COURSE DESCRIPTION CARD - SYLLABUS

Course name
Air Protection Systems

Course

Field of study
Environmental Protection Technologies

Area of study (specialization)
-

Level of study
First-cycle studies

Form of study
full-time

Year/Semester
III/6

Profile of study
general academic

Course offered in
Polish

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	0
Tutorials	**Projects/seminars**	
0	15	

Number of credit points
3

Lecturers

Responsible for the course/lecturer:

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Faculty of Environmental Engineering and Energy

ul. Piotrowo 5 60-965 Poznań

Responsible for the course/lecturer:

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. 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.

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. The student has knowledge of the modern approach to protect the air. -[K_W01, K_W05, K_W08]

2. Student understands 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 knowledge of the description of elevation and dispersion of air pollutants depending on the technical issue and topographic conditions and meteorological. - [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]

8. The student knows and understands the processes that affect air quality in the urban agglomeration - [K_W01, K_W05]

9. The student has knowledge of atmospheric monitoring, standards and indicators of air quality and odorymetrii - [K_W05, K_W06]

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. HE 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 from both the high and low pollution sources. - [K_U11]

Social competences

1. The student understands the complexity of the natural and technical environment and the necesity of cooperation in various fields in solving theoretical and practical problems - [K_K02, K_K07]

2. 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]

3. The student is aware of the responsibility of environmental protection specialist for the quality of life especially in the urban agglomeration - [K_K02, K_K04]

4. Student recognizes the need for systematic deepening and broadening of its powers. - [K_K01]

5. Student learns teamwork - [K_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: written exam [K_W01, K_W05, K_W08, K_W04, K_W07, K_W06,] ; 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 from 50%

Project excersises: Ongoing control of the project during exercise and consultation; completion of the project on the basis of an oral defense of the work.on the basis of an oral defense of the work. Verification of effects [K_U01, K_U03, K_U04, K_U10, K_U11, K_U12, K_U13, K_U14]

Laboratory exercises: entrance tests before each class; control of progress during classes; exercise report; continuous assessment during each class (rewarded activity). Verification of effects [K_U08, K_U09, K_U11]. The condition of passing is the correct performance of all exercises provided for in the program.

Programme content

Model system of protection of atmospheric air.

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

Natural and anthropogencal sources of air pollution - short characteristics.

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.

Low temperature sulfur corrosion . 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 (secondary technologies): theoretical basis of technology based on adsorption, absorption, combustion (including catalytic); biodegradable pollutants; areas of application.

Designing the concept of optimal reduction method of dust and gas for the indicated process.

Emitters, technical conditions of emission, pollutant uplift.

Impact of meteorological and topographic conditions on the uplift of pollutants and their spread.

Wind direction and speed, vertical gradient of wind speed.

Atmospheric stability (equilibrium) classes, influence of stability class on air pollution and their dispersion.

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).

Polish and EU legislation in the field of emission and immission standards.

Subject of design 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

Topics of laboratory exercises:

1. Measurement of O2, CO and CO2 concentration in indoor and outdoor air.

2.Dust sieve analysis

3. Microscopic analysis of dust.

4. Testing the efficiency of gravity and centrifugal dust collectors.

5. Determination of absolute dust density.

6. Determination of the particulate mass by weight of dust using a sedimentation pipette.

7. Measurement of pollution concentrations from a biomass boiler.

8. Visualization of the spread of pollution in the wind tunnel

Teaching methods

Lecture: Depending on the subject, the lecture is given as an informative multimedia presentation, as a problem-based or conversational lecture. Achieved effects: K_W01, K_W05, K_W08, K_W04, K_W07, K_W06, K_K02, K_K05, K_K07,

Design exercises: They involve practical projects in small groups with case studies. Conversational lecture. Achieved effects: K_U01, K_U03, K_U04,, K_U10, K_U11, K_U12, K_U13, K_U14, K_K02, K_K05, K_K07, K_K01,

3. Laboratory exercises: The method of experiment - students independently, based on the materials available, conduct research and observe the course of the analyzed phenomenon, The effect achieved: K_U08, K_U09, K_U11, K_K02, K_K05, K_K07, K_K01,

Bibliography

Basic

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2. Warych J. Oczyszczanie przemysłowych gazów odlotowych. WNT, 2000.

3. Zwoździak J., Zwożdziak 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

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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.

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7. Alloway B.J., D.C. Ayres: Chemiczne podstawy zanieczyszczenia środowiska; PWN Warszawa 1999

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	3,0
Classes requiring direct contact with the teacher	80	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	40	1,0

[1] delete or add other activities as appropriate