SUBJECT DESCRIPTION

Subject code: VŽHTM09E
Subject title: NATURAL METHODES OF WASTEWATER TREATMENT

Credit value 6 ECTS, 160 hours: 72 contact hours, 88 student’s independent work hours.

Types of student learning activities

<table>
<thead>
<tr>
<th>Classwork and tutorials</th>
<th>Hours</th>
<th>Student’s independent work/self-study</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>48</td>
<td>Preparation for individual task</td>
<td>24</td>
</tr>
<tr>
<td>Practicums and seminars</td>
<td>20</td>
<td>Preparation for practicums</td>
<td>9</td>
</tr>
<tr>
<td>Tutorials/consultations</td>
<td>2</td>
<td>Preparation for seminars</td>
<td>15</td>
</tr>
<tr>
<td>Examination</td>
<td>2</td>
<td>Preparation for exam</td>
<td>40</td>
</tr>
</tbody>
</table>

Subject purpose

<table>
<thead>
<tr>
<th>Study cycle</th>
<th>Study programme</th>
<th>Type of the subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>First cycle</td>
<td>Hydraulic Engineering</td>
<td>Elective</td>
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</table>

Subject objectives: to provide knowledge about the natural wastewater treatment technologies, teach to choose appropriate wastewater treatment systems, to evaluate their application possibilities and effectiveness.

Prerequisites: ability to study and analyze technical literature independently. The course requires knowledge in fields of mathematics, hydraulics, wastewater treatment.

Learning outcomes:

Knowledge and understanding: after finishing the course students will know about physical and biochemical processes of contaminants purification in soil and water, will be able to choose natural wastewater treatment technology and equipment, environmentally appropriate location of wastewater treatment plant, will know how to use and maintain the natural wastewater treatment facilities.

Special abilities and skills: the students will be able to design natural wastewater treatment plant; to carry out the analysis of operation efficiency of natural wastewater treatment facilities; to assess the impact of wastewater treatment plants on the environment and select its mitigation measures; will learn to systematize theoretical knowledge and rational use in practice.

Values and attitudes: to become aware that environmental regulations need to be obeyed when treating wastewater, nature should be respected because it is an inseparable part of our surroundings, which needs to be protected and cherished; a reasonable combination of nature, technology and technological factors needs to be strived for.

Assessment criteria of learning outcomes: understanding and use of basic concepts of study subject; the absorption of knowledge which was indentified by study results; formulation and analysis of practical problems and reasoning of the decision; self-studies of additional literature.
Subject content:

Lectures 48/40 val.:
1. Introduction 2/1 hr.
2. Treatment of contaminants by natural methods 8/7 hr.
3. Biological treatment of domestic sewage under natural conditions 6/5 hr.
4. Sand filters 6/5 hr.
5. Plant-ground filters 8/7 hr.
6. Peat filters 4/3 hr.
7. Biological pounds 6/5 hr.
8. Other natural wastewater treatment systems 8/7 hr.

Practicums 11/9 val.:
1. Design of plant-ground filter 3/2 val.

Seminars 9/15 val.:
1. Analysis of efficiency of sand and plant-ground filters instaled in Lithuania 3/5 val.
2. Analysis of efficiency of systems with biological pounds instaled in Lithuania 3/5 val.
3. Natural system installation for wastewater treatment of village, houses, and other objects 3/5 val.

Methods of learning: Theoretical part (lectures) is taught with the help of means to visualize information. In the beginning of the lecture the topicality of issues is presented, students are introduced to the aim and contents of the lecture, sources of reference used to prepare the lecture are presented. If possible, lectures are conducted in the form of discussion, i.e. students are given questions in order to involve them into a short-term discussion. At the end of the lesson the ideas of the lecture are summarized, students are given additional sources and additional objectives of the issue discussed. During the seminars students present works carried out by individual tasks. Debates between students themselves on one or another issue are also encouraged. During the practicums students are taken to natural wastewater treatment facilities. There, students carry out the visual analysis of wastewater treatment plants, take wastewater samples. In ASU Environmental Laboratory students investigate contamination of wastewater and assess the efficiency of equipment.

Assessment methods of student learning outcomes: Lectures and practice take place according to the programme provided. Examination is taken in written form according to the regulations of University in the time of exam session. The main criteria of assessment are absorption of acquired knowledge and interpretation of its application. Absorbed knowledge in practical field is assessed with regard to the quality of task performance, ability to solve problem issues, summarized results obtained, ability to draw logical conclusions. Individual task is assessed according to the quality of work report and presentation. A ten-point criterion-cumulative assessment system is applied. Knowledge of the subject is assessed in 10 point scale for practicums and seminars, individual task and examination separately. Grades are multiplied by weight factor and added up.

Structure and terms of cumulative assessment

<table>
<thead>
<tr>
<th>Types of student’s independent work</th>
<th>Weight score</th>
<th>Deadlines of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual task</td>
<td>0,3</td>
<td>At the end of semester</td>
</tr>
<tr>
<td>Practicums and seminars</td>
<td>0,2</td>
<td>During the semester</td>
</tr>
</tbody>
</table>
### Interaction between study programme learning outcomes and learning methods and methods of student learning outcomes assessment

<table>
<thead>
<tr>
<th>Study programme learning outcomes</th>
<th>Subject learning outcomes</th>
<th>Learning methods</th>
<th>Assessment methods of student learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify, formulate and solve the engineering problems in the field of water protection engineering</td>
<td>Knowledge of natural wastewater treatment technologies and facilities, their strengths and weaknesses.</td>
<td>Lectures, seminars, discussion, studying subject literature individually.</td>
<td>Checking students’ knowledge through examination by asking for explanations, interpretation by the author.</td>
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<tr>
<td></td>
<td>Abilities to acquire the skills of natural wastewater treatment plant design, to perform the efficiency analysis of operation of natural wastewater treatment systems, to assess the environmental impact of these systems and to select its mitigation measures.</td>
<td>Lectures, working in groups; case studies during the visits to the objects; preparation of work under the individual task; students presentations method.</td>
<td>Checking students’ knowledge through examination; presentation of the results of practicums; presentation of the results of work under the individual task.</td>
</tr>
</tbody>
</table>

### Required literature references for subject study:


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5. Natural Systems for Water and Wastewater Treatment and Reuse. [http://www.switchurbanwater.eu/outputs/pdfs/w3-2_5-3_gen_prs_natural_treatment_systems_in_uwm.pdf](http://www.switchurbanwater.eu/outputs/pdfs/w3-2_5-3_gen_prs_natural_treatment_systems_in_uwm.pdf)

Teachers:
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assoc. prof.dr. Stefaniya Misevičienė, Department of Land Reclamation.

Approval at department: 20 June 2011, Minutes No.9
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Subject description valid until: 31 August 2014