

**AGH**AGH UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

Code: int.courses-182    Module name: Air pollution

Academic year: 2019/2020    Semester: Fall    ECTS credits: 4

Programme: AGH UST International Courses

Course homepage: <https://intcourses.agh.edu.pl>    Lecture language: English

Responsible teacher: dr inż. Samek Lucyna (Lucyna.Samek@fis.agh.edu.pl)

### Module summary

Student should characterize air pollutants. Student should have knowledge on EU regulations. Student knows how samples of PM are collected and how chemical content of PM are determined.

### Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Method of learning outcomes verification (form of completion)
Social competence		
M_K001	Student is able to perform experimental work in the form of team work and is able to discuss in scientific English	Report, Involvement in teamwork, Execution of exercises, Activity during classes
Skills		
M_U001	Student should be capable of performing simple laboratory experiments	Execution of laboratory classes, Completion of laboratory classes
M_U002	Student should be capable of using simple software for elemental analysis of particulate matter	Execution of laboratory classes, Completion of laboratory classes
Knowledge		
M_W001	Student should characterize gaseous and particulate matter pollution together with identification of sources	Examination, Activity during classes
M_W002	Student should have knowledge on regulations of air pollution	Examination, Activity during classes
M_W003	Student should have knowledge on the impact of air pollution on human health and cultural heritage objects	Examination, Activity during classes

## Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	15	0	15	0	0	0	0	0	0	0	0

## FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Student is able to perform experimental work in the form of team work and is able to discuss in scientific English	-	-	+	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Student should be capable of performing simple laboratory experiments	+	-	+	-	-	-	-	-	-	-	-
M_U002	Student should be capable of using simple software for elemental analysis of particulate matter	+	-	+	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student should characterize gaseous and particulate matter pollution together with identification of sources	+	-	-	-	-	-	-	-	-	-	-
M_W002	Student should have knowledge on regulations of air pollution	+	-	-	-	-	-	-	-	-	-	-
M_W003	Student should have knowledge on the impact of air pollution on human health and cultural heritage objects	+	-	-	-	-	-	-	-	-	-	-

## Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	28 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	30 h
Realization of independently performed tasks	30 h
Examination or Final test	2 h
Summary student workload	120 h
Module ECTS credits	4 ECTS

## Additional information

### Module content

#### Lectures

##### Lecture 1

Introduction. Definitions, natural, anthropogenic, primary, secondary pollution. Why it is important? Events: volcano in Indonesia influences on air in Europe.

##### Lecture 2

Gaseous pollution: SO<sub>2</sub>, NO<sub>x</sub>, CO, CO<sub>2</sub>, <acronym title="ozone">O<sub>3</sub></acronym>. EU directives, WHO regulations, <acronym title="USA">EPA</acronym> regulations, Polish regulations. Concentration changes during years.

##### Lecture 3

Particulate matter pollution (PM).

Smog-definition, Smog in London (history). First regulations. Total suspended particulate matter (TSP), PM<sub>10</sub>, PM<sub>2.5</sub>, PM<sub>1</sub>.

EU directives, WHO regulations, <acronym title="USA">EPA</acronym> regulations, Polish regulations. Concentration changes during years.

##### Lecture 4

Particulate matter pollution (PM).

Sampling: methods, devices, EU directives, Polish regulations

Concentrations: EU directives, Polish regulations,

Chemical analyses - reference methods (EU,USA): elements, ions, organic compounds, black carbon, black smoke, organic carbon, C-14,

##### Lecture 5

Health impact of PM. Influence of size of particles, short term expose, long term expose. Diseases. Children, Elders. Program AirQ, what can be calculated. Data from whole world, Krakow.

##### Lecture 6

Receptor models for source identification and apportionment

Species (indicators) - what kind of sources?

Data preparation. Statistical analyses: principal component analysis (PCA), multilinear regression analysis (MLRA), positive matrix factorization (PMF), chemical mass balance (CMB).

How they work-explanation, results-examples.

##### Lecture 7

Air pollution and cultural heritage research. What is done? Why is done? Examples from Krakow research (Wawel, churches).

### **Laboratory classes**

Laboratory classes

Exercise 1. Collection and gravimetric analysis of particulate matter. (Report no 1). (Lab.-FPACS)

Exercise 2. Qualitative elemental analysis of particulate matter by energy dispersive X-ray spectrometry (Report no 2). (Lab.-FPACS)

Exercise 3. Quantitative elemental analysis of particulate matter by energy dispersive X-ray spectrometry (Report no 3). (Lab.-FPACS)

### **Teaching methods and techniques:**

Lectures: The content of the lecture is presented in the form of a multimedia presentation in combination with a classic blackboard lecture enriched with shows related to the presented issues.

Laboratory classes: During the laboratory, students independently solve a given practical problem by choosing the right tools. The leader stimulates the group to reflect on the problem, so that the results obtained have a high substantive value.

### **Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:**

The reports from the laboratories.

### **Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:**

Lectures:

- Attendance is mandatory: No

- Participation rules in classes: Students participate in classes learning about the next teaching content according to the subject syllabus. Students are to blame for keep asking questions and clarifying doubts. Registration audiovisual lecture requires the teacher's consent.

Laboratory classes:

- Attendance is mandatory: Yes

- Participation rules in classes: Students perform laboratory exercises in accordance with materials shared by the teacher. The student is obliged to prepare for the subject of the exercise, which can written or oral colloquium will be verified. Examination classes are based on the presentation of the solution given problem. Completing the module is possible after passing all classes laboratory.

### **Method of calculating the final grade**

EG- Exam Grade

LG- Laboratory Grade

Final Grade=  $0.6EG+0.4LG$

### **Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:**

One absence on laboratories will be arrange individually.

### **Prerequisites and additional requirements**

No prerequisites for foreign students.

**Recommended literature and teaching resources**

Recommended literature and teaching resources not specified

**Scientific publications of module course instructors related to the topic of the module**

Additional scientific publications not specified

**Additional information**

None