulsory
Mechatronics: Abschlussarbeit: Compulsory
Biomedical Engineering: Abschlussarbeit: Compulsory
Microelectronics and Microsystems: Abschlussarbeit: Compulsory
Product Development, Materials and Production: Abschlussarbeit: Compulsory
Renewable Energies: Abschlussarbeit: Compulsory
Naval Architecture and Ocean Engineering: Abschlussarbeit: Compulsory
Ship and Offshore Technology: Abschlussarbeit: Compulsory
Theoretical Mechanical Engineering: Abschlussarbeit: Compulsory
Process Engineering: Abschlussarbeit: Compulsory
Water and Environmental Engineering: Abschlussarbeit: Compulsory