

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Technological research of wastewater sludges and wastes		Code 1010101261010137725
Field of study Environmental Engineering First-cycle Studies	Profile of study (general academic, practical) (brak)	Year /Semester 3 / 6
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) elective
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 15 Classes: 15 Laboratory: - Project/seminars: -		No. of credits 4
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences		ECTS distribution (number and %) 4 100%
Responsible for subject / lecturer: dr inż. Tymoteusz Jaroszyński email: tymoteusz.jaroszynski@put.poznan.pl tel. 616652436 Wydział Budownictwa i Inżynierii Środowiska ul. Piotrowo 5 60-965 Poznań		Responsible for subject / lecturer: dr Piotr Krajewski email: piotr.krajewski@put.poznan.pl tel. 616653662 Wydział Budownictwa i Inżynierii Środowiska ul. Piotrowo 5 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge about existing systems wastewater management at first-cycle studies. Basic knowledge about chemistry, fluid mechanic in the scope of first-cycle studies.
2	Skills	Ability of mathematical, physical, chemical calculations. Ability to use existing knowledge and its application in a new perspective of sludge?s and wastes utilization.
3	Social competencies	Awareness to constantly update and supplement knowledge and skills.
Assumptions and objectives of the course: The course is dealing with problems concerning waste utilization and solids management; wastewater sludge?s use and technological researches of sludge utilization processes.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Student knows basically law regulations of waste solids management - [K_W03, K_W04, K_W07] 2. Student knows processes and system of wastewater treatment and sludge?s and wastes utilization - [K_W03, K_W04, K_W07] 3. Student knows demanded scope of sludge?s and wastes researches controlling process - [K_W04, K_W07]		
Skills:		
1. Student can classify wastes according law regulations - [K_U01, K_U12, K_U18] 2. Student is able to plan the way of wastes sampling and physico-chemical analysis - [K_U01, K_U12, K_U18] 3. Student knows laboratory technics of waste sampling - [K_U12, K_U18] 4. Student is able to analyse wastes in accordance with obligatory norms - [K_U18]		
Social competencies:		
1. Student understands the need for teamwork in solving theoretical and practical problems - [K_K01, K_K03, K_K06] 2. Student understands the different roles in teamwork and the need for information and knowledge exchange in a group work - [K_K02, K_K04, K_K05] 3. Student understands the need for a systematic deepening and broadening his/her competences - [K_K03, K_K04, K_K05]		
Assessment methods of study outcomes		

-Lecture

1. Attendance and lecture activity checkup
2. Written finale exam - 10 questions to answer. Duration 50 minutes. (effects W1,W2,W3,K1).

Maximum amount of point for each question 10. Criteria of estimates depending on get amount of point number

Points - estimate

91 - 100 very good (5,0)

81 - 90 Good plus (4,5)

71 - 80 Good (4,0)

61 - 70 Sufficient plus (3,5)

50 - 60 Sufficient (3,0)

50 points below - insufficient (2,0)

Training participation (effects U1,U9,U10,U12,K1,K2,K4)

Checking progress in the implementation of the exercise topic. Written test in the last class. Final grade from the exercises - arithmetic mean of all grades obtained during the exercises and the final test (each part and the colloquium must be considered positive).

Colloquium - 5 open questions (W3, U3, U4). For each question maximum number of points 20. Assessment criteria depending on the number of points obtained:

Number of points - rating

91 -100 very good (5.0)

81 - 90 good plus (4,5)

71 - 80 good (4.0)

61 - 70 sufficient plus (3,5)

50 - 60 satisfactory (3.0)

Below 50 points - insufficient (2.0)

Course description

Principles of waste-solids and wastewater sludge?s according law regulations, classification of wastes solids, organization waste solids management, utilizing methods, unit indicators of waste solids; determination of volume and mass indicators for waste solids, morphological and fractional waste solids composition, principles of morphological studies, technological properties of waste-solids. Determination of screening composition, granular composition (uptake and storage waste ? solids samples, wetness determination, morphological analysis, determination of organic compounds, determination of nitrogen , phosphorus and potassium, incineration features (heat of combustion, caloric value). Composing of waste?solids and wastewater sludge?s process control: determination of organic carbon and total nitrogen and phosphorus, compost maturing indicators (temperature , organic and mineral substances concertation, C/N ratio, Chaetomium indicator, ATu indicator. Wastewater sludge?s examination: determination of organic and mineral substances; determination of: nitrogen, phosphorus, potassium and calcium contents; possibility of sludge?s use for agricultural purposes and ground recultivation, microbiological examination of sludge?s, determination of heavy metals contents. Agricultural use of sludge?s: low regulations, UE indirections, determination of heavy metals in soil, limit of heavy metal concentration in soil, examples of sludge doses calculation for agricultural use.

Education methods:

Lecture - lecture with the use of multimedia presentation and the elements of seminar lecture and problem-focused lecture.

Classes - based on training method completed by visual cases study and classic lecture (with multimedia presentation) .

Basic bibliography:

1. Podedworna J., Umiejewska K.: Technologia osadów ściekowych. Warszawa. Oficyna Wyd. Politechniki Warszawskiej. 2008
2. . Bień J.B.: Osady sciekowe. Teoria i praktyka. Wydawnictwo Politechniki Częstochowskiej. Częstochowa 2002
3. Rosik-Dulewska Cz.: Podstawy gospodarki odpadami, PWN 2010
4. Jędrzak A.: Biologiczne przetwarzanie odpadów, PWN 2007
5. Namieśnik J., Łukasiak J., Jarmógiewicz Z.: Pobieranie próbek środowiskowych do analizy - PWN 1995

Additional bibliography:

1. . Gajkowska-Stefanska L., Guberski S., Gutowski W., Mamak Z., Szperliński Z.: Laboratoryjne badania wody, ścieków i osadów ściekowych, część I i II, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2007
2. Skalmowski K., Wolska K., Pieniak U., Roszczyńska I.: Badania właściwości technologicznych odpadów komunalnych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2004

Result of average student's workload		
Activity	Time (working hours)	
1. Lecture participation (contact hours)	15	
2. Training participation (contact hours)	15	
3. Preparation for training exercises (work at home)	15	
4. Preparation for training exercises (work at home)	25	
5. Preparation for the exam (work at home)	28	
6. Presence at the exam (contact hours)	2	
Student's workload		
Source of workload	hours	ECTS
Total workload	100	4
Contact hours	32	1
Practical activities	68	3