# Waste and Waste Water Technologies

**C Compulsory Modules (Pflichtmodule)**

**VALIDITY: from Oct 01, 2010 [STATUS: 15.03.11]**

---

## Relevance for ResEngin curriculum
- compulsory

<table>
<thead>
<tr>
<th>Administration</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>ResEngin Office</td>
<td><a href="mailto:res.eng@bg.uni.uka.de">res.eng@bg.uni.uka.de</a></td>
</tr>
</tbody>
</table>

## Term(s) offered
- 1st term (Winter term Oct-Mar)

## Duration | Cycle
- 1 term; every other year

## Language of instruction
- English

## Prerequisites
- Bachelor

## Module coordinator
- WINTER, Dr.rer.nat. habil. Josef; Ord., IBA [Modulverantwortlicher]

## Learning outcomes
- Description see p. 2.
- Reference list see p. 3.

## Basis for module(s)
- M 5 Protection & Use of Riverine Systems
- M 7 Integrated Projects
- M MSc Masterarbeit

## Intersection with module(s)
- M T2a Air, Water, and Soil Purification Processes

---

## Lecture courses

### (training mode)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Points</th>
<th>Workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>19608</td>
<td>Waste Water Biotechnology (lecture)</td>
<td>3.0 CP</td>
<td>2 WCH</td>
</tr>
<tr>
<td>19609</td>
<td>Non Thermal Waste Treatment &amp; Waste Management (lecture)</td>
<td>3.0 CP</td>
<td>2 WCH</td>
</tr>
<tr>
<td>19606</td>
<td>Waste Water &amp; Waste Analysis (labcourse, excursion; limited seats)</td>
<td>3.0 CP</td>
<td>2 weeks</td>
</tr>
</tbody>
</table>

**SUM** | **9.0 CP** | **4 WCH** | **+ 2 wks**

## Workload specification

<table>
<thead>
<tr>
<th>Workload</th>
<th>9 x 30 h</th>
<th>270 h</th>
</tr>
</thead>
</table>

**Lecture Phase:**
- Contact hours |
- Self instruction hours |
- Lab work |

**Documentation:**
- Protocol |
- Group report |

**Exam Phase:**
- Self instruction hours (6 x 9h) | 54 h |

---

## Module examination(s)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Scope</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>written</td>
<td>60 min</td>
<td>9.0/9.0 CP</td>
</tr>
</tbody>
</table>

---

## Lecturers

- GALLERT, PD Dr.rer.nat. Claudia; IBA
- WINTER, Dr.rer.nat. habil. Josef, Ord.; IBA

## Individual lecture courses

- Descriptions + Recommended background knowledge see pp. 4.
Module 2: “Waste and Waste Water Technologies” (cont.)

Module topic

Principal technologies and bio-chemical reactions of wastewater and waste treatment processes including management practices and environmental policy, bio-chemical analysis of wastewater parameters to describe process efficiency. Basic design examples.

Learning outcomes

Disciplinary knowledge

- **concepts, theories & definitions**
  Wastewater treatment covering decentralized simple treatment facilities for small settlements, e.g. lagoon or pond systems, to technically sophisticated treatment plants with aerobic wastewater and anaerobic sludge treatment for mega cities.
  Definition of waste, waste management practices in Germany and in the EU; waste collection/transportation, waste treatment options for different types of waste.
  Analysis of parameters dealing with carbon and nitrogen removal, methane production and toxicity according to standard methods.

- **subject matter (factual data, examples)**
  Process technologies as well as the chemical and biological background: examples from praxis.
  Possible waste treatment options according to the respective waste policies.
  Analytical tools to evaluate or to design a technological process.

- **methods & procedures**
  Mechanical, chemical and biological means to treat domestic wastewater, including activated sludge treatment, pond systems and constructed wetlands; sum parameters and boundary values as a tool for process efficiency description.
  Composting of green waste, fermentation of biowaste, mechanical biological waste treatment of residual waste, sanitary landfill of pre-treated waste.
  Characterize wastewater samples with the most important (bio-)chemical analytic approaches; microscopic characterization of activated sludge; methane production potential; toxicity tests.

- **critical awareness of** the interaction between biochemical and engineering aspects of the respective processes; evaluation of analyzed data, their impact on processes and data reliability.

Professional skills

- To apply wastewater treatment technologies; to decide on a rational basis which treatment system would be appropriate for a certain settlement structure.
- To perform analytical tests, including evaluation of the results and discussing reliable and representative sample withdrawal, possible analytical errors and importance of the results for planning wastewater treatment plants. To learn which analytical data are required and how to deal with these analytical data for basic process planning.

Personal competence

- Synopsis of the content from the previous lecture presented by individual students.
- Presentation of country specific data e.g. costs for waste collection and treatment acc. to respective BIP.
- Team work and time management.
Module 2: “Waste and Waste Water Technologies” (cont.)

Literature/ Course material


Lecture notes

- (1) “Non Thermal Waste Treatment & Waste Management“:
  weekly download of lecture material
- (2) Lab course script including schemes from Gallert, C. and J. Winter (2006).
Module 2

Waste and Waste Water Technologies

Course

Waste Water Biotechnology

<table>
<thead>
<tr>
<th>KIT Lecture ID</th>
<th>19608</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>compulsory</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Bachelor</td>
</tr>
<tr>
<td>Term(s)</td>
<td>1st term (winter)</td>
</tr>
<tr>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>Training mode</td>
<td>Lecture, 2 WCH *</td>
</tr>
<tr>
<td>Workload</td>
<td>3 CP ( \Rightarrow ) 90.0 h</td>
</tr>
</tbody>
</table>

**Workload specification**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Contact (based on 2 WCH)</th>
<th>Self instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>LECTURE</td>
<td>21.0 h</td>
<td>42.0 h</td>
</tr>
<tr>
<td>EXAM</td>
<td>Self instruction</td>
<td>27.0 h</td>
</tr>
</tbody>
</table>

**Contact**

josef.winter@kit.edu

**Lecturer(s)**

WINTER, Dr. rer. nat. habil. Josef, Ord.; IBA

**Course topic**

The connection between biochemical and engineering aspects of waste treatment processes.

**Recommended background knowledge**

Fundamentals of natural sciences (biology, chemistry), engineering, and ecology.

**Learning outcomes**

**Disciplinary knowledge**

- **concepts, theories & definitions**
  wastewater treatment covering decentralized simple treatment facilities for small settlements, e.g. lagoon or pond systems, to technically sophisticated treatment plants with aerobic wastewater and anaerobic sludge treatment for mega cities.

- **subject matter (factual data, examples)**
  process technologies as well as the chemical and biological background.

- **methods & procedures**
  mechanical, chemical and biological means to treat domestic wastewater including activated sludge treatment, pond systems and constructed wetlands; sum parameters and boundary values as a tool for process efficiency description.

**Professional skills**

To apply wastewater treatment technologies; to decide on a rational basis which treatment system would be appropriate for a certain settlement structure.

**Personal competence**

Synopsis of the content from the previous lecture presented by individual students.

**Assessment specification**

written 60 min = module exam “Waste & Waste Water Technologies” together with LV Non Thermal Waste Treatment & Waste Mgmt & LV Waste Water & Waste Analysis (lab)

oral ---

other ---

* WCH = Weekly Contact Hours
Module 2

Course

Waste and Waste Water Technologies

Non Thermal Waste Treatment & Waste Management

<table>
<thead>
<tr>
<th>KIT lecture ID</th>
<th>Workload specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>19609</td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>compulsory</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Bachelor</td>
</tr>
<tr>
<td>Term(s)</td>
<td>1st term (winter)</td>
</tr>
<tr>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>Training mode</td>
<td>Lecture, 2 WCH *</td>
</tr>
<tr>
<td>Workload</td>
<td>3 CP ⇒ 90.0 h</td>
</tr>
</tbody>
</table>

**LECTURE PHASE**
- Contact (based on 2 WCH) 21.0 h
- Self instruction 42.0 h

**EXAM PHASE**
- Self instruction 27.0 h

**Contact**
claudia.gallert@kit.edu

**Lecturer(s)**
GALLERT, PD Dr rer. nat. Claudia; IBA

**Course topic**
The connection between biochemical and engineering aspects of waste treatment processes.

**Recommended background knowledge**
Fundamentals of natural sciences (biology, chemistry), engineering, and ecology.

**Learning outcomes**

**Disciplinary knowledge**
- **concepts, theories & definitions**
  definition of waste, waste management practices in Germany and in the EU; waste collection/transportation, waste treatment options for different types of waste.
- **subject matter (factual data, examples)**
  possible waste treatment options according to the respective waste policies; process technologies as well as the chemical and biological background; examples from praxis.
- **methods & procedures**
  composting of green waste, fermentation of biowaste, mechanical biological waste treatment of residual waste, sanitary landfill of pre-treated waste.

**Professional skills**
To apply waste treatment technologies; to decide on a rational basis which treatment system would be the appropriate for a certain settlement structure.

**Personal competence**
Presentation of country specific data e.g. costs for waste collection and treatment according to the respective BIP.

**Assessment specification**
written 60 min = module exam “Waste & Waste Water Technologies” together with LV Waste Water Biotechnology & LV Waste Water & Waste Analysis (lab)
oral ---
other ---

* WCH = Weekly Contact Hours
### Module 2

Waste and Waste Water Technologies

### Course

**Waste Water & Waste Analysis (labcourse)**

<table>
<thead>
<tr>
<th>KIT lecture ID</th>
<th>19606</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>compulsory</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Bachelor</td>
</tr>
<tr>
<td>Term(s)</td>
<td>1st term (winter)</td>
</tr>
<tr>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>Training mode</td>
<td>Labcourse, 2 weeks</td>
</tr>
<tr>
<td>Workload</td>
<td>3 CP $\Rightarrow$ 90.0 h</td>
</tr>
</tbody>
</table>

#### Workload specification

<table>
<thead>
<tr>
<th><strong>LECTURE PHASE</strong></th>
<th><strong>Instruction (lab work)</strong></th>
<th>45.0 h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DOCUMENTATION</strong></td>
<td>Protocol</td>
<td>10.0 h</td>
</tr>
<tr>
<td></td>
<td>Group report</td>
<td>10.0 h</td>
</tr>
<tr>
<td><strong>EXAM PHASE</strong></td>
<td>Exam Preparation</td>
<td>9.0 h</td>
</tr>
</tbody>
</table>

#### Lecturer(s)

GALLERT, PD Dr. rer. nat. Claudia; IBA

+ scientific research assistants at IBA

#### Course topic

The evaluation of analyzed data, their impact on processes and data reliability.

#### Recommended background knowledge

Manual skills in lab work, fundamentals of statistics.

#### Learning outcomes

**Disciplinary knowledge**

- **concepts, theories & definitions**
  
  analysis of parameters dealing with carbon and nitrogen removal, methane production and toxicity according to standard methods.

- **subject matter (factual data, examples)**
  
  analytical tools to evaluate or to design a technological process.

- **methods & procedures** to characterize wastewater samples with the most important (bio-)chemical analytic approaches; microscopic characterization of activated sludge; methane production potential; toxicity tests.

**Professional skills**

To perform analytical tests, including evaluation of the results and discussing reliable and representative sample withdrawal, possible analytical errors and importance of the results for planning wastewater treatment plants. To learn which analytical data are required and how to deal with analytical data for basic process planning.

**Personal competence**

Team work and time management.

#### Assessment specification

- **written** 60 min = module exam “Waste & Waste Water Technologies”
  
  together with LV Waste Water Biotechnology & LV Non Thermal Waste Treatment & Waste Mgmt

- **oral** ---

- **other** ---

* WCH = Weekly Contact Hours