STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Atmosphere Protection Engineering**		Code **1010134281010131348**
Field of study **Environmental Engineering Extramural First-**	Profile of study (general academic, practical) **(brak)**	Year /Semester **4 / 8**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **22** Classes: **-** Laboratory: **10** Project/seminars: **10**		No. of credits **5**
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** **Technical sciences**		ECTS distribution (number and %) **5 100%** **5 100%**

Responsible for subject / lecturer:

dr hab. inż. Marek Juszczak
email: marek.juszczak@put.poznan.pl
tel. 61 6653494
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The basic chemical reactions. Flows of compressible fluid and incompressible in pipes and open channels. Mass forces, the forces of friction. Intermolecular forces. Fundamentals of adsorption and absorption. Rose, vertical wind speed gradient in the atmosphere, the vertical temperature gradient. Equation of state of gas. And second law of thermodynamics.
2	**Skills**	Measurements of temperature, pressure, gas flow. Solving simple problems from fluid mechanics (gas) and thermodynamics.
3	**Social competencies**	Ability to work in a team. Awareness of the need for continuous replenishment of knowledge and skills.

Assumptions and objectives of the course:

-Transfer of basic knowledge and skills in reducing the formation and emission of air pollutants from technological processes; present the basic methods of measurement and calculation assessment of the level of pollutant concentrations in the air.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has knowledge of the modern approach to the issues of air protection - [[K_W01, K_W05, K_W08]]
2. Student and understand the mechanism of air pollution from fuel combustion - [[K_W04, K_W07]]
3. The student knows and understands the basic technology, primary and secondary, reduce dust and gas air pollutants - [[K_W06,K_W07]]
4. The student knows the design principles of the reduction of air pollution for selected technologies - [[K_W06, K_W07]]
5. The student has knowledge of the description of elevation and dispersion of air pollutants depending on the technical issue and topographic conditions and weather - [[K_W07]]
6. The student has knowledge of the reference mathematical model of dispersion of pollutants in ambient air - [[K_W07]]
7. The student has insight in the current legislation, Polish and EU emission standards and immission - [[K_W08]]

Skills:

1. The student is able to present the place and importance of technical activities in the area of air protection - [[K_U01, K_U03, K_U04, K_U10]]
2. He can calculate unos and emissions of air pollutants from the basic technological processes - [[K_U11, K_U14]]
3. He can discuss a draft of the dust removal and desulfurization for medium power sources - [[K_U12, K_U13, K_U14]]
4. He can perform a quantitative analysis of the dust - [[K_U08]]
5. Can measure the concentration of dust and gas pollutants in the pipes - [[K_U08, K_U09]]
6. He can determine the impact of topographical and meteorological elevation and spread of air pollution - [[K_U11]]

Social competencies:

1. Student realizes that the protection of atmospheric air is a complex issue, whose effective resolution requires the cooperation of experts from various fields - [[K_K02, K_K05, K_K07]]
2. Student recognizes the need for systematic deepening and extending their competencies - [[K_K01]]
3. Student learns teamwork - [[K_K03]]

Assessment methods of study outcomes

-Lecture:

written exam ? duration 70 min. ; Individual possible discussion after the results of the written work; Evaluation of written work? based on the obtained points of individual tasks; Bonus activity during lectures; taking into account assessments of the exercises in the final assessment.

-Ćwiczenia Design:

Ongoing control of the project during exercise and consultation; completion of the project on the basis of an oral defense of the work.

-Laboratory exercises:

short work of control before exercise (entrance fee); checking in progress; report of the exercises; discussion during the counting exercise.

Course description

-Model System of protection of atmospheric air.

Basic concepts (eg. Emissions, concentration, unos, efficiency flue gas cleaning), solving simple problems using these concepts and different units (eg. Ppm g / m3).

Sources of air pollution from natural and anthropogenic? short characteristics.

Conditions for the formation of air pollutants: SO2, NOx, CO, PAHs, JWA, CO2, H2O from fuel combustion in stationary sources and mobile; Calculation of the sling (emissions) for SO2, CO2, H2O as a result of fuel combustion.

Corrosion sulfur low temperature. Flue gas desulphurization technology-based alkaline (mainly calcium): dry, semi-dry and wet; operating principles, patterns, ranges of applications, calculate the balance.

Reduction of dust pollution: the base extraction techniques (systematics dust, physical properties of dust), cyclones, fabric, electrostatic; scopes and principles of operation, schematics,

Reduction of gaseous pollutants: the theoretical foundations of technology based on adsorption, absorption, combustion (including catalytic); biodegradable pollutants; range of applications.

Designing concept of pollution reduction (dust and gas) optimal for the specified process.

Emitters, technical conditions of the issue, the elevation of pollution.

The impact of meteorological and topographic elevation of pollutants and their spread.

Wind direction and speed, vertical wind speed gradient.

Class stability (equilibrium) of the atmosphere, the impact of class stability in terms of the dispersion of air pollutants.

Fundamentals of dispersion of pollutants in the atmosphere? by Gaussian models (models Sutton and Pasquill)? functional dependencies; concepts of roughness, diffusion coefficients, wet and dry deposition

Shadow aerodynamic emitters low emission low emission load (base).

The impact of meteorological conditions and topography on the dispersion of pollutants from the sources of high and low emitters.

Polish legislation regarding emission standards and immission

Topics design exercises:

projects are carried out in teams of 2 persons

The project of dry or semi-dry flue gas desulphurization technology, along with the dust collection system for a coal-fired boiler.

Topics of laboratory exercises:

laboratory exercises are carried out in teams of 4-5 people

1. Determining the density of dust with a pycnometer
2. Sieve analysis of dust
3. Analysis of sedimentation dust
4. Analysis of the microscopic dust
5. Measurement of the concentration of the exhaust gas
6. Evaluation of the effect of the structure of buildings on the dispersion of pollutants from low emitters point

Basic bibliography:

1. Bagieński Z.: System ochrony powietrza , cz.1. PFP , Poznań 2003
2. Warych Jerzy.: Oczyszczanie przemysłowych gazów odlotowych, WNT, 2000
3. Kowalewicz A.: Podstawy procesów spalania WNT, 1996
4. Zwoździak .J.; Zwoździak A., Szczurek A., Meteorologia w ochronie atmosfery, Wyd. Politechniki Wrocławskiej, 1998
5. Markiewicz M., Podstawy modelowania rozprzestrzeniania się zanieczyszczeń w powietrzu atmosferycznym, Wyd. Politechniki Warszawskiej, 2004

Additional bibliography:

1. Kośmider J., Mazur-Chrzanowska B., Odory, PWN, Warszawa 2002
2. Tomeczek J., Gradoń B., Rozpondek M., Redukcja emisji zanieczyszczeń z procesów konwersji paliw i odpadów, Wyd. Politechniki Śląskiej,2009
3. Zieliński S. : Skażenie chemiczne w środowisku ; Wyd. Politechniki Wrocławskiej; 2000
4. Alloway B.J., D.C. Ayres: Chemiczne podstawy zanieczyszczenia środowiska; PWN Warszawa 1999

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures	25
2. Participation in the exercises projects	10
3. Implementation of projects (at home)	30
4. Participation in laboratory exercises	10
5. Preparation for laboratory exercises	15
6. consultations	10
7. Preparation for credit projects and laboratories	10
8. Preparation for the exam	15

Student's workload

Source of workload	hours	ECTS
Total workload	125	5
Contact hours	70	3
Practical activities	55	2