



Module name: Modern environmental analytics

Academic year: 2019/2020 Code: STCH-2-116-ET-s ECTS credits: 3

Faculty of: Energy and Fuels

Field of study: Chemical Technology Specialty: Energy Transition-KIC

Study level: Second-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 1

Course homepage: —

Responsible teacher: dr inż. Samojeden Bogdan (bogdan.samojeden@agh.edu.pl)

## Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	Student can demonstrate her/his ability to take responsibility and collaborate with others when working in a team		Activity during classes
Skills: he can			
M_U001	Student is able to acquire and creatively process information from the scientific literature databases, and other properly chosen sources concerning about analytical methods in the field of environmental analytics, using English language	TCH2A_U02, TCH2A_U01	Activity during classes, Execution of laboratory classes, Report
M_U002	Student is able to interpret the obtained results, as well as formulate conclusions	TCH2A_U08	Activity during classes, Report
Knowledge: he knows and understands			
M_W001	Student is able to explain environmental analytics to perform various measurements using advanced techniques typical for instrumental analysis	TCH2A_W01	Activity during classes, Execution of laboratory classes, Report, Test
M_W002	Student is able to compare the use of specialized devices and software typical for modern environmental analytics	TCH2A_W06	Activity during classes, Execution of laboratory classes, Report, Test

**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
45	15	0	30	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 can demonstrate her/his ability to take responsibility and collaborate with others when working in a team	-	-	+	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Student is able to acquire and creatively process information from the scientific literature databases, and other properly chosen sources concerning about analytical methods in the field of environmental analytics, using English language	+	-	+	-	-	-	-	-	-	-	-
M_U002	Student is able to interpret the obtained results, as well as formulate conclusions	-	-	+	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student is able to explain environmental analytics to perform various measurements using advanced techniques typical for instrumental analysis	+	-	+	-	-	-	-	-	-	-	-
M_W002	Student is able to compare the use of specialized devices and software typical for modern environmental analytics	+	-	+	-	-	-	-	-	-	-	-

## Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	45 h
Preparation for classes	30 h
Realization of independently performed tasks	15 h
Summary student workload	90 h
Module ECTS credits	3 ECTS

## Additional information

### Module content

#### Lectures

- Environmental samples preparation (water, wastewater, sludge)
- Fundamentals of UV/VIS spectroscopy and IR spectroscopy
- Beer-Lambert's law
- Separation techniques
- Liquid chromatography (TLC, HPLC)
- Gas chromatography
- Ion-exchange chromatography (HPIC)
- Detectors in chromatographic analysis
- Examples of application of chromatographic methods in environmental science
- Data analysis (the calibration curves, spectral analysis, quality and quantity analysis)

#### Laboratory classes

1. Environmental samples preparation (solid phase extraction and Soxhlet extraction).
2. Spectrometric methods in water and wastewater quality control.
3. Measurement of total, organic and inorganic carbon in environmental samples.
4. Separation, detection and determination of selected organic compounds (non steroidal anti-inflammatory drugs, antibiotics and preservatives) in aquatic samples by means of high performance liquid chromatography (HPLC).
5. Analysis of oil samples using Fourier transform infrared spectrometer (FTIR).

### Teaching methods and techniques:

Lectures: Treści prezentowane na wykładzie są przekazywane w formie prezentacji multimedialnej w połączeniu z klasycznym wykładem tablicowym wzbogaconymi o pokazy odnoszące się do prezentowanych zagadnień.

Laboratory classes: W trakcie zajęć laboratoryjnych studenci samodzielnie rozwiązują zadany problem praktyczny, dobierając odpowiednie narzędzia. Prowadzący stymuluje grupę do refleksji nad problemem, tak by otrzymane wyniki miały wysoką wartość merytoryczną.

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

Nie określono

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

Lectures:

- Attendance is mandatory: No
- Participation rules in classes: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z sylabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego.

Laboratory classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Studenci wykonują ćwiczenia laboratoryjne zgodnie z materiałami udostępnionymi przez prowadzącego. Student jest zobowiązany do przygotowania się w przedmiocie wykonywanego ćwiczenia, co może zostać zweryfikowane kolokwium w formie ustnej lub pisemnej. Zaliczenie zajęć odbywa się na podstawie zaprezentowania rozwiązania postawionego problemu. Zaliczenie modułu jest możliwe po zaliczeniu wszystkich zajęć laboratoryjnych.

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

Grading formula:  $FG = w \cdot PMWF_{collo} \cdot PMG_{collo} + PMW_{flab} \cdot PMG_{lab} + PMW_{FAC}$

Where:

- FG-final grade
- PMWFcollo - written colloquium part weighting factor - 0,5
- PMWflab - laboratory exercises part weighting factor - 0,5
- PMGcollo - Grade of achieved LOs relevant to written colloquium
- PMGlab - Grade of achieved LOs relevant to laboratory exercises
- PMWFAC- activity student during lectures and laboratories part weighting factor - 0-0,5

$W = 1$  for first evaluation deadline,  $w = 0.9$  for 1st retake,  $w = 0.8$  for 2nd retake.

All LO weighting factors associated with part of the module (PM) equal 1.

The grade from a written colloquium and evaluation of laboratory exercises is calculated as follows: percent of points obtained is recalculated to grade according to rules of studies at AGH

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

Nie określono

## **Prerequisites and additional requirements**

Student is expected to have the basic knowledge of chemistry and fundamentals of analytical chemistry.

## **Recommended literature and teaching resources**

1. S. Ahuja, N. Jespersen: Modern Instrumental Analysis, Elsevier, 2006
2. P. Konieczka, J. Namieśnik: Quality Assurance and Quality Control in the Analytical Chemical Laboratory: A Practical Approach, CRC Press, 2009

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

Additional scientific publications not specified

## **Additional information**

The overall assessment consist of two steps:

1. Assessment of fulfilling of module learning outcomes and OLOs.
2. Assessment and grading of the quality of students work.

EIT OLOs assessed in the industrial internship:

- Making value judgments and sustainability competencies (EIT OLO 1)
- Creativity skills and competencies (EIT OLO 3)
- Research skills and competencies (EIT OLO 5)
- Intellectual transforming skills and competencies (EIT OLO 6)
- Leadership skills and competencies (EIT OLO 7)

The Method of assessments indicated in point escription of learning outcomes for modulen icludes assessment of learning outcomes and OLOs