

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Treatment of waste gases</b>		Code <b>1010101271010137726</b>
Field of study <b>Environmental Engineering First-cycle Studies</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>4 / 7</b>
Elective path/specialty <b>-</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>elective</b>
Cycle of study: <b>First-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>10</b> Classes: <b>-</b> Laboratory: <b>-</b> Project/seminars: <b>-</b>		No. of credits <b>1</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b>		ECTS distribution (number and %) <b>1 100%</b>
<b>Responsible for subject / lecturer:</b>  dr hab. inż. Marek Juszczyk email: marek.juszczyk@put.poznan.pl tel. 61 6653494 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	Basic processes and chemical reactions. Flows of compressible fluid and incompressible in pipes and open channels. Mass forces, the forces of friction. Intermolecular forces. Fundamentals of adsorption, absorption and combustion. Equation of state of gas. And second law of thermodynamics.
2	<b>Skills</b>	Measurements of temperature, pressure, gas flow. Solving simple problems from fluid mechanics (gas) and thermodynamics
3	<b>Social competencies</b>	Ability to work in a team. Awareness of the need for continuous replenishment of knowledge and skills.
<b>Assumptions and objectives of the course:</b> -Assumptions and objectives of the course: Transfer of basic knowledge and skills in reducing the formation and emission of air pollutants from technological processes and combustion .		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
1. The student has knowledge of the modern approach to protect the air - [[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 reduction of particulate and gaseous 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 insight in the current legislation, Polish and EU emission standards and immission - [[K_W08] ]		
<b>Skills:</b>		
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 - [[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] ]		
<b>Social competencies:</b>		

1. Student realizes that the protection of atmospheric air is a complex issue, whose effective resolution requires the cooperation of specialists from different disciplines - [[K\_K02, K\_K05, K\_K07]
2. Student recognizes the need for systematic deepening and broadening of its powers - [[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

**-Exercises Project:**

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

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

The conditions and mechanism of formation of air pollutants: SO<sub>2</sub>, NO<sub>x</sub>, CO, PAHs, JWA, CO<sub>2</sub>, H<sub>2</sub>O from fuel combustion in stationary sources and mobile; Primary technologies to reduce pollution. Calculation of the sling (emissions) for SO<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O as a result of fuel combustion.

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

Reduction of gaseous pollutants (secondary technologies): theoretical basis of technology based on adsorption, absorption, combustion (including catalytic); biodegradable pollutants; areas of application.

#### 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. Juda J., S. Chróściel : Ochrona powietrza atmosferycznego; WNT, 1974
5. Kuroпка J.,Oczyszczanie gazów odlotowych z zanieczyszczeń gazowych, Politechnika Wroclawska,1991
6. Rozporządzenia Ministra Środowiska oraz Dyrektywy UE

#### 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. . Nowak W., Pronobis M., Nowe technologie spalania i oczyszczania spalin, Wydawnictwo Politechniki Śląskiej, Gliwice, 2016

### Result of average student's workload

Activity	Time (working hours)	
1. Participation in lectures	10	
2. Preparation for credit and credit	10	
Student's workload		
Source of workload	hours	ECTS
Total workload	20	1
Contact hours	12	1
Practical activities	0	0