

Course title: Protection of atmosphere Ochrona powietrza		
Field of study: Environmental Engineering		
Type of study: Wybierz element.	The level of education: 1-BSc	Code: 0712
Type of subject: Wybierz element.	Semester: Wybierz element.	Course language: English
Course type: lecture, tutorials	Number of hours: 30L, 30T	ECTSCredit points: 6

SYLLABUS

COURSE OBJECTIVES

- C.1. Transfer of knowledge on fundamentals of air protection and air pollutants transport in the atmosphere
- C.2. Transfer of knowledge on air quality measurement and assessment
- C.3. Transfer of knowledge on technologies of air pollution control (dedusting, desulphurization, measures of NOx emission control)

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

- 1. Knowledge on basic concepts relating to environment protection and processes generating air pollutants
- 2. Skill in the field of calculation of air pollutant concentrations
- 3. Ability to independently use of technical literature

SUBJECT EDUCATIONAL EFFECTS

- EU 1 - has knowledge on factors and phenomena affecting ambient air quality
- EU 2 - has knowledge on environmental problems of global concern (ozone layer depletion, acid rains, climate change)
- EU 3 - has knowledge on technologies of air pollution control (dedusting, desulphurization, measures of NOx emission control)

COURSE CONTENT

Form of classes - lectures	Hours
Factors affecting concentration levels of air pollutants in the atmosphere	6
Environmental problems of local and regional concern (smog episodes, acid rains, emissions from combustion sources of low capacity)	4
Air pollutants – types and properties	4
Environmental problems of global concern – climate change – causes and mechanism of the phenomenon	4

Technologies of emission control of solid air pollutants	2
Flue gas treatment from gaseous pollutants - desulfurization technologies	2
Technologies of NO _x emission control	2
Emissions of mercury and other heavy metals	4
Main problems of air quality in Poland – reasons and possible counteractions	2
Final test	2
Form of classes - tutorials	Hours
Introduction, basic physical quantities and units used in calculations relating to air protection	2
Comparison and analysis of exhaust gas desulphurization methods	8
Combustion of fuels (solid, gas, liquid)	12
Emission factors for fuel combustion processes and methods of air pollutants emission calculation, emission benchmark	6
Final test	2

COURSE STUDY METHODS

1. blackboard, multimedia presentations
2. demonstration of equipment, technical diagrams and methodological materials relating to the measurement methods and technologies that have been discussed

METHODS OF ASSESMENT (F - formative; S - summative)

F1. -activity in classes
F2. -assessment self-preparation for classes
F3. -assessment of response to questions and problems posed to students during lectures and tutorial meetings
S1. -test checking assimilation of subjects discussed during lectures

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	30 h
Laboratory	- h
Participation in project classes	- h
Participation in seminar	- h
Preparation course on e-learning	- h
Test	2 h
Entrance test for laboratory classes	- h
Project's defence	- h
Exam	- h
Consultation hours	5 h
DIRECT TEACHING, hours/ ECTS	67 h / 3 ECTS

Preparation for tutorials	30 h
Preparation for laboratories	- h
Preparation for projects	- h
Preparation for seminars	- h
Preparation for e-learning classes	- h
Participation in e-learning classes	- h
Working on project	- h
Preparation for tests	30 h
Preparation for exam	- h
SELF-STUDY, hours/ ECTS	60 h / 3ECTS
TOTAL (hours)	Σ127
TOTAL ECTS	6 ECTS

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Zarzycki R., Imbierowicz M., Stelmachowski M., Wprowadzenie do inżynierii środowiska, Warszawa, WNT, 2007
Koniecznyński J. Ochrona powietrza przed szkodliwymi gazami, WPS, Gliwice, 2004
Warych J., Oczyszczanie gazów, Warszawa, WNT, 1998
Kordylewski W. Spalanie i paliwa, OWPWr, Wrocław, 2004
Sasinowski H., Energetyka a środowisko, Wyd. Polit. Białostockiej, 1996
Saha K., The Earth's Atmosphere, Springer 2008
Protecting the earth's atmosphere: An international challenge : interim report of the Study Commission of the 11th German Bundestag "Preventive Measures to Protect the Earth's Atmosphere." Deutscher Bundestag Referat Öffentlichkeitsarbeit (1989)
Stephen O Anderson S.O., Sarma M.K., Protecting the Ozone Layer The United Nations History, Earthscan, 2005
Borngraber E. The Layers of Earth's Atmosphere (Spotlight on Weather and Natural Disasters), PowerKids Press, 2018
Vallero D.A., Fundamentals of Air Pollution, Academic Press, 2014
Cooper D.C., Air Pollution Control: A Design Approach, Waveland Pr Inc; 4 edition, 2010
Seigneur C., Air Pollution: Concepts, Theory, and Applications, Cambridge University Press, 2019
de Nevers N., Air Pollution Control Engineering, Third Edition 3rd Edition, Waveland Press, Inc.; 2016
Schnelle Jr. K.B, Dunn R.F., Ternes M.E., Air Pollution Control Technology Handbook 2nd Edition, Routledge, 2017
Schiffner K.C., Air Pollution Control Equipment Selection Guide 2nd Edition, CRC Press, 2013

SUBJECT COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assessment
EU 1	K_W01, K_W10, K_U05, K_K01	C.1	lecture	1,2	F1,P1,P2
EU 2	K_W01, K_W10, K_U05, K_K01	C.2	lecture	1,2	F2,P2,
EU 3	K_W01, K_W10, K_U05,K_U06 K_K01	C.3	tutorials	1,2	F2,P2,

OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: <https://is.pcz.pl/>.
2. The information about the consultation hours is provided to students on the first class meeting and posted online at <https://is.pcz.pl/>.
3. The information on course completion and grade is provided to students on the first class meeting.