Modules for Environmental Modelling

Mastermodule

inf501 - Environmental Information Systems

<table>
<thead>
<tr>
<th>Module label</th>
<th>Environmental Information Systems</th>
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<tbody>
<tr>
<td>Module code</td>
<td>inf501</td>
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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
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<tr>
<td>Used in course of study</td>
<td>Master Informatik &gt; Mastermodule</td>
</tr>
<tr>
<td></td>
<td>Master Umweltmodelleierung &gt; Mastermodule</td>
</tr>
<tr>
<td></td>
<td>Master Wirtschaftsinformatik &gt; Bereichswahlmodule</td>
</tr>
</tbody>
</table>

Contact person

Module responsibility

- Ute Vogel-Sonnenschein
- Die im Modul Lehrenden

Authorized examiners

- Ute Vogel-Sonnenschein
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module

The module gives an overview of the phases and important aspects of the environmental information processing.

Professional competence

The students:

- apply basic processing algorithms to classify and process data
- compare, evaluate and design data structures to store spatial data efficiently
- apply basic functions of a geo-information system
- describe, evaluate and apply basic processes of data mining
- describe, evaluate and apply basic geostatistics processes
- evaluate and apply multicriteria decision making processes

Methodological competence

The students:

- use geoinformation systems for environmental application
- use data mining tools for data analysis

Social competence

The students:

- solve tasks in teams of 2-3 students
- present and discuss their solutions in class

Self-competence

The students:

- reflect their own behaviour with regard to the methods of environmental informatics

Module contents

Content of the Module: Environmental information systems make information about the general environmental state available for public management and public facilities, enterprises or interested citizens. The collection, storage and evaluation of this information is interesting for computer science.

Within the scope of the lecture we will examine the processing of environmental information step-by-step, this means:

- problems of data acquisition and data processing,
- data structures and database concepts for an efficient access to (usually) spatial data,
- introduction of data analysis (in particular from geostatistics and data mining),
- introduction of multicriteria decision processes, as well as
- the supply of data supported by meta data.
The module "Umweltinformationssysteme" is accompanied by the module "Modellbildung in Simulation ökologischer Systeme". The subjects of "Modellbildung in Simulation ökologischer Systeme" represent the dynamic aspects of environmental systems (mainly of ecological systems). Nevertheless, the modules can be taken independently from each other.

**Reader’s advisory**

**Links**
- German
- 1 Semester
- jährlich
- unlimited
- Associated with the module:
  - inf500 Modellbildg. und Sim. ökol. Systeme

**Module level**
AS (Akzentsetzung / Accentuation)

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**
- Informationssysteme I
  - Grundlagen der Statistik

**Vorkenntnisse / Previous knowledge**

**Examination**

<table>
<thead>
<tr>
<th>Final exam of module</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tbody>
<tr>
<td></td>
<td>Second and third week after the end of the lecture period</td>
<td>Oral exam</td>
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<tr>
<td></td>
<td>- retake before the upcoming lecture period</td>
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**Course type**

<table>
<thead>
<tr>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>3.00</td>
<td></td>
<td>42 h</td>
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<td>Exercises</td>
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<td>1.00</td>
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**Total time of attendance for the module**

56 h
inf510 - Energy Information Systems

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<th>Energy Information Systems</th>
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<tr>
<td>Module code</td>
<td>inf510</td>
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<tr>
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<td>6.0 KP</td>
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<tr>
<td>Workload</td>
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</table>

Used in course of study
- Master Informatik > Mastermodule
- Master Umweltmodellierung > Mastermodule
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person
- Module responsibility
  - Sebastian Lehnhoff
  - Die im Modul Lehrenden
- Authorized examiners
  - Sebastian Lehnhoff
  - Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module
The students will learn different approaches to integrate distributed facilities, the regulatory framework, relevant standards and architecture concepts of energy management systems and will be able to apply this knowledge.

Professional competence
The students:
- develop and evaluate IT-architectures for energy management systems
- model objects of this domain appropriately
- model energy information systems
- realise and differentiate advanced tasks of decentralised energy management systems

Methodological competence
The students:
- identify problems of energy management, analyse these problems systematically and provide solutions
- apply different simulation approaches of decentralised plants and consumers

Social competence
The students:
- discuss solutions for energy management systems in the group
- develop use cases in teams
- present self-developed solutions

Self-competence
The students:
- reflect their actions with regard to structuring and decomposing systems
- reflect their own use of power as a limited resource

Module contents
This module provides the computer science basics for energy management. It provides the requirements of energy supply information systems with the focus on technical components and the requirements of decentralised and renewable energy plants.

These are:
- Architectures for energy information systems, e.g. SOA, Seamless Integration Architecture (IEC TC 57), OPC-UA
- Norms and standards of energy industry data models (CIM, 61850)
- Systematisation of energy information system requirements based on ontologies
- Development, analysis and adaption of energy industry reference models and processes
- Methods and technologies to support energy industry processes
- Methods and algorithms to support decision processes of the decentralised energy plants control
- Smart Grid plant communication, particularly for load management
- Methods for modelling and simulation of power supply system dynamics
Reader’s advisory

- Crastan V.: “Elektrische Energieversorgung II”, Springer 2004

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>German</th>
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<tbody>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
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<tr>
<td>Module frequency</td>
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<td>Module capacity</td>
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<td>Modullevel</td>
<td>AS (Akzentsetzung / Accentuation)</td>
</tr>
<tr>
<td>Modulart</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<table>
<thead>
<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td>At the end of the semester</td>
<td>Student research project or presentation</td>
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<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
<td>2.00</td>
<td></td>
<td>28 h</td>
</tr>
<tr>
<td>Seminar</td>
<td>2.00</td>
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<td>28 h</td>
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Total time of attendance for the module: 56 h
inf511 - Smart Grid Management

Module label: Smart Grid Management
Module code: inf511
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Mastermodule
- Master Umweltmodellierung > Mastermodule
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person:
Module responsibility:
- Sebastian Lehnhoff
- Die im Modul Lehrende

Authorized examiners:
- Sebastian Lehnhoff
- Die im Modul Lehrende

Entry requirements:
After successful completion of the course the students should be able to understand the existing structures and technical basis of energy systems to produce, transfer and distribute electricity and their interaction and dependency on each other. They should have developed an understanding for necessary IT- and process control technology components, methods and processes to control and operate electrical energy systems. The students are able to estimate and evaluate the requirements and challenges of ICT and computer science which are caused by the development and integration of unforeseeable fluctuations of decentralised plants. The students will be able to estimate the influence of distributed control concepts and algorithms for decentralised plants and consumers in the so-called Smart Grid energy systems. Regarding the requirements the students will be able to analyse the safety, reliability, real-time capability and flexibility of Smart Grid energy systems.

Professional competence
The students:
- understand the existing structures and the technical basis of energy systems producing, transferring and distributing electricity and their interaction and dependency on each other.
- develop an understanding for necessary IT- and process control technology components, methods and processes to control and operate electrical energy systems.
- estimate and evaluate the requirements and challenges of ICT and computer science which are caused by the development and integration of unforeseeable fluctuations of decentralised plants.
- estimate the influence of distributed control concepts and algorithms for decentralised plants and consumers in the so-called Smart Grid energy systems.

Methodological competence
The students:
- analyse the safety, reliability, real-time capability and flexibility of Smart Grid energy systems
- use advanced mathematical methods to calculate networks

Social competence
The students:
- create solutions in small teams
- discuss their solutions

Self-competence
The students:
- reflect their own use of electricity as a limited resource

Module contents:
Content of the Module: In this course information technology, economical energy industry and technical basic knowledge and methods are analysed by using concrete Smart Grid approaches. The basic calculation methods for an intelligent grid management are introduced.

This module deals with the technical and economical framework for a permissible electrical network as well as mathematical modelling and calculation methods to analyse conditions of electrical energy networks (in stationary conditions).
These are:

- The organisation of the EU energy market (regulatory framework, responsibility in liberalisation of electrical energy systems)
- Establishment and operation of electrical energy supply networks (network topology, statutory duties of supply, supply quality/system services, malfunctions and protection systems)
- Intelligent network management (Smart Grids), aggregation forms, machine learning approaches)

Reader's advisory

Suggested reading:

- Crastan V.: "Elektrische Energieversorgung II", Springer 2004

Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Modulelevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

<table>
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<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>At the end of the semester</td>
<td>Oral exam</td>
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Course type | Comment | SWS | Frequency | Workload attendance |
---|---|---|---|---|
Lecture | | 3.00 | | 42 h |
Exercises | | 1.00 | | 14 h |

Total time of attendance for the module: 56 h
### inf535 - Computational Intelligence I

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<tr>
<th>Module label</th>
<th>Computational Intelligence I</th>
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<tr>
<td>Module code</td>
<td>inf535</td>
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<tr>
<td>Credit points</td>
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<td>Workload</td>
<td>180 h</td>
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<td>Master Umweltmodellierung &gt; Mastermodule</td>
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#### Contact person
- Module responsibility
  - Oliver Kramer
  - Die im Modul Lehrenden
- Authorized examiners
  - Oliver Kramer
  - Die im Modul Lehrenden

#### Entry requirements

<table>
<thead>
<tr>
<th>Skills to be acquired in this module</th>
<th>Professional competence:</th>
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<tbody>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>- recognise optimisation problems</td>
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<td></td>
<td>- implement simple algorithms of heuristic optimisation</td>
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<td></td>
<td>- critically discuss solutions and selection of methods</td>
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<tr>
<td></td>
<td>- deepen previous knowledge of analysis and linear algebra</td>
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</table>

**Methodological competence**

- deepen programming skills
- apply modelling skills
- learn about the relation between problem class and method selection

**Social competence**

- cooperatively implement content introduced in lecture
- evaluate own solutions and compare them with those of their peers

**Self-competence**

- evaluate own skills with reference to peers
- realize personal limitations
- adapt own problem solving approaches with reference to required method competences

#### Module contents

Computational Intelligence comprises intelligent and adaptive methods for optimisation and learning. The module "Computational Intelligence I" concentrates on methods for evolutionary optimisation and heuristic approaches. The exercises introduce and deepen practical aspects of the implementation and algorithmic design, also taking into account application aspects.

**Overview of Content:**

- foundations of optimisation
- genetic algorithms and evolution strategies
- parameter control and self-adaptation
- runtime analysis
- swarm algorithms
- constrained optimisation
- multi-objective optimisation
- meta-modeling

#### Reader's advisory


<table>
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<tbody>
<tr>
<td>Language of instruction</td>
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<td>Duration (semesters)</td>
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<td>Module capacity</td>
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<table>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<th>Type of examination</th>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>Written or oral exam</td>
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<th>Workload attendance</th>
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<td>Lecture</td>
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<td>Exercises</td>
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| Total time of attendance for the module | 56 h |

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<td>Frequency</td>
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inf536 - Computational Intelligence II

Module label: Computational Intelligence II
Module code: inf536
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Informatik > Mastermodule
- Master Umweltmodellierung > Mastermodule

Contact person
Module responsibility
- Oliver Kramer

Authorized examiners
- Die im Modul Lehrenden
- Oliver Kramer

Entry requirements

Skills to be acquired in this module

Professional competence
The students:
- Recognise machine learning problems
- Implement simple algorithms of machine learning
- Critically discuss solutions and selection of methods
- Deepen previous knowledge of analysis and linear algebra

Methodological competence
The students:
- Deepen programming skills
- Apply modelling skills
- Learn about the relation between problem class and method selection

Social competence
The students:
- Cooperatively implement content introduced in lecture
- Evaluate own solutions and compare them with those of their peers

Self-competence
The students:
- Evaluate own skills w.r.t. peers
- Realise personal limitations
- Adapt own problem solving approaches w.r.t. required method competences

Module contents
Computational Intelligence comprises intelligent and adaptive methods for optimisation and learning. The module "Computational Intelligence II" concentrates on methods for machine learning and data mining. The exercises introduce and deepen practical aspects of the implementation and algorithmic design, also taking into account application aspects.

Overview of Content:
- Foundations of learning and classification
- Nearest neighbouring methods
- Model selection and parameter tuning
- Regression
- Support vector and kernel methods
- Clustering
- Dimensionality reduction

Reader's advisory

- HASTIE, T., TIBSHIRANI, R., FRIEDMAN, J.H.: The Elements of Statistical Learning, Springer 2009
<table>
<thead>
<tr>
<th>Links</th>
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<tbody>
<tr>
<td>Languages of instruction</td>
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<td>Duration (semesters)</td>
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<td>Module frequency</td>
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| Vorkenntnisse / Previous knowledge | - inf535 Computational Intelligence I  
- Statistics |

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<td>Written or oral exam</td>
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<th>Frequency</th>
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<tr>
<td>Exercises</td>
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<td>2.00</td>
<td>SuSe</td>
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**Total time of attendance for the module**: 56 h
inf651 - Environmental Management Information Systems I

Module label: Environmental Management Information Systems I
Module code: inf651
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Mastermodule
- Master Sustainability Economics and Management > Ergänzungsmodule
- Master Umweltmodellierung > Mastermodule
- Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik

Contact person:
Module responsibility:
- Jorge Marx Gomez
- Die im Modul Lehrenden

Authorized examiners:
- Jorge Marx Gomez
- Die im Modul Lehrenden

Entry requirements:
This module completes the knowledge and abilities gained in the field of Environmental Informatics and it creates a strong reference to up to date topics in the field of sustainability. The content taught in this module can directly be applied in an upcoming study and professional career.

Professional competence
The students:
- are able to classify and explain the sustainability paradigm
- are aware of the current status of sustainability reporting
- are able to define and to model material flows
- have obtained know-how in the field of corporate environmental management information systems (CEMIS)

Methodological competence
The students:
- implement CEMIS
- apply different techniques and methods to case studies
- develop new case studies in teams

Social competence
The students:
- are supposed to work in teams and therefore have to identify working packages and have to take on responsibility for the jobs assigned to them
- present and discuss their own results with the team and the other members of the course

Self-competence
The students:
- learn about their own limitations and learn to accept criticism in order to strengthen their own abilities

Module contents:
This course teaches methods, approaches and techniques in the field of information processing in order to support solutions to problems that arise from companies' impact on the environment. In particular, ICT supported approaches of production-integrated environmental protection, environmental controlling and reporting are introduced and discussed. In order to enable the integration of such approaches into environmental protection, environmental management and its systems are taught as well.

The content in detail:
- environmental management as a basis for sustainability
- sustainability and material flow management
- strategic environmental management
- eco-controlling life cycle
- characteristics and system architectures of CEMIS
- standard software systems
- environmental accounting systems

**Reader's advisory**


**Links**
http://www.wi-ol.de

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited

**Modullevel**
AS (Akzentsetzung / Accentuation)

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**
V+Ü

**Vorkenntnisse / Previous knowledge**

<table>
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<tr>
<th>Examination</th>
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<tbody>
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<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>exercises and written exam (max. 120 min.)</td>
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**Course type**

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<th>Workload attendance</th>
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<td>28 h</td>
<td></td>
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<tr>
<td>Exercises</td>
<td>2.00</td>
<td>28 h</td>
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Total time of attendance for the module 56 h
inf659 - Environmental Management Information Systems II

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<tbody>
<tr>
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<td>inf659</td>
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<td>6.0 KP</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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<tr>
<td>Used in course of study</td>
<td>Master Informatik &gt; Mastermodule</td>
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<tr>
<td></td>
<td>Master Sustainability Economics and Management &gt; Ergänzungsmodule</td>
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<td></td>
<td>Master Umweltmodellierung &gt; Mastermodule</td>
</tr>
<tr>
<td></td>
<td>Master Wirtschaftsinformatik &gt; Akzentsetzungsmodule Bereich Wirtschaftsinformatik</td>
</tr>
<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>• Jorge Marx Gomez</td>
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<tr>
<td></td>
<td>• Die im Modul Lehrenden</td>
</tr>
<tr>
<td>Authorized examiners</td>
<td>• Jorge Marx Gomez</td>
</tr>
<tr>
<td></td>
<td>• Die im Modul Lehrenden</td>
</tr>
<tr>
<td>Entry requirements</td>
<td>This course aims at examining emerging research questions in the field of corporate environmental management information systems (CEMIS). After finishing this course, the students will have extensive knowledge regarding Business Environmental Informatics. In addition, they will be aware of recent research topics and challenges as well as relevant software solutions and practical projects.</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Professional competence</td>
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<tr>
<td></td>
<td>The students:</td>
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<tr>
<td></td>
<td>• will obtain extensive knowledge in the field of CEMIS</td>
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<tr>
<td></td>
<td>• know emerging research questions and challenges as well as software solutions and projects</td>
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<tr>
<td></td>
<td>Methodological competence</td>
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<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• find their own solutions or apply already existing approaches to new and unsolved questions in the field of CEMIS</td>
</tr>
<tr>
<td></td>
<td>• capture required data, analyse it and present it to their team or the whole group</td>
</tr>
<tr>
<td></td>
<td>Social competence</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
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<tr>
<td></td>
<td>• are supposed to work in teams and therefore have to identify working packages and have to take on responsibility for the jobs assigned to them</td>
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<tr>
<td></td>
<td>• present and discuss their own results with the team and the other members of the course</td>
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<tr>
<td></td>
<td>Self-competence</td>
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<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• learn about their own limitations and learn to accept criticism in order to strengthen their own abilities</td>
</tr>
<tr>
<td>Module contents</td>
<td>A strong social pressure forces enterprises to question their current way of implementing their business and to include different aspects of sustainability into their strategies and operational actions. Such a rethinking of one's business is supported by corporate environmental management information systems. Such systems aim at optimising the energy and resource usage, emission and waste minimisation as well as production integrated environmental protection. Of course they support the fulfilment of legal requirements such as waste management or hazardous material handling.</td>
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<tr>
<td></td>
<td>The module will cover:</td>
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<tr>
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<td>• recent and emerging research questions and topics related to the field of CEMIS as well as Business Environmental Informatics.</td>
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<tr>
<td></td>
<td>• discussion and hands-on experience of standard software systems and newly established solutions.</td>
</tr>
<tr>
<td></td>
<td>• applying the knowledge obtained to the definition of new as well as on solving new case studies.</td>
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Reader's advisory

Hershey (PA), London

- Rautenstrauch, C. (1999), Betriebliche Umweltinformationssysteme, Springer-Verlag

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<th><a href="http://www.wi-ol.de">http://www.wi-ol.de</a></th>
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| Total time of attendance for the module | 56 h |

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| Total time of attendance for the module | 56 h |
inf980 - Introduction to Computer Science for Natural Science Students

Module label: Introduction to Computer Science for Natural Science Students

Module code: inf980

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:

- Fach-Bachelor Betriebswirtschaftslehre für Leistungssportlerinnen und Leistungssportler > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Betriebswirtschaftslehre für Leistungssportlerinnen und Leistungssportler > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Betriebswirtschaftslehre mit juristischem Schwerpunkt > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Betriebswirtschaftslehre mit juristischem Schwerpunkt > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Business Administration in mittelständischen Unternehmen > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Business Administration in mittelständischen Unternehmen > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Biologie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer" more...
- Fach-Bachelor Biologie > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Chemie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Chemie > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Comparative and European Law > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Comparative and European Law > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Engineering Physics > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Engineering Physics > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Informatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Informatik > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Intercultural Bildung und Beratung > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Intercultural Bildung und Beratung > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Mathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Mathematik > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Nachhaltigkeitsökonomik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Nachhaltigkeitsökonomik > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Pädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogik > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Physik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Physik > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Physik, Technik und Medizin > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Physik, Technik und Medizin > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Sozialwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Sozialwissenschaften > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Umweltwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Umweltwissenschaften > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Wirtschaftsinformatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Wirtschaftsinformatik > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Wirtschaftswissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Wirtschaftswissenschaften > Säule "Überfachliche Professionalisierung"
- Master Umweltmodellierung > Mastermodule
- Zwei-Fächer-Bachelor Anglistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Anglistik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Biologie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Biologie > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Chemie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Chemie > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Elementarmathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Elementarmathematik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Ev. Theologie und Religionspädagogik > PP "Medieninformatik für Studierende
musisch-künstlerischer Fächer“

- Zwei-Fächer-Bachelor Ev. Theologie und Religionspädagogik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Gender Studies > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Gender Studies > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Germanistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Germanistik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Geschichte > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Geschichte > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Informatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Interdisziplinäre Sachbildung > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Interdisziplinäre Sachbildung > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Kunst und Medien > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Kunst und Medien > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Literaturwissenschafts-Textwissenschafts > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Literaturwissenschafts-Textwissenschafts > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Materielle Kultur: Textil > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Materielle Kultur: Textil > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Mathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Mathematik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Musik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Musik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Niederlandistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Niederlandistik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Ökonomische Bildung > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Ökonomische Bildung > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Politik-Wirtschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Politik-Wirtschaft > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Pädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Pädagogik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Philosophie / Werte u. Normen > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Philosophie / Werte u. Normen > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Physik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Physik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Politik-Wirtschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Politik-Wirtschaft > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Sozialwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Sozialwissenschaften > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Sportwissenschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Sportwissenschaft > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Technik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Technik > Säule "Überfachliche Professionalisierung"
- Zwei-Fächer-Bachelor Wirtschaftswissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Wirtschaftswissenschaften > Säule "Überfachliche Professionalisierung"

**Contact person**

Module responsibility

- Ute Vogel-Sonnenschein

Authorized examiners

- Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction**

German
### Duration (semesters)
1 Semester

### Module frequency

### Module capacity
unlimited

### Module level
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### Moduleart
je nach Studiengang Pflicht oder Wahlpflicht

### Lern-/Lehrform / Type of program

### Vorkenntnisse / Previous knowledge

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mar353 - Grundlagen mathematischer Modellierung

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mar354 - Advanced mathematical modelling

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  - Master Marine Umweltwissenschaften > Mastermodule
  - Master Umweltmodellierung > Mastermodule

Contact person

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Language of instruction | German |
Duration (semesters)    | 1 Semester |

Module frequency

Module capacity | unlimited |
Modullevel      | --- |
Modulart        | je nach Studiengang Pflicht oder Wahlpflicht |

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: ---

Module capacity: unlimited

Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

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mar355 - Physikalische Ozeanographie

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- **Used in course of study**
  - Master Marine Umweltwissenschaften > Mastermodule
  - Master Umweltmodelierung > Mastermodule

**Contact person**

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction**  German

**Duration (semesters)**  1 Semester

**Module frequency**

**Module capacity**  unlimited

**Modulart**  je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Examination**

**Course type**  Lecture

**Time of examination**  SWS

**Type of examination**  SuSe or WiSe

**Frequency**

**Workload attendance**  28 h

**Course type**  Seminar or exercise

**Time of examination**  SWS

**Type of examination**  SuSe or WiSe

**Frequency**

**Workload attendance**  28 h

**Total time of attendance for the module**  56 h
mar356 - Ozean-Klima-Umweltphysik

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| Contact person          |                         |
| Entry requirements      |                         |
| Skills to be acquired in this module |                 |
| Module contents         |                         |
| Reader’s advisory       |                         |
| Links                   |                         |
| Language of instruction | German                  |
| Duration (semesters)    | 1 Semester              |
| Module frequency        |                         |
| Module capacity         | unlimited               |
| Module level            | ---                     |
| Modulart                | je nach Studiengang Pflicht oder Wahlpflicht |

| Lern-Lehrform / Type of program |                         |

| Vorkenntnisse / Previous knowledge |                         |

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mar357 - Meeres- und Geochemie

Module label: Meeres- und Geochemie
Module code: mar357
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Marine Umweltwissenschaften > Mastermodule
- Master Umweltmodellierung > Mastermodule

Contact person:

Entry requirements:

Skills to be acquired in this module:

Module contents:

Reader's advisory:

Links:

Language of instruction: German
Duration (semesters): 1 Semester

Module frequency:
Module capacity: unlimited
Module level:
Module type:

Lern-/Lehrform / Type of program:

Vorkenntnisse / Previous knowledge:

Examination:
- Final exam of module
- Type of examination: KL

Course type:
- Lecture

SWS:
- 4.00

Frequency:
- SuSe or WiSe

Workload attendance:
- 56 h
mar363 - Theorie ökologischer Gemeinschaften

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### Used in course of study
- Master Marine Umweltwissenschaften > Mastermodule
- Master Umweltmodellierung > Mastermodule

### Contact person

### Entry requirements

### Skills to be acquired in this module

### Module contents

### Reader's advisory

### Links

### Language of instruction
- German

### Duration (semesters)
- 1 Semester

### Module frequency

### Module capacity
- unlimited

### Modulelevel
- ---

### Modulart
- je nach Studiengang Pflicht oder Wahlpflicht

### Lern-/Lehrform / Type of program

### Vorkenntnisse / Previous knowledge

### Examination
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### Total time of attendance for the module
- 56 h
mar364 - Zeitreihenanalyse

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**Contact person**

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction** German

**Duration (semesters)** 1 Semester

**Module frequency** ---

**Module capacity** unlimited

**Modullevel** ---

**Modulart** je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Total time of attendance for the module** 56 h
mar365 - Stochastische Prozesse

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**Used in course of study**
- Master Marine Umweltwissenschaften > Mastermodule
- Master Umweltmodellierung > Mastermodule

**Contact person**

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**

**Module capacity**
- unlimited

**Modullevel**
- ---

**Modulart**
- je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Total time of attendance for the module**
- 56 h
mar367 - Ozeanmodelle

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**Used in course of study**
- Master Marine Sensorik > Mastermodule
- Master Marine Umweltwissenschaften > Mastermodule
- Master Umweltmodellierung > Mastermodule

**Contact person**

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**

**Module capacity**
- unlimited

**Modullevel**
- ---

**Modulart**
- je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Total time of attendance for the module**
- 56 h
mar368 - Klimamodelle

Module label: Klimamodelle
Module code: mar368
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Marine Umweltwissenschaften > Mastermodule
- Master Umweltmodellierung > Mastermodule

Contact person
Entry requirements
Skills to be acquired in this module
Module contents
Reader's advisory
Links
Language of instruction: German
Duration (semesters): 1 Semester

Module frequency: unlimited
Modullevel: ---
Moduleart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge

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Total time of attendance for the module: 56 h
mar369 - Kritische Zustände im System Erde: Kipppunkte und Resilienz

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mar374 - Nichtlineare Dynamik im Erdsystem

Module label
Nichtlineare Dynamik im Erdsystem

Module code
mar374

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Master Marine Umweltwissenschaften > Mastermodule
- Master Umweltmodellierung > Mastermodule

Contact person

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency

Module capacity
unlimited

Modullevel
---

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination

Type of examination

Final exam of module
KL

Course type
Comment
SWS
Frequency
Workload attendance
Lecture
2.00
SuSe or WiSe
28 h
Exercises
2.00
SuSe or WiSe
28 h

Total time of attendance for the module
56 h
mar375 - Modelle in der Populationsdynamik

Module label | Modelle in der Populationsdynamik
---|---
Module code | mar375
Credit points | 6.0 KP
Workload | 180 h

Used in course of study
- Master Marine Umweltwissenschaften > Mastermodule
- Master Umweltmodellierung > Mastermodule

Contact person

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Language of instruction | German
Duration (semesters) | 1 Semester

Module frequency

Module capacity | unlimited
Modulelevel | ---
Modulart | je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination | Time of examination | Type of examination
---|---|---
Final exam of module | | KL

Course type | Time | Frequency | Workload attendance
---|---|---|---
Lecture | 2.00 | SuSe or WiSe | 28 h
Exercises | 2.00 | SuSe or WiSe | 28 h

Total time of attendance for the module | 56 h
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| **Used in course of study** | - Master Marine Umweltwissenschaften > Mastermodule  
- Master Umweltmodellierung > Mastermodule |
| **Contact person** | |
| **Entry requirements** | |
| **Skills to be acquired in this module** | |
| **Module contents** | |
| **Reader's advisory** | |
| **Links** | |
| **Language of instruction** | German |
| **Duration (semesters)** | 1 Semester |
| **Module frequency** | |
| **Module capacity** | unlimited |
| **Modуль level** | --- |
| **Moduleart** | je nach Studiengang Pflicht oder Wahlpflicht |
| **Lern-/Lehrform / Type of program** | |
| **Vorkenntnisse / Previous knowledge** | |
| **Examination** | Time of examination | Type of examination |
| **Final exam of module** | | KL |
| **Course type** | Comment | SWS | Frequency | Workload attendance |
| Lecture | | 2.00 | SuSe or WiSe | 28 h |
| Exercises | | 2.00 | SuSe or WiSe | 28 h |
| **Total time of attendance for the module** | | | | 56 h |
### mar431 - Marine Klimatologie

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#### Contact person

#### Entry requirements

#### Skills to be acquired in this module

#### Module contents

#### Reader's advisory

#### Links

#### Language of instruction
German

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#### Module frequency

#### Module capacity
unlimited

#### Modulart
je nach Studiengang Pflicht oder Wahlpflicht

#### Lern-/Lehrform / Type of program

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### Language of instruction
German

### Duration (semesters)
1 Semester

### Module frequency

### Module capacity
unlimited

### Modulart
je nach Studiengang Pflicht oder Wahlpflicht

### Examination

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### Course type
Lecture

### SWS
4.00

### Frequency
SuSe or WiSe

### Workload attendance
56 h
mar432 - Biogeochemie

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                           | • Master Umweltmodellierung > Mastermodule |
| Contact person          |                                       |
| Entry requirements      |                                       |
| Skills to be acquired in this module |                                       |
| Module contents         |                                       |
| Reader's advisory       |                                       |
| Links                   |                                       |
| Language of instruction | German                                |
| Duration (semesters)    | 1 Semester                            |
| Module frequency        |                                       |
| Module capacity         | unlimited                             |
| Modulelevel             | ---                                   |
| Modulart                | je nach Studiengang Pflicht oder Wahlpflicht |

**Lern-/Lehrform / Type of program**

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**Total time of attendance for the module**

56 h
### mar438 - Marine Umweltchemie

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**Contact person**

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction** German

**Duration (semesters)** 1 Semester

**Module frequency**

**Module capacity** unlimited

**Modullevel** ---

**Modulart** je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Course type**

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**Total time of attendance for the module** 56 h
### mar457 - Ökologie benthischer Mikroorganismen

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mar458 - Gewässerökologie

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| Used in course of study | • Master Marine Umweltwissenschaften > Mastermodule  
|                       | • Master Umweltmodelierung > Mastermodule |

Contact person

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Language of instruction | German |
Duration (semesters)    | 1 Semester |

Module frequency

Module capacity | unlimited |
Module level | --- |
Modulart | je nach Studiengang Pflicht oder Wahlpflicht |

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination | Time of examination | Type of examination |
--- | --- | --- |
Final exam of module | | KL |
Course type | Lecture |
SWS | 4.00 |
Frequency | SuSe or WiSe |
Workload attendance | 56 h |
### mar459 - Macrobenthos communities

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SWS
Frequency
Workload attendance
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mar470 - Programmierkurs Meereswissenschaften

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mar671 - Statistik-Software R: Einführung

Module label          Statistik-Software R: Einführung
Module code           mar671
Credit points         6.0 KP
Workload              180 h
Used in course of study
• Master Umweltmodellierung > Mastermodule
Contact person
Entry requirements
Skills to be acquired in this module
Module contents
Reader's advisory
Links
Language of instruction German
Duration (semesters)   1 Semester
Module frequency
Module capacity unlimited
Modullevel             ---
Modulart               je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program
Vorkenntnisse / Previous knowledge

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Total time of attendance for the module 56 h
mar672 - Bodenkunde, Hydrologie und Ökosystem

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mar673 - Hydrogeologie

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Used in course of study
- Master Umweltmodellierung > Mastermodule

Contact person

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Language of instruction German

Duration (semesters) 1 Semester

Module frequency

Module capacity unlimited

Modullevel ---

Modulart je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

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Total time of attendance for the module 56 h
mar700 - Introduction to Environmental Modelling

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Entry requirements
Skills to be acquired in this module
Module contents
Reader's advisory
Links
Language of instruction          German
Duration (semesters)             1 Semester
Module frequency
Module capacity                   unlimited
Modullevel                       ---
Modulart                         je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

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Total time of attendance for the module 56 h
mar710 - Fundamental Competences

Module label: Fundamental Competences
Module code: mar710
Credit points: 18.0 KP
Workload: 540 h

Used in course of study:
- Master Umweltmodellierung > Mastermodule

Contact person:
- Module responsibility
  - Bernd Blasius
- Authorized examiners
  - Alle hier genannten
- Module counseling
  - Lehrende der Meereswissenschaften
  - Lehrende der Biologie
  - Lehrende der Landschaftsoekologie
  - Lehrende der Informatik

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links
Languages of instruction: German, English

Duration (semesters): 1 Semester

Module frequency: 

Module capacity: unlimited
Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination

Time of examination

Type of examination

Final exam of module

M

Course type
Lecture
Seminar
Exercises

Comment

SWS

Frequency
WiSe
0 h

Workload attendance
28 h
28 h

Total time of attendance for the module
56 h
mar715 - Grundlagen Biologie/Ökologie

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**Vorkenntnisse / Previous knowledge**

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**mar717 - Statistische Umweltmodellierung**

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| Total time of attendance for the module | 56 h |

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mar718 - Hydrodynamik

Module label Hydrodynamik
Module code mar718
Credit points 6.0 KP
Workload 180 h

Used in course of study • Master Umweltmodellierung > Mastermodule

Contact person

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Language of instruction German

Duration (semesters) 1 Semester

Module frequency

Module capacity unlimited

Modullevel ---

Modulart je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination Time of examination Type of examination

Final exam of module KL
Course type Comment SWS Frequency Workload attendance
Lecture 2.00 SuSe or WiSe 28 h
Exercises 2.00 SuSe or WiSe 28 h

Total time of attendance for the module 56 h
mar719 - Mathematische Modellierung

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**mar720 - Environmental Systems and Biodiversity**

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**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Languages of instruction** | German, English |
**Duration (semesters)**    | 2 Semester     |

**Module frequency**

**Module capacity** | unlimited |
**Modullevel** | --- |
**Modulart** | je nach Studiengang Pflicht oder Wahlpflicht |

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**Vorkenntnisse / Previous knowledge**

**Examination**

**Course type** | Course selection |
**SWS** | 4.00 |
**Frequency** | WiSe |
**Workload attendance** | 56 h |
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mar723 - Biodiversität der Pflanzen

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</tbody>
</table>

**Contact person**

- Module responsibility
  - Detlev Heinemann
  - Authorized examiners
    - Alle hier genannten

- Module counseling
  - Joachim Peinke
  - Jürgen Parisi
  - Gerald Steinfeld
  - Bernhard Stoevesandt

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

Languages of instruction | German, English
---|---
Duration (semesters) | 2 Semester
Module frequency | ---
Module capacity | unlimited
Modulart | je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**

Vorkenntnisse / Previous knowledge

<table>
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**Final exam of module**

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**Total time of attendance for the module**

56 h
mar732 - Computational Fluid Dynamics

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| Contact person             |                               |
| Skills to be acquired in this module |                               |
| Module contents            |                               |
| Reader's advisory          |                               |
| Links                      |                               |
| Language of instruction    | German                       |
| Duration (semesters)       | 1 Semester                   |
| Module frequency           |                               |
| Module capacity            | unlimited                    |
| Modullevel                 | ---                          |
| Modulart                   | je nach Studiengang Pflicht oder Wahlpflicht |

| Lern-Lehrform / Type of program |                               |
| Vorkenntnisse / Previous knowledge |                               |
| Examination                  | Time of examination           |
| Final exam of module         | KL                           |
| Course type                  | Vorlesung und Übung          |
| SWS                         | 4.00                         |
| Frequency                   | SuSe or WiSe                 |
| Workload attendance         | 56 h                         |
mar733 - Wind Resource and its Application

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| Lern-Lehrform / Type of program           |                                    |

| Vorkenntnisse / Previous knowledge       |                                    |

| Final exam of module                     | KL                                 |
| Course type                              | Comment SWS Frequency Workload attendance |
| Lecture                                  | 2.00 SuSe or WiSe 28 h              |
| Seminar                                  | 2.00 SuSe or WiSe 28 h              |

| Total time of attendance for the module  | 56 h                               |
mar734 - Solar Resource and its Application

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**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

Language of instruction: German

**Duration (semesters)**

1 Semester

**Module capacity**

unlimited

Modullevel: ---

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Total time of attendance for the module**

56 h
## mar735 - Bioenergy

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**Course type**: Lecture

**SWS**: 4.00

**Frequency**: SuSe or WiSe

**Workload attendance**: 56 h
**mar736 - Energy Systems**

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**Lern-Lehrform / Type of program**

| **Vorkenntnisse / Previous knowledge** | - |
| **Examination** | - |
| **Time of examination** | - |
| **Type of examination** | - |

| **Final exam of module** | KL |
| **Course type** | Lecture |
| **SWS** | 4.00 |
| **Frequency** | SuSe or WiSe |
| **Workload attendance** | 56 h |
mar740 - Environmental and Resource Economy

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**Contact person**
- Module responsibility
  - Heinz Welsch
- Authorized examiners
  - Alle hier genannten
- Module counseling
  - Christoph Böhringer
  - Carsten Helm
  - Klaus Eisenack

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Languages of instruction**
- German, English

**Duration (semesters)**
- 2 Semester

**Module frequency**

**Module capacity**
- unlimited

**Modullevel**
- ---

**Modulart**
- je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

**Examination** | **Time of examination** | **Type of examination**
--- | --- | ---
Final exam of module | M |

**Course type**
- Lecture

**SWS**
- 0.00

**Frequency**
- WiSe

**Workload attendance**
- 0 h
### mar742 - Umwelt- und Ressourcen-Ökonomie

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**Links**

**Duration (semesters)**

**1 Semester**

**Module frequency**

**Module capacity**

**unlimited**

**Modullevel**

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**Lern-Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

**Examination**

**Time of examination**

**Type of examination**

**Final exam of module**

**KL**

**Course type**

**Lecture**

**SWS**

4.00

**Frequency**

SuSe or WiSe

**Workload attendance**

56 h
mar743 - Energie- und Klimawandel-Ökonomie

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**Used in course of study**
- Master Umweltmodellierung > Mastermodule

**Contact person**

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader’s advisory**

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**

**Module capacity**
- unlimited

**Modullevel**
- ---

**Modulart**
- je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

**Examination**

**Time of examination**

**Type of examination**

**Final exam of module**
- KL

**Course type**
- Lecture

**SWS**
- 4.00

**Frequency**
- SuSe or WiSe

**Workload attendance**
- 56 h
### mar750 - Process and System-oriented Environmental Modelling

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<td>- Ulrike Feudel</td>
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<td>- Alle hier genannten</td>
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<td>- Jan Freund</td>
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### mar754 - Modellierung komplexer Systeme

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**Language of instruction**: German

**Duration (semesters)**: 1 Semester

**Module frequency**: ---

**Module capacity**: unlimited

**Modullevel**: ---

**Modulart**: je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Course type**: Seminar

**SWS**: 4.00

**Frequency**: SuSe or WiSe

**Workload attendance**: 56 h
mar755 - Fluiddynamik

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### mar760 - Statistical Environmental Modelling

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<td>Jan Freund</td>
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<td>Cord Peppler-Lisbach</td>
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<td>Robert Biedermann</td>
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### Entry requirements

### Skills to be acquired in this module

### Module contents

### Reader's advisory

### Links

**Languages of instruction**

German, English

**Duration (semesters)**

2 Semester

**Module frequency**

**Module capacity**

unlimited

**Modullevel**

---

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

### Lern-Lehrform / Type of program

**Vorkenntnisse / Previous knowledge**

**Examination**

**Time of examination**

**Type of examination**

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**Total time of attendance for the module**

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mar768 - Statistische Analyse

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mar770 - Modelling of Large Systems

Module label: Modelling of Large Systems
Module code: mar770
Credit points: 18.0 KP
Workload: 540 h

Used in course of study:
- Master Umweltmodellierung > Mastermodule

Contact person:
- Module responsibility
  - Michael Sonnenschein
- Authorized examiners
  - Alle hier genannten
- Module counseling
  - Ute Vogel-Sonnenschein
  - Angelika May
  - Alexander Hartmann
  - Christoph Böhringer
  - Jorge Marx Gomez
  - Andreas Winter

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Languages of instruction: German, English
Duration (semesters): 2 Semester

Module frequency: ---
Module capacity: unlimited
Module level: je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination:
- Time of examination: G
- Type of examination: Final exam of module

Final exam of module
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Total time of attendance for the module: 56 h
**mar779 - Computerorientierte Physik**

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| **Contact person** | |
| **Entry requirements** | |
| **Skills to be acquired in this module** | |
| **Module contents** | |
| **Reader's advisory** | |

| **Language of instruction** | German |
| **Duration (semesters)**    | 1 Semester |
| **Module frequency**        | \--- |
| **Module capacity**         | unlimited |
| **Modulart**                | je nach Studiengang Pflicht oder Wahlpflicht |

| **Lern-Lehrform / Type of program** | |

| **Vorkenntnisse / Previous knowledge** | |

| **Final exam of module** | KL |

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mar780 - Practical Seminar Modelling Study

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mar790 - Supplementary Modules

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Total time of attendance for the module 56 h
mar800 - Research Project

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Contact person

- Module responsibility
  - Ulrike Feudel
- Authorized examiners
  - Alle hier genannten
- Module counseling
  - Lehrende Umweltmodellierung

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Languages of instruction | German, English
Duration (semesters)     | 1 Semester
Module frequency
Module capacity           | unlimited
Module level             | ---
Moduleart                | je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

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Final exam of module

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Total time of attendance for the module

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mar997 - Applied Statistics in Biology and Environmental Science

Module label: Applied Statistics in Biology and Environmental Science
Module code: mar997
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Betriebswirtschaftslehre für LeistungssportlerInnen und Leistungssportler > Fachnahe Angebote Biologie
- Fach-Bachelor Betriebswirtschaftslehre für LeistungssportlerInnen und Leistungssportler > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Betriebswirtschaftslehre mit juristischem Schwerpunkt > Fachnahe Angebote Biologie
- Fach-Bachelor Betriebswirtschaftslehre mit juristischem Schwerpunkt > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Biologie > Fachnahe Angebote Biologie
- Fach-Bachelor Business Administration in mittelständischen Unternehmen > Fachnahe Angebote Biologie
- Fach-Bachelor Business Administration in mittelständischen Unternehmen > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Chemie > Fachnahe Angebote Biologie
- Fach-Bachelor Chemie > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Comparative and European Law > Fachnahe Angebote Biologie
- Fach-Bachelor Comparative and European Law > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Engineering Physics > Fachnahe Angebote Biologie
- Fach-Bachelor Engineering Physics > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Informatik > Fachnahe Angebote Biologie
- Fach-Bachelor Informatik > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Interkulturelle Bildung und Beratung > Fachnahe Angebote Biologie
- Fach-Bachelor Interkulturelle Bildung und Beratung > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Mathematik > Fachnahe Angebote Biologie
- Fach-Bachelor Mathematik > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Nachhaltigkeitsökonomik > Fachnahe Angebote Biologie
- Fach-Bachelor Nachhaltigkeitsökonomik > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Pädagogik > Fachnahe Angebote Biologie
- Fach-Bachelor Pädagogik > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft > Fachnahe Angebote Biologie
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Physik > Fachnahe Angebote Biologie
- Fach-Bachelor Physik > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Physik, Technik und Medizin > Fachnahe Angebote Biologie
- Fach-Bachelor Physik, Technik und Medizin > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Sozialwissenschaften > Fachnahe Angebote Biologie
- Fach-Bachelor Sozialwissenschaften > Fachnahe Angebote Umweltwissenschaften
- Fach-Bachelor Wirtschaftswissenschaften > Fachnahe Angebote Biologie
- Fach-Bachelor Wirtschaftswissenschaften > Fachnahe Angebote Umweltwissenschaften
- Master Umweltmodellierung > Mastermodule
- Zwei-Fächer-Bachelor Anglistik > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Anglistik > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Biologie > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Biologie > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Chemie > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Chemie > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Elementarmathematik > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Elementarmathematik > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Ev. Theologie und Religionspädagogik > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Ev. Theologie und Religionspädagogik > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Gender Studies > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Gender Studies > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Germanistik > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Germanistik > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Geschichte > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Geschichte > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Informatik > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Informatik > Fachnahe Angebote Umweltwissenschaften
- Zwei-Fächer-Bachelor Interdisziplinäre Sachbildung > Fachnahe Angebote Biologie
- Zwei-Fächer-Bachelor Interdisziplinäre Sachbildung > Fachnahe Angebote Umweltwissenschaften
### mat837 - Extreme Value Statistics and Applications

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<td>Credit points</td>
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<tr>
<td></td>
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<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>Marcus Christiansen</td>
</tr>
<tr>
<td></td>
<td>Angelika May</td>
</tr>
<tr>
<td></td>
<td>Peter Ruckdeschel</td>
</tr>
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</table>

#### Entry requirements

#### Skills to be acquired in this module

#### Module contents

#### Reader’s advisory

#### Languages of instruction

German, English

#### Duration (semesters)

1 Semester

#### Module capacity

unlimited

#### Module level

---

#### Modulart

je nach Studiengang Pflicht oder Wahlpflicht

#### Lern-/Lehrform / Type of program

#### Vorkenntnisse / Previous knowledge

#### Examination

<table>
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#### Final exam of module

<table>
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<tr>
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<td></td>
<td>3.00</td>
<td>--</td>
<td>42 h</td>
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<tr>
<td>Exercises</td>
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<td>1.00</td>
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Total time of attendance for the module 56 h
### mat839 - Time Series Models resp. State Space Models

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<td><strong>Used in course of study</strong></td>
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<td>• Master Mathematik &gt; Mastermodule</td>
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<td></td>
<td>• Master Umweltmodellierung &gt; Mastermodule</td>
</tr>
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</table>

#### Contact person

Module responsibility

- Marcus Christiansen
- Angelika May
- Peter Ruckdeschel

### Entry requirements

### Skills to be acquired in this module

### Module contents

### Reader’s advisory

### Languages of instruction

German, English

### Duration (semesters)

1 Semester

### Module frequency

#### Module capacity

unlimited

### Module level

---

### Module art

je nach Studiengang Pflicht oder Wahlpflicht

### Lern-/Lehrform / Type of program

### Vorkenntnisse / Previous knowledge

#### Examination

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<tr>
<td>Exercises</td>
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<td>1.00</td>
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### Total time of attendance for the module

56 h
# mat843 - Elements of Multivariate Statistics

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<td>Master Umweltmodellierung &gt; Mastermodule</td>
</tr>
<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>Angelika May</td>
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<td></td>
<td>Marcus Christiansen</td>
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<td></td>
<td>Peter Ruckdeschel</td>
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## Entry requirements

## Skills to be acquired in this module

## Module contents

## Reader's advisory

## Languages of instruction
German, English

## Duration (semesters)
1 Semester

## Module frequency

## Module capacity
unlimited

## Moduleart

je nach Studiengang Pflicht oder Wahlpflicht

## Lern-/Lehrform / Type of program

## Vorkenntnisse / Previous knowledge

## Examination

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## Total time of attendance for the module
56 h
# mat847 - Elements of Exploratory Data Analysis, Robust Statistics, and Diagnostics

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<td></td>
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<tr>
<td>Contact person</td>
<td>(Module responsibility)</td>
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<td></td>
<td>• Marcus Christiansen</td>
</tr>
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<td>• Angelika May</td>
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<td>• Peter Ruckdeschel</td>
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### Entry requirements

### Skills to be acquired in this module

### Module contents

### Reader's advisory

### Languages of instruction
  German, English

### Duration (semesters)
  1 Semester

### Module frequency
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### Module capacity
  unlimited

### Lern-/Lehrform / Type of program
  je nach Studiengang Pflicht oder Wahlpflicht

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| Total time of attendance for the module | 56 h |
mat849 - Statistical Algorithms

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<td>Master Umweltmodellierung &gt; Mastermodule</td>
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<tr>
<td>Contact person</td>
<td>Module responsibility</td>
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<td>Marcus Christiansen</td>
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<td>Peter Ruckdeschel</td>
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**Entry requirements**

Skills to be acquired in this module

**Module contents**

Reader's advisory

**Links**

Languages of instruction | German, English
Duration (semesters) | 1 Semester

**Module frequency**

Module capacity | unlimited
Modullevel | ---
Modulart | je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Course type**

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Total time of attendance for the module | 56 h
wir808 - Multivariate Statistics

Module label               Multivariate Statistics
Module code               wir808
Credit points             6.0 KP
Workload                  180 h

Used in course of study
- Master Sustainability Economics and Management > Ergänzungsmodule
- Master Umweltmodellierung > Mastermodule
- Master Wirtschaftsinformatik > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master Wirtschafts- und Rechtswissenschaften > Mantelmodule
- Master Wirtschafts- und Rechtswissenschaften > Schwerpunkt "Volkswirtschaftslehre" (VWL)

Contact person
Module responsibility
- Bernd Siebenhüner
- Ralf Werner Stecking
Authorized examiners
- Ralf Werner Stecking
- Anelise Rahmeier Seyffarth
Module counseling
- Anelise Rahmeier Seyffarth

Entry requirements
Skills to be acquired in this module
With successful completion of the course, students shall:
- be aware of and be able to evaluate advanced methods of multivariate data analysis.
- be able to select adequate methods in relevant fields of application, like prediction, classification, and segmentation analysis.
- be able to run computer-aided analyses and to interpret the results properly.

Module contents
Various methods of quantitative data analysis such as:
- Linear Regression,
- Logistic Regression,
- Linear Discriminant Analysis,
- Principal Component Analysis,
- Feature selection and evaluation methods.

Reader's advisory

Links
Language of instruction              German
Duration (semesters)                1 Semester
Module frequency                   jährlich
Module capacity                    unlimited
Modulelevel                        MM-PB (Professionalisierungsbereichsmodul im Master)
Modulart                           Wahlpflicht

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

<table>
<thead>
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<th>Type of examination</th>
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<td>written exam or oral exam (30 minutes)</td>
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Total time of attendance for the module 56 h
Abschlussmodul

mam - Master´s Thesis Module

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<td></td>
<td>• Ulrike Feudel</td>
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<td>Authorized examiners</td>
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Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Languages of instruction | German, English |
Duration (semesters)      | 1 Semester     |
Module frequency          | ---            |
Module capacity           | unlimited      |
Modulart                  | je nach Studiengang Pflicht oder Wahlpflicht |
Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination Time of examination Type of examination
Final exam of module G

Course type Seminar

SWS

Frequency

Workload attendance 0 h