**COURSE DESCRIPTION CARD – SPECIMEN**

<table>
<tr><td colspan="10">Faculty of Civil Engineering and Environmental Sciences</td></tr>
<tr><td>Field of study</td><td colspan="6"></td><td colspan="2">Degree level and programme type</td><td></td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6"></td><td colspan="2">Study profile</td><td>academic profile</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Biogas</td><td colspan="2">Course code</td><td>IS-FCEE-00138W</td></tr>
<tr><td colspan="2">Course type</td><td>Erasmus</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>winter</td></tr>
<tr><td>15</td><td></td><td>15</td><td>15</td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>4</td></tr>
<tr><td>Entry requirements</td><td colspan="9">Basic chemistry</td></tr>
<tr><td>Course objectives</td><td colspan="9">Acquaint the student with global climate warming and its implications. Acquaint the student with biogas production and digestate utilization. Teaching students skill of laboratory analyses necessary in biogas production. Teaching students skill of preparation of calculations and projects about biogas production and biogas potential.</td></tr>
<tr><td>Course content</td><td colspan="9">Lectures: Air pollution. Climate warming. Greenhouse gases. GHG reduction policies and measures. Anaerobic digestion. Substrates for biogas production. Biochemical processes of anaerobic digestion. Kinetics of biogas production. Main parameters of biogas production. Biogas plants: types, operational parameters, technology, components. Utilization of biogas. Digestate use and management. Environmental impact of biogas production. Advantages of biogas technologies for society.<br>Laboratory: Chemical analyses of biogas substrates and digestate. Biomethane potential test as a method for measuring the methane specific yield.<br>Project: The determination of biogas potential in the selected region. Calculation of the efficiency of biogas production from different substrates. Determination of the potential and kinetics of biogas production from different substrates based on laboratory analyses.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture, presentations, laboratory analyses, projects, calculations</td></tr>
<tr><td>Assessment method</td><td colspan="9">test, project, report</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="7">Learning outcomes</td><td colspan="2">Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="7">knows and characterizes the types of waste generated in agriculture, agri-food processing and landscape management</td><td colspan="2">IR2_W06</td></tr>
<tr><td>LO2</td><td colspan="7">knows, understands and explains biogas production technologies</td><td colspan="2">IR2_W06, IR2_W07</td></tr>
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|---|---|---|
| **LO3** | can make a qualitative assessment of products coming from waste and biomass management processes | IR2_U07 |
| **LO4** | properly interprets the obtained test results and draws conclusions | IR2_U07 |
| **LO5** | | |
| **LO6** | | |

| **Symbol of learning outcome** | **Methods of assessing the learning outcomes** | **Type of tuition during which the outcome is assessed** |
|---|---|---|
| **LO1** | Test | L |
| **LO2** | Test | L |
| **LO3** | project, report | P,LC |
| **LO4** | project, report | P,LC |
| **LO5** | | |
| **LO6** | | |

| **Student workload (in hours)** | | **No. of hours** |
|---|---|---|
| **Calculation** | attendance to lectures | 15 |
| | attendance to projects | 15 |
| | attendance to laboratory classes | 15 |
| | preparation for test | 20 |
| | preparation of projects | 20 |
| | preparation of laboratory reports | 15 |
| | **TOTAL:** | 100 |

| **Quantitative indicators** | **HOURS** | **No. of ECTS credits** |
|---|---|---|
| **Student workload – activities that require direct teacher participation** | 45 | 3 |
| **Student workload – practical activities** | 65 | 2.6 |

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| **Basic references** | 1. Al Seadi T., Rutz D., Prassl H., Köttner M., Finsterwalder T., Volk S., Janssen R. 2008. Published by University of Southern Denmark Esbjerg, Niels Bohrs Vej 9-10, DK-6700 Esbjerg, Denmark<br>2. Tabatabaei M., Ghanavati H., 2018. Biogas. Fundamentals, Process, and Operations. Biofuel and Biorafinery Technology 6., Springer International Publishing AG, part of Springer Nature<br>3. Horan N., Yaser A.Z., Wid N., 2018. Anaerobic Digestion Processes. Applications and Effluent Treatment. Springer Nature Singapore Pte Ltd.<br>4. IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.<br>5. Nieder R., Benbi D.K., 2008. Carbon and nitrogen in terrestrial environment. Springer Science + Business Media B.V. |
| **Supplementary references** | 1. Baltrenas P., Baltrenaite E., 2018 Small reactors for management of biodegradable waste. Springer International Publishing AG, part of Springer Nature<br>2. Treichel H., Fongaro G., 2019. Improving biogas production. Technological |

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|---|---|---|
| | challenges, alternative sources, future developments. . Biofuel and Biorafinery Technology 6., Springer International Publishing AG, part of Springer Nature<br>3. IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp. | |
| **Organisational unit conducting the course** | Department of Agri-Food Engineering and Environmental Management | **Date of issuing the programme** |
| **Author of the programme** | dr inż. Agnieszka Wysocka-Czubaszek | 13.11.2019 |

**L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar**