Course code: ……. **Plan position:** ……

A. INFORMATION ABOUT THE COURSE

B. Basic information

Name of course	***Physico-chemical technologies in environmental engineering***
Field of studies	Chemical technology
Level of studies	Second degree
Profile of studies	General academic
Form of studies	Stationary
Specialty	1. Waste material engineering 2. Industrial Biotechnology 3. Chemical and Foodstuff Analytics 4. Modern Materials Technologies
Unit responsible for the field of studies	Faculty of Chemical Technology and Engineering
Name and academic degree of teacher(s)	Terese Rauckyte-Żak, PhD
Introductory courses	Fundamentals of inorganic and organic chemistry, chemical engineering, chemical technology
Introductory requirements	Basic concepts from general chemistry; chemistry of solutions; analytical chemistry and instrumentation

C. Semester/week schedule of classes

Semester	Lectures (W)	Auditorium classes (Ć)	Laboratory classes (L)	Project classes (P)	Seminar (S)	Field classes (T)	Number of ECTS points
summer	30^{E}	15					5

2. LEARNING OUTCOME

No.	Learning outcomes description	The reference to the learning outcomes of specific field of study	The reference to the learning outcomes for the area
KNOWLEDGE			
W1	Has the knowledge necessary to understand non-technical aspects of chemical technology activities including environmental protection.	K_W06	P7S_WG P7S_WK
SKILLS			
U1	Be able to assess sources and monitor industrial contamination, take action to prevent contamination from entering the environment, apply environmental legislation.	K_U06	P7S_UW
SOCIAL COMPETENCES			

K1	Is aware of the importance of and understands the non-technical aspects and implications of chemical engineering activities, including their impact on the environment.	K_K05	P7S_KK
K2	Understands the need for lifelong learning and is able to inspire and organise the learning process of others.	K_K01	P7S_KK P7S_KO

3. TEACHING METHODS

A. Traditional methods used

Multimedia lectures. Project classes performed by students under supervision of academic staff.

4. METHODS OF EXAMINATION

Lectures - written exam, classes- submit reports.

5. SCOPE

Lectures	Water quality assessment and control; photosynthesis and respiration; groundwater contamination; water treatment processes; activated carbon adsorption; membrane processes; disinfection; coagulation and flocculation; hardness removal; sedimentation; filtration; adsorption; types of adsorption processes; adsorbent types; characteristics of domestic wastewater; disinfection – chlorine dioxide; chloramines; ozonation; uv radiation; ion exchange processes, chemistry of chlorination; wastewater treatment systems; air emission control; fundamentals of fuel cell technologies.
Classes	Municipal waste combustion systems; environmental impact of stack emissions; engineering calculations of catalytic extraction processing; air pollution control calculations; particulate concentration calculations; calculations of carnot efficiency and fuel cell efficiency.

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES

LEARNING OUTCOME	Form of assessment					
	Oral examination	Written exam	Colloquium	Project	Presentation	Reports
W1		x				
U1						x
K1						x
K2		x				x

7. LITERATURE

Basic literature	1. C. C. Lee, S. D. Lin, Handbook of Environmental Engineering Calculations, 2nd edition, McGraw-Hill Companies, 2007. 2. M.-K. L. Davis, S. J. Masten, Principles of Environmental Engineering and Science, 2nd Edition, Irwin/McGraw-Hill, 2008. 3. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGraw-Hill Publication, New Delhi, 2003. 4. C.N. Sawyer, P.L. McCarty, G.F. Parkin, Chemistry for Environmental Engineering and Science, Tata McGraw-Hill, Fifth edition, New Delhi, 2003.
Supplementary literature	*1.* Baird, Environmental Chemistry, Freeman and company, New York, 5th Edition, 2012. *2.* G.W. Vanloon, S.J. Duffy, Environmental chemistry – a global perspective, Oxford University press, New York, 2000. *3.* R. A. Hites, Elements of Environmental Chemistry, Wiley, 2nd Edition, 2012.

	4. APHA, Standard Methods for the Examination of Water and Wastewater, 22nd Ed. Washington, 2012.

8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity		Student workload– number of hours
Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes	Participation in classes indicated in point 1B	45
	Supervision hours	15
Student's own work	Preparation for classes	25
	Reading assignments	20
	Other (preparation for exams, tests, carrying out a project etc)	20
Total student workload		125
	Number of ECTS points	**5**