Course Syllabus

I. General Information

Course name	Biotechnology of sewage and waste materials
Programme	Biotechnology
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	MSc
Form of studies (full-time, part-time)	part-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator/person responsible	Dr hab. Anna Szafranek-Nakonieczna

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	15	II	6
tutorial			
classes	42	II	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit	3	II	

Course pre-requisites	Basic knowledge of chemistry, biochemistry, analytical methods in biotechnology, technology and bioprocess engineering.

II. Course Objectives

Acquainted with the issue of sewage and waste segregation in the ecological and economic aspects.
Presentation of the existing technological solutions used in the sewage and waste materials treatment using microorganisms and plants.
Acquiring by the students practical skills for the estimation of indicators and parameters serving for sludge and waste characterization and evaluation of efficiency of biological processes in wastewater treatment and waste treatment.
Introducing students to the work of the Central Laboratory of MPWiK in Lublin
To acquaint students with the methods of water analysis, sewage and sewage sludge, in the scope of microbiological and physicochemical indicators in accordance with applicable law.

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	Student is able to characterize waste water (sewage water) and wastes based on their origin, level and type of contamination and define basic biotechnological terms and processes related to waste water treatment and waste management as well as define environmental threats resulting from incorrect sewage and waste management.	K_W01
W_02	Student can distinguish and describe fermentation technology of wastes and sludge and determine the optimal conditions of their processing.	K_W01, K_W02
W_03	Student possess the knowledge on conducting the analysis using research tools and techniques in scope of biotechnology of sewage and waste processing.	K_W05
W_04	Compares different methods of biological waste water treatment and subject them into critical evaluation.	K_W03
W_05	Possess the knowledge about health and safety procedures in an accredited laboratory dealing with the analysis of water and sewage.	K_W07
SKILLS		
U_01	Student designs measurements of basic physicochemical parameters of sewage and wastes.	K_U01
U_02	Determines the efficiency of biological removal of contaminants from waste wasters (for each type of contaminant) on the basis of empirical data.	K_U01
U_03	Student is aware of the usefulness of acquired skills from the scope of biotechnological processes in power engineering, environmental protection, agriculture. She/he can indicate the usefulness of compost and post-fermentation sludge.	K_U11
U_04	Interprets processes and phenomena occurring in activated sludge, biofilters and wastes; estimates threats for environment connected with applying waste water treatment and waste processing techniques	K_U12
U_05	Prepare written reports from performed analysis and interpret obtained results, formulate conclusions.	K_U14
U_06	Possess the ability of using different sources of information referring sewage and waste issues, their verification, synthesis and judgment formulation, is able critically analyzing results of experimental works.	K_U14
U_07	Student knows the practical application of natural science, understands the need for continuous deepening of knowledge, updating skills and searching for new research methods or modifications already existing to analyze the state of the environment. It is open to modern technologies used in wastewater treatment.	K_U16
SOCIAL COMPETENCIES		

K_01	Student is aware of the necessity of controlling the state of environment and searching new technologies and solutions contributing in improving sludge quality and limiting the production of sludge and wastes.	K_K01
K_02	Student cares of his/her work place, equipment, shows the ability of work in group. Is ready to consult experts on issues related to the subject	K_K03

IV. Course Content

Lecture: Characteristics of sludge and the aims for their treatment. Types of wastes and their composition. The legal basis of waste management. Transformation of organic compounds in sludge and wastes under aerobic and anaerobic conditions. Transformations of nitrogen and phosphorus compounds in sludge. Biological methods of waste water treatment (activated sludge, biofilters, hydrophytes) from organics, nutrients, heavy metals and pesticides. Technology of waste composting. Technological systems applied in waste water treatment plants. The management of wastes and sludge.
Laboratory classes: Introduction, health and safety regulations, general requirements. Determination of selected physicochemical properties of sewage (raw and treated) and wastes. Chemical and biochemical oxygen demand as estimators of waste water treatment efficiency. Biological removal of phosphate and nitrogen compounds from sewage. Aerobic and anaerobic transformations in sludge and wastes. Determination of organic and inorganic carbon contents in sludge ad wastes. The influence of toxic substances on dehydrogenases activity of activated sludge and raw sludge. The use of bioinformatic tools in the analysis of microorganisms and their usefulness in biotechnological processes. Biological test from different wastes.
Study visit: Tasks and objectives of the MPWiK laboratory in the field of water, sewage and sewage sludge. Microbiological and physico-chemical indicators of water, sewage and sewage sludge in accordance with applicable law. The latest methods, techniques, research procedures and modern measuring devices used in the analysis of water and sewage.

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture Laboratory analysis	Written exam Report Written test	Evaluated exam Report printout / Report file Completed and evaluated test
W_02	Conventional lecture Laboratory analysis	Written exam Report Written test	Evaluated exam Report printout / Report file Completed and evaluated test
W_03	Work under the guidance	Report	Report printout / Report file
W_04	Laboratory analysis	Report Written test	Report printout / Report file Completed and evaluated test

W_05	Laboratory analysis Study visit	Observation Report	Rating card / Report from observation Report printout / Report file
SKILLS			
U_01	Laboratory classes	Observation Report	Rating card / Report from observation Report printout / Report file
U_02	Laboratory classes	Observation Report	Rating card / Report from observation Report printout / Report file
U_03	Laboratory classes	Observation Report	Rating card / Report from observation Report printout / Report file
U_04	Laboratory classes	Obserwacja Study visit	Rating card / Report from observation Report printout / Plik sprawozdania
U_05	Laboratory classes	Observation Report	Rating card / Report from observation Report printout / Report file
U_06	Laboratory classes	Observation Report	Rating card / Report from observation Report printout / Report file
U_07	Laboratory classes	Observation Report	Rating card / Report from observation Report printout / Report file
SOCIAL COMPETENCIES			
K_01	Laboratory classes Study visit	Observation Report	Rating card / Report from observation Report printout / Report file
K_02	Laboratory classes	Observation	Rating card / Report from observation

VI. Grading criteria, weighting factors.....

Lecture: Written exam - 90%, participation in the lectures - 10%
Classes: Tests (4) – 90%, written reports on the exercises and timeliness of their submission - 10%
Study visit: Presence at the classes – 50%, preparation of a written report – 50%.

Mark	**Evaluation criteria**	
very good (5)	the student realizes the assumed learning outcomes at a very good level	the student demonstrates knowledge of the education content at the level of 91-100%
overgood (4.5)	the student accomplishes the assumed learning outcomes an over good level	the student demonstrates knowledge of the education content at the level of 86-90 %
good(4)	the student accomplishes the assumed learning outcomes at a good level	the student demonstrates knowledge of the education content at the level of 71-85%
quite good(3.5)	the student accomplishes the assumed learning outcomes at a quite good level	the student demonstrates knowledge of the education content at the level of 66-70%
sufficient (3)	the student accomplishes the assumed learning outcomes at a sufficient level	the student demonstrates knowledge of the education content at the level of 51-65%
insufficient (2)	the student accomplishes the assumed learning outcomes at an insufficient level	the student demonstrates knowledge of the education content below the level of 51%

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	60
Number of hours of individual student work	90

VIII. Literature

Basic literature
Von Sperling M. Biological wastewater treatment series, Volume 1. Wastewater characteristic, treatment and disposal IWA Publishing, India, 2007 Srinivas T., Environmental biotechnology, New Age International(P) Ltd., Publishers, 2008 Sharma S.K., Sanghi R., Advances in water treatment and pollution prevention, Springer, 2012. Evans G.M., Furlong J.C., Environmental Biotechnology: Theory and Application. Second edition. Wiley, 2011. Sharma S.K., Sanghi R., Advances in water treatment and pollution prevention, Springer, 2012.
Additional literature
Seadi T. A., Rutz D., Prassl H., Köttner M., Finsterwalder T., Volk S., Janssen R., Biogas handbook, University of Southern Denmark Esbjerg, Denmark, 2008. Higson S., Analytical chemistry, Oxford University Press, 2001. Stępniewski W., Stępniewska Z., Bennicelli R.P., Gliński J., Oxygenology in outline, Institute of Agrophysics PAS, Lublin, 2005.