# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Air protection systems [S1TOZ1>SOP]

## Course

Field of study
Circular System Technologies

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
30

## Number of credit points

4,00

## Coordinators

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## Lecturers

## Prerequisites

1. Knowledge: 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 and absorption. Equation of state of gas. First snd 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.

## Course objective

Transfer of basic knowledge and skills in formation and emission of air pollutants from technological processes and its monitoring and reduction.

## Course-related learning outcomes

Knowledge:
1. student knows the modern approach to protect the air. he knows the mechanism of air pollutionformation in the fuel combustion and has knowledge of basic technologies, primary and secondary, reductions and gaseous pollutants [k_w05, k_w07, k_w11].

2.student knows the design principles of the reduction of air pollution for selected technologies [k_w22, k_w24].
3. student has knowledge of the description of elevation and dispersion of air pollutants depending on the technical issue and topographic conditions and meteorological [k_w03].
4. the student has knowledge about the current legislation, polish and eu emission standards and immission [k_w26].
5. the student has knowledge about atmospheric monitoring, standards and indicators of air quality and odour measurements [k_w09, k_w06].

Skills:
1. student has the ability to self-study. the student searches and analyzes relevant legal acts [k_u01, k_u04].
2. student is able to present the place and meaning of technical activities in the area of air protection [k_u02, k_u10].
3. student can calculate the float and emission of air pollutants from basic technological processes [k_u20].
4. student can develop a design of the flue gas dedusting and desulphurization system for medium power sources [k_u12, k_u14, k_u20].
5. student can measure the concentration of dust and gas pollutants [k_u03, k_u21].

Social competences:
1. the student understands the complexity of the technical-natural environment and the need of cooperation specialists from various fields in solving theoretical and practical problems [k_k02, k_k07].
2. the student is aware of the responsibility of an environmental protection specialist for the quality of life, especially in an urban agglomeration [k_k04, k_k08, k_k10].
3. the student notices and the need to systematically deepen and expand his knowledge and competences [k_k01].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: written exam; individual discussion after writtten exam annouccement; evaluation of written work based on points resulted in each individual tasks; bonus for activity during lectures; passing level 50%.In the case of e-learning, the exam will be on the eKursy platform.
Project excersises: ongoing control of the project during exercise and consultation; completion of the project on the basis of an oral or written defense.

## Programme content

Formation and emission of air pollutants from technological processes and its monitoring. System protection of atmospheric air. Odour and odor measurments. Flue gas desulphurization. Reduction of dust and gaseous pollution.

## Course topics

Lectures
1. Model system protection of atmospheric air.
2. Polish and EU legislation concerning air pollutant emission and immission standards.
3. Basic concepts (eg. emissions, concentration, sling, efficiency of flue gas cleaning), solving simple problems using these concepts and different units (eg. ppm g /m3).
4. Natural and anthropogencal sources of air pollution - short characteristics.
5. The conditions and mechanism of air pollutants formation: SO2, NOx, CO, PAHs, JWA, CO2, H2O from fuel combustion in stationary and mobile sources. Primary technologies to reduce pollution. Calculation of the sling (emissions) for SO2, CO2, H2O as a result of fuel combustion.
6. Odour and odor measurments.
7. Flue gas desulphurization technology-based alkaline (mainly calcium): dry, semi-dry and wet; operating principles, patterns, ranges of applications, calculate the balance.
8. Reduction of dust pollution: the base extraction techniques (systematics dust, physical properties of dust), cyclones, fabric, electrostatic; scopes and principles of operation, schematics.

9. Reduction of gaseous pollutants (secondary technologies): theoretical basis of technology based on adsorption, absorption, combustion (including catalytic); biodegradable pollutants; areas of application.
10. Designing the concept of optimal reduction method of dust and gas for the indicated process.
11. Emitters, technical conditions of emission, pollutant uplift. Impact of meteorological and topographic conditions on the uplift of pollutants and their spread.
12. Wind direction and speed, vertical gradient of wind speed. Atmospheric stability (equilibrium) classes, influence of stability class on air pollution and their dispersion.
13. Fundamentals of air pollutant dispersion the atmosphere - up to Gaussian models (Sutton and Pasquill models) - functional dependencies; concepts: roughness of the terrain, diffusion coefficients, dry and wet deposition, aerodynamic shadow, low emitters, low emission, emission load (bases).
Project exercises: Design of dry or semi-dry flue gas desulphurisation technology, together with a dust removal system for a coal-fired boiler. Projects are implemented in teams of two.

## Teaching methods

Lecture: Depending on the subject, either multimedia presentationor conversational lecture.
Design exercises: They involve practical projects in small groups with case studies. Conversational lecture.

## Bibliography

Basic
1. Kościelnik B. Dąbrowski T. Podstawy ochrony atmosfery. Wydawnictwo Uczelniane Politechniki Koszalińskiej, 2016.
2. Warych J. Oczyszczanie przemysłowych gazów odlotowych. WNT, 2000.
3. Zwoździak J., Zwoździak A., Szczurek A. Meteorologia w ochronie atmosfery. Wydawnictwo. Politechniki Wrocławskiej, 1998
4. Wielgosiński G., Zarzycki R. Technologie i procesy ochrony powietrza, PWN, 2018.
5. Rup K. Procesy przenoszenia zanieczyszczeń w środowisku naturalnym, PWN, 2017.
6. Juszczak M. Źródło ciepła małej mocy zasilane biomasą. Efektywność energetyczno-ekologiczna dla wybranych paliw. Wydawnictwo Politechniki Poznańskiej, seria Rozprawy nr 533, 2016
7. Odpowiednie Rozporządzenia Ministra Środowiska oraz Dyrektywy UE
Additional
1. J. Kośmider J., Mazur-Chrzanowska B., Odory.PWN, 2002.
2. Bagieński Z. System ochrony powietrza, cz.1. PFP, 2003.
3. Markiewicz M., Podstawy modelowania rozprzestrzeniania się zanieczyszczeń w powietrzu atmosferycznym. Wyd. Politechniki Warszawskiej, 2004
4. Tomeczek J., Gradoń B., Rozpondek M., Redukcja emisji zanieczyszczeń z procesów konwersji paliw i odpadów, Wyd. Politechniki Śląskiej, 2009
5. Bagieński Z.: Emisja ze źródeł stacjonarnego spalania jako wyznacznik energetycznego wskaźnika jakości powietrza, [w] Współczesne osiągnięcia w ochronie powietrza atmosferycznego, praca zbiorowa red. A. Musialik-Piotrowska, J. Rutkowski; Politechnika Wrocławska 2010, 21-30.
6. Juszczak M., K. Pałaszyńska, K. Rolirad. M. Janicki, E. Szczechowiak. Próba zastosowania w peletach z agrobiomasy dodatków podwyższających temperaturę topnienia popiołu w celu uniknięcia tworzenia się żużla w palenisku.2017. Ciepłownictwo, Ogrzewnictwo, Wentylacja, T. 48, nr 8, 320-326
7. Alloway B.J., D.C. Ayres: Chemiczne podstawy zanieczyszczenia środowiska; PWN Warszawa 1999

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 100 | 4,00 |
| Classes requiring direct contact with the teacher | 63 | 2,50 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 37 | 1,50 |