

**Course name:**

**BIOTECHNOLOGY OF WASTE, WASTEWATER AND ACTIVATED SLUDGE**

ECTS	6
Course status	obligatory
Course final assesement/evaluation of outcomes	exam
Prerequisites	basic knowledge of environmental chemistry and microbiology

**Main field of study:**

**field of study name (capital letters)**

Profile of study	General-academic
The code of studies (education level)	SI
Semester of studies	summer
Language of instruction	English

**Course offered by:**

Name of faculty offering the course	Faculty of Agriculture and Economics
Name of department offering the course	Department of Agricultural and Environmental Chemistry / Department of Microbiology and Biomonitoring
Course coordinator	Jacek Antonkiewicz, Iwona Paśmionka

**Learning outcomes of the course:**

Symbol of outcome	Description of learning outcome	Reference to	
		main field of study outcomes	discipline#

**KNOWLEDGE – student knows and/or understands:**

BWWAS_W1	issues related to solid waste management	IS1_W02	IS
BWWAS_W2	issues related to water and sewage management	IS1_W04	IS
BWWAS_W3	the possibility of using solid waste in segregation, recycling and microorganisms in the biological wastewater treatment process	IS1_W05	IS
BWWAS_W4	the basic terminology in the field of waste management, wastewater treatment and the methods used	IS1_W06	IS

**SKILLS – student is able to:**

BWWAS_U1	choose the optimal methods of recycling	IS1_U02	IS
BWWAS_U2	identify selected indicator organisms	IS1_U07	IS
BWWAS_U3	using different techniques to convert into new products	IS1_U13	IS
BWWAS_U4	conduct a waste and wastewater analysis	IS1_U18	IS
BWWAS_U5	use microscopic techniques for biological analysis of activated sludge	IS1_U19	IS

**SOCIAL COMPETENCE- student is ready to:**

BWWAS_K1	formulating objective assessments of waste management and biological wastewater treatment in the context of environmental protection	IS1_K02	IS
----------	--------------------------------------------------------------------------------------------------------------------------------------	---------	----

**Teaching contents:**

<b>Lectures</b>	<b>30</b>	<b>hours</b>
-----------------	-----------	--------------

Topics of the lectures	<p>1-2. Waste management according to regulations. Principles of waste management.</p> <p>3-4. Basic in waste segregation.</p> <p>5-6. Recycling of mineral waste.</p> <p>7-8. Recycling of organic waste.</p> <p>9-10. An environmental use for municipal sewage sludge.</p> <p>11-12. Municipal waste management in Poland. Illegal waste management.</p> <p>13-14. Disposal of solid waste.</p> <p>15-6. Reclamation of landfills.</p> <p>17-18. Natural waters. Water ecology.</p> <p>19-20. Biology of aquatic microorganisms.</p> <p>21-22. Polluted waters and sewage. The bacteria as a sanitation indicators.</p> <p>23-24. Biological methods of wastewater treatment. Ecology of activated sludge.</p> <p>25-26. The communities of organisms in activated sludge. Biochemical processes in the activated sludge metod.</p> <p>27-28. The role of protozoa in activated sludge. Bioindicators occurring in activated sludge.</p> <p>29-30. The characteristic biocenosis of the activated sludge.</p>
------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Accomplished learning outcomes	<i>BWWAS_W1, BWWAS_W2, BWWAS_W3, BWWAS_W4, BWWAS_K1</i>
Verification methods, rules and criteria of outcome assessment	<i>single / multiple choice test (50% share in the final assessment)</i>

<b>Classes</b>	<b>30</b>	<b>hours</b>
----------------	-----------	--------------

Topics of the classes	<p>1-2. Recognition, segregation, the use of industrial waste materials, raw materials.</p> <p>3-4. Recognition segregation of plastics.</p> <p>5-6. Recognition, raw material, the use of segregated papers.</p> <p>7-8. Determination of the amount of heavy metals introduced into soils with municipal sewage sludge used for fertilizer crops.</p> <p>9-10. Determination of the amount of organic pollutants (WWA, PCB and other) introduced into ground with municipal sewage sludge used for biological reclamation.</p> <p>11-12. Waste management in the Solvay's Park.</p> <p>13-14. Waste management in the quarry.</p> <p>15-16. The composting of organic waste process.</p> <p>17-18. Health and safety at work. Morphology of activated sludge flocs as an indicator of its operations.</p>
-----------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- 19-20. Identification of filamentous microorganisms in activated sludge.
- 21-22. Staining of polyphosphates in activated sludge bacteria cells.
- 23-24. Protozoa and Metazoa present in activated sludge.
- 25-26. Function and indicator significance of organisms present in activated sludge.
- 27-28. The food dependence of activated sludge organisms.
- 29-30. Macro and microscopic observations of activated sludge. Preparation a biological card of the assessment of activated sludge.

Accomplished learning outcomes	BWWAS_U1, BWWAS_U2, BWWAS_U3, BWWAS_U4, BWWAS_U5, BWWAS_K2
Verification methods, rules and criteria of outcome assessment	passing the laboratory work report (50% share in the final grade)

**Seminars** ... **hours**

Topics of the seminars	
Accomplished learning outcomes	symbol of learning outcomes of the seminars
Verification methods, rules and criteria of outcome assessment	together with participation in the final assesement (in %)

**References:**

Basic	J. Saunders A.M., Aibertsen M., Villertsen J., Nielsen P.H. 2016. The activated sludge. 2. Richard M., Collins F. 2003. Activated sludge microbiology problems and their control. The 20th Annual USEPA National Operator Trainers Conference, Buffalo, NY. 3. Pasik Dulowska C. 2021. Basic of waste
Supplementary	1. Spellman F. R. 2014. Handbook of Water and Wastewater Treatment Plant Operations. CRC Press, Taylor&Francis Group, Broken Sound Parkway NW. 2. Legislations accordings to European Union. 3. Journals of waste management technologies engineering

**Structure of learning outcomes:**

Discipline: # IS	6	ECTS**
Discipline: # (provide appropriate symbol - if the course relates to more than one academic discipline )	...	ECTS**

**Structure of student activities:**

Contact hours	68	hours	2,7	ECTS**
including:				
lectures	30	hours		
classes and seminars	30	hours		
consultations	6	hours		
participation in research		hours		
mandatory trainships	...	hours		
participation in examinations	2	hours		
e-learning	...	hours	...	ECTS**
student own work	83	hours	3,3	ECTS**

Syllabus valid from the academic year 2021/2022

\* where 10 hours of classes = 1 ECTC (in case of 15 h → 2 ECTS)

\*\* stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes

# academic discipline code: IS - environmental engineering, mining and energy