Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Life Sciences Engineering

- Courses in English -

- Applied Limnology
- Biomonitoring
- Fuel Cells; an introduction
- Mathematics 3
- Materials Science
- Particle Technology
- Pharmacology/Toxicology
- Sustainable Energy Economics*

* every other year starting in 2013

(Faculty of Life Sciences; January 2013)

Course Name: Applied Limnology

Degree programme: **Environmental Engineering** (Bachelor)	Responsible Lecturer: Prof. Dr. Carolin Floeter

Work load: 150	**Lecture hours per week:** 4	**ECTS Credits:** 5

Course objectives:

- gain basic knowledge in hydrobiology (freshwater and marine)
- learn methods for an ecological and ecotoxicological risk assessment
- identify impacts on freshwater and marine ecosystems
- develop risk reduction measures to improve the water quality of freshwater and marine ecosystems
- apply the knowledge on freshwater case studies: the rivers Bille and Elbe
- apply the knowledge on marine case studies: North Sea and Baltic Sea
- evaluate water and sediment quality of european freshwater and marine ecosystems according to international, EU and national regulation (e.g. EU Water Framework Directive and EU Marine Strategy Directive)
- gain insight into occupational areas of applied hydrobiology and ecotoxicology

Curse contents:

The students get an introduction to hydrobiological and ecotoxicological risk assessment procedures in order to develop risk mitigation and risk management options for freshwater and marine ecosystems. The course considers regulatory demands, e.g. EU Water Framework Directive and EU Marine Strategy Directive. The course includes several excursions within Germany and integrates external experts. It contains the following areas:

- Basic hydrobiology: physical and chemical properties of water, classification of lakes due to stratification and circulation, nutrient cycles (C-, N and P), river continuum concept, aquatic biocoenosis and food webs, marine ecosystems;
- Methods and parameter to assess the water and sediment quality according to European regulation (EU Water Framework Directive and EU Marine Strategy Directive);
- Ecological methods for the assessment of water and sediment quality of rivers: macrozoobenthos (invertebrates living in the sediment) analysis and evaluation according to the EU Water Framework Directive;
- Ecotoxicological methods for the risk assessment of water/sediment samples and for single substances: biomarker, bioassays and mesocosm studies, as well as biomonitoring ;
- Impacts on aquatic ecosystems: e.g. pollution by point and diffuse sources, cooling water extraction and discharge, waste water discharge, hydrological constructions, e.g. weirs, shipping, dredged material management, tourism, fishery;
- different risk assessment procedures according to international and national regulation: for pesticides, waste water and sediments (dredged material management); PBT (Persistence, Bioaccumulation, Toxicity and "veryP veryB") Concept, Predicted Environmental Concentration (PEC), Predicted No Effect Concentration (PNEC), Risk Quotient method, Endocrine Disruptors (EDs);
- risk assessment, risk mitigation and risk management;
- Bille and Elbe river: impact analysis and management scenarios;
- North Sea/ Baltic Sea: insight into environmental impact assessment, e.g. of offshore windparks.

About didactics and work load distribution:

- Main content will be presented by the lecturer and students apply the knowledge by solving tasks in groups;
- Additional topics will be developed and presented in groups of two students;
- Special topics will be presented by external experts, e.g. from authorities;
- Excursions e.g. to the river Bille and Elbe, to the Artificial Stream and Pond System at the Federal Environmental Agency in Berlin

Requirements for participation:

Biology 1 and Biology 2, Biology practical course is recommended, Chemistry 1 and 2, Physics 1 and 2, Biological and Chemical Parameters of Environmental Risk Assessment (BCU)

Course language:

English

Type of exam:

Oral presentations in groups of two and written summary

Requirements for credit point allocation:

Class attendance and successful oral presentations in groups of two and written summary

Literature:

- Robert G. Wetzel (2001): Limnology: lake and river ecosystems. 3. Aufl., Acad. Press.
- Jacob Kalff (2003): Limnology: inland water ecosystems. Prentice Hall. Pearson Education.
- Jürgen Schwoerbel, Heinz Brendelberger (2010): Einführung in die Limnologie. 9. Aufl., Elsevier, Spektrum Akad. Verl..
- Winfried Lampert; Ulrich Sommer (2007): Limnoecology: the ecology of lakes and streams. 2. ed. Univ. Press.
- Christer Brönmark; Lars-Anders Hansson (2005): The biology of lakes and ponds. 2. ed., reprint (with corr.). O.U.P.
- Michael C. Newman (2010): Fundamentals of ecotoxicology. 3rd Ed. CRC Press. ISBN: 978-1-420-06704-0.
- Walker, C.H., Hopkin, S.P., Sibly, R.M. & Peakall, D.B. (2006): Principles of Ecotoxicology. 3rd Edition CRC Press.
- Karl Fent (2007): Ökotoxikologie: Umweltchemie, Toxikologie, Ökologie. Thieme. 3., überarb. und aktualisierte Aufl.
- Futher literature (e.g. reports from OSPARCOM, HELCOM and UBA) will be recommended in the lectures.

Course Name: Biomonitoring

Degree programmes: **Environmental Engineering** (Bachelor) **Biotechnology** (Bachelor)	Responsible Lecturer: Prof. Dr.-Ing. Holger Mühlberger

Work load: 75 hours	**Lecture hours per week:** 2	**ECTS Credits:** 2,5

Course objectives:

- knowledge of the "philosophy" of biomonitoring
- introduction to biomonitoring and the capabilities of selected biologic analytical methods as well as static and dynamic biotests (biologic early warning system) to monitor environment water, soil and air
- detection of anthropogenic impacts to creatures and ecosystems

Contents:

Biological verification procedures
introduction to environmental biomonitoring (impact analysis, indicator- and monitoring organisms, bio markers), „philosophy of biomonitoring"

Biological effects of typical environmental poisons
classification of contaminants and methods for toxicity determination, environmental quality standards (quality objectives, prescriptive limits), behaviour of pesticides and heavy metals in food webs, bio accumulation

Lawful environmental monitoring with biological impact tests
toxicity tests according to DIN for emission- and immission monitoring in water, soil and air

Dynamic toxicity test systems for continuous waters- and waste water monitoring
application of a continuous operating test system with automatic alarm detection

Detection of carcinogenic and mutagenic substance effects with animals, plants and cell cultures
tests for the analysis of mutagenic effects

About didactics and work load distribution:
50% problem based learning and student presentations; 50% lectures

Requirements for participation: –	**Course language:** English
Type of exam: student presentation or written examination	

Requirements for credit point allocation:
presentation or written examination

Literature:

Course Name: Fuel Cells – an introduction

Degree programme: **Environmental Engineering** (Bachelor)	Responsible Lecturer: Prof. Dr. Marion Siegers

Work load: 75	**Lecture hours per week:** 2	**ECTS Credits:** 2.5

Course objectives:

The students improve their knowledge about renewable energies in the area of fuel cells and gain an insight into low-emission power generation via fuel cells.

Contents:

This course deals with fuel cell systems and their application:

Basic Principles of a Fuel Cell

- Principle of a Fuel Cell
- Thermodynamics (excerpts)
- Efficiency
- Voltage-Current-Characteristics

Fuel Gas Supply

- Reformer Technology (Steam Reforming (SR), Partial Oxidation (POX), Autothermal Reformation (ATR))
- CO Removal Technology
- Internal Reforming

Applications

- Mobile Applications
- Stationary Applications
- Portable Applications

About didactics and work load distribution:

Lectures in the form of a seminar, exercises

Requirements for participation:

Basic knowledge of science and engineering

Type of exam:

Written exam

Course language:

English

Requirements for credit point allocation:

Attendance and participation in class; successful completion of the written exam

Literature:

- Heinzel, Mahlendorf, Roes, Brennstoffzellen – Entwicklung, Technologie, Anwendung, C.F. Müller
- Larminie, Dicks, Fuel Cell Systems Explained, Wiley
- Kurzweil, Brennstoffzellentechnik, Vieweg Verlag
- Kordesch, Simader, Fuel Cells and Their Applications, VCH-Verlag

Course Name: Mathematics 3

Degree programme: **Environmental Engineering** (Bachelor)	Responsible Lecturer: Prof. Dr. Rainer Sawatzki

Work load: 75	**Lecture hours per week:** 2	**ECTS Credits: 2.5**

Course objectives:

Students will acquire the ability:

- to describe technical and scientific problems with the mathematical syntax.
- to use the basic concepts of differential and integral calculus, ordinary differential equations and series.
- to apply the tools of the aforementioned areas reliably.

Contents:

- general series, power series, Taylor and Fourier series
- Ordinary differential equations of first and second order

About didactics and work load distribution:

- Seminars with exercises (25%)
- working in small groups (25%)
- independent study (50%)

Requirements for participation:
Knowledge of calculus

Type of exam:
Written test

Course language:
English

Requirements for credit point allocation:
Active participation in class and successful completion of the final examination

Literature:

- Papula, Lothar: Mathematik für Ingenieure und Naturwissenschaftler 1-3
- Fetzer, Albert; Fränkel, Heiner: Mathematik Bd.1-2
- Engeln-Müllges, Gisela; Schäfer, Wolfgang; Trippler, Gisela: Kompaktkurs Ingenieurmathematik
- Dürrschnabel, Klaus: Mathematik für Ingenieure

Course Name: Materials Science

Degree programme: **Process Engineering** (Bachelor)	Responsible Lecturer: Prof. Dr. Bernd Sadlowsky	
Work load: 150	**Lecture hours per week:** 4	**ECTS Credits:** 5

Course objectives:

Students develop an understanding between internal structure, internal mechanisms and externally measurable material properties. They become acquainted with the most important material test procedures and the significance of the mechanical properties of materials and on this basis they are able to compare materials in relation to their suitability for a construction or manufacturing process. They also learn about the basic principles for the formation and influence of microstructures in metallic materials in solidification and heat treatment applications.

Course content:

- Construction of materials: atomic and molecular structure, bonds and principal material groups.
- Principles of metallurgy: crystalline structure, material defects, thermally activated processes, alloys and corrosion.
- Ferrous metals: iron-carbon system, heat treatment, alloy elements, steel types and nomenclature, steel manufacturing, processing and application, cast iron materials.
- Non-ferrous metals: aluminium, copper, nickel and titanium.
- Plastics: structure, properties, plastic types, plastics nomenclature, plastics manufacturing, processing and application.
- Principles of mineral, non-metallic materials: ceramics and glass.
- Destructive materials testing: tensile test, pressure test, impact test, fatigue test, metallographic analysis, scanning electron microscopic analysis, EDX analysis and spectral analysis.
- Non-destructive materials testing: visual inspection, dye penetrant testing, ultrasonic testing, radiographic examination, acoustic emission testing and replica technology.
- Damage analysis: damage investigation procedure based on visual, metallographic and fractographic analyses and group work.

About didactics and work load distribution:

Lectures, supported by blackboard presentation projectors and integrated by the students performed exercises, worksheets; lab work. (Presence study 54 hours, 96 hours self-study)

Requirements for participation:

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Course language:

English

Type of exam:

Written exam

Requirements for credit point allocation:

Successful completion of the written examination

Literature:

- Aparna Guapta, Santosh Kumar: "Material Science for Engineers", CBS Publishers & Distributers
- Donald R. Askeland, Pradeep P. Fulay, D. K. Bhattacharya: "Materials Science and Engineering"; Cengage Learning
- William D. Callister, "Materials Science and Engineering", International Student Version

Course Name: Particle Technology

Degree programme: **Environmental Engineering** (Bachelor)		Responsible Lecturer: Prof. Dr. Martin Geweke
Work load: 90	**Lecture hours per week:** 2	**ECTS Credits:** 3

Course objectives:

The module is an introduction to the subject of particle technology to students studying degree courses in disciplines requiring knowledge of the processing and handling of particles and powders (students of process technology or mechanical or chemical engineering)

Contents:

- Particle size analysis (singe particle / bulk material)
- Methods of particle size measurement
- Motion of particles in a fluid
- Classifier
- Separation of particles from a gas

About didactics and work load distribution:

- Lectures: 32 h
- Self study: 58 h

Requirements for participation:

Recommended for students in the fields of chemical engineering, process engineering or environmental engineering (2nd / 3rd year).

Course language:

English

Type of exam:

written / oral test

Requirements for credit point allocation:

Participation in class and successful completion of the final examination

Literature:

- M. Rhodes: Introduction to particle technology

Course Name: Pharmacology/Toxicology

Degree programme: **Environmental Engineering** (Bachelor)	Responsible Lecturer: Prof. Dr. Claus Wacker

Work load: 150	**Lecture hours per week:** 4	**ECTS Credits:** 5

Course objectives:

Contents:

The course looks at the following subjects:

Pharmacology

- Administration of Drugs and Subsequent Processes
- Pharmacokinetics 1: Absorption and Distribution
- Pharmacokinetics 2: Biotransformation (Metabolism)
- Pharmacokinetics 3: Toxification of Xenobiotics during Metabolism; Elimination from the Organism
- Pharmacodynamics 1: Pharmacological Effects on Receptors and Transport Systems
- Pharmacodynamics 2: Pharmacological Effects on Enzymes and Microorganisms
- Pharmacodynamics 3: Structure-Activity- and Dose-Response-Relationship
- Pharmacodynamics 4: Side Effects of Drugs
- Development and Testing of new Drugs

Toxicology

- Heavy Metals
- Air-way poisons and irritant gases
- Asbestos
- Aromatic Hydrocarbons
- Chlorinated organic compounds

About didactics and work load distribution:

Lectures, supported by blackboard presentation projectors and integrated by the students performed exercises, worksheets; lab work. (72 hours lectures, 78 hours self-study)

Requirements for participation:	**Course language:** English
Type of exam: Written examination	

Requirements for credit point allocation:

Successful completion of the written examination

Literature:

Course Name: Sustainable Energy Economics (every other year starting 2013)

Degree programme: **Environmental Engineering** (Bachelor)	Responsible Lecturer: Prof. Dr. Jörg Andreä

Work load: 150	**Lecture hours per week:** 4	**ECTS Credits:** 5

Course objectives:

This course looks at: the formation of fossil fuels; the development of the demand for energy in Germany and worldwide; the mechanisms of energy economics; an introduction to energy production and management; the future perspectives of the use of renewable energies; energy and the environment (global warming, etc.); sustainable energy concepts for the future.

The target is for the participants to know, be able to describe and valuate Forms of Energy, Generation of Energy, Distribution of Energy, Applications of Energy, Energy Economics, Environmental Aspects, Future Concepts of Energy Supply, and perform basic calculations!

Contents:

- From Big Bang to Presence
- Energy Forms and Systems, Energy Cycle of Life
- Energy Demand, Economics, Supplies
- Conventional and Nuclear Power Plants
- Electricity from Renewable Energy Sources
- Future Perspectives: Nuclear Fusion, etc.
- Applications of Energy
- Energy and Environment
- Energy Technologies for the Future (Presentations)

About didactics and work load distribution:

(72 hours lectures, 78 hours self-study)

Requirements for participation:

Basic knowledge of mathematics and physics, knowledge of English

Course language:

English

Type of exam:

- Presentation on a Topic of „Energy Technologies for the Future“ (30%)
- Final Examination (written or oral test in English) (70%)

Requirements for credit point allocation:

Successfully passing the final examination; participation in the excursion to a power plant

Literature:

- John R. Fanchi: Energy: Technology and Directions for the Future, Academic Press (2004)
- Vaclav Smil: Energy: A Beginner's Guide (Beginners Guide), Oneworld (2006)
- Vaclav Smil: Energy at the Crossroads: Global Perspectives and Uncertainties, MIT Press (2005)
- Vikram Janardhan, Robert D. Fesmire: Energy explained: Understanding the Science, Technology and Economics of the World's Most Vital Commodity, Praeger Frederick A (2011)
- David JC MacKay:Sustainable Energy – Without the Hot Air, Uit Cambridge Ltd (2008)
- Roland Wengenmayr and Thomas Bührke: Renewable Energy: Sustainable Energy Concepts for the Future, Wiley – VCH Ltd. (2008)