# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Methods of technological processes control [S2TOZ1>MKPT]

## Course

Field of study
Circular System Technologies

Year/Semester
1/2

Area of study (specialization)
Material recycling and chemical recovery

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

## Number of credit points

2,00

## Coordinators

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## Lecturers

## Prerequisites

Knowledge of general chemistry, physical chemistry, organic chemistry, basic analytical chemistry, bas ic chemical equipment, spectroscopic methods, mathematics

## Course objective

Presentation of basic principles of selecting control and measurement equipment in industry, familiarization of students with types of industrial analyzers and methods of their installation, familiarization of students with extended knowledge of chromatographic processes as a technique used in the vast majority of technological processes, use of chromatographic and spectroscopic techniques in qualitative and quantitative process analysis. Students will be familiarized in practice with equipment used in chromatographic methods. Presentation of possibilities of using gas and liquid process chromatography. Application of laser techniques in technological

## Course-related learning outcomes

Knowledge:
K_W07 P7S_WG Has in-depth knowledge allowing to design technological processes based on the principles of the circular economy.

K_W08 P7S_WK Has in-depth knowledge of the social, ethical, economic and legal-administrative aspects of the functioning of an enterprise in the circular economy.
K_W09 P7S_WK Uses basic legal, economic and ethical acts of actions taken for the protection of the environment and the circular economy.
K_W10 P7S_WG Has systematic knowledge of the collection, storage of samples and the proper selection of analytical techniques for their determination.
K_W15 P7S_WG Has systematic and in-depth knowledge of the control of technological processes, understands the justification for their control and the resulting benefits for technologies related to the circular economy and the natural environment.

Skills:
K_U08 P7S_UW Has the ability to selectively adapt knowledge of chemistry and related fields in planning and implementing research and technological tasks in the area of technologies based on the circular economy and analyze their impact on the natural environment.
K_U09 P7S_UO Is able to cooperate with others and take a leading role in a team to solve engineering problems related to methods and devices used in technologies, including those related to the circular economy.

Social competences:
K_K01 P7S_KR Is aware of personal responsibility resulting from the professional role performed and the emergence of moral and ethical problems in the context of professional activities.
K_K02 P7S_KO Understands the need to popularize knowledge in the field of sustainable production and technological solutions in the circular economy.
K_K03 P7S_KK Critically evaluates his/her knowledge, understands the need to educate himself/herself and improve his/her professional, personal and social competences.
K_K04 P7S_KO Is able to think and act in an entrepreneurial manner, while being aware of his/her social role and public interest.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

lecture: written pass - stationary, via website ekursy.put.poznan.pl in case of on-line pass (50 % test, 50 % open quastions)
laboratories: oral and written test before each class, exercise reports

## Programme content

Basic principles of selecting control and measurement equipment in industry, review of types of industrial analyzers and methods of their installation, extended knowledge of chromatographic processes used in industry

## Course topics

1. Process analysis - general types and principles of using process analyzers.
2. Tasks of process analysis.
3. Economic aspects of process analysis.
4. Sample collection and preparation system for process analysis.
5. Gas chromatography - basic knowledge (apparatus, principles of separation and chromatographic analysis, retention parameters); selection of conditions for conducting the chromatographic process.
6. Liquid chromatography - types of liquid chromatography; separation basics; column in liquid chromatography; HPLC and TLC equipment.
7. Qualitative and quantitative analysis in chromatographic methods.
8. Application of delayed standard in chromatographic process analysis.
9. Application of analyzers based on UV, FT-MIR/NIR, NMR spectroscopy.
10. Application of laser techniques to control the technological process.

## Teaching methods

lecture, discussion, practical exercises

## Bibliography

Basic:
1. Chromatografia procesowa, K. Kadlec, A. Voelkel, Wyd. PP, Poznań, 2011. - in Polish
2. Podstawy chromatografii i technik elektromigracyjnych, Z. Witkiewicz, WNT, Warszawa, 2017. - in Polish
3. Zastosowanie metod chromatograficznych, K. Bielicka-Daszkiewicz, K. Milczewska, A. Voelkel, Wyd. PP, Poznań, 2005. - in Polish
4. Materiały e-learningowe wiodących firm w analizie procesowej, m. in. ABB, Siemens, Metrohm, knkluzje BAT: https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=OJ:L_202302749

Additional:
1. Chromatografia gazowa, Z. Witkiewicz, W. Wardencki, WNT, Warszawa, 2018 - in Polish.
2. The essence of chromatography, C.F. Poole, Elsevier, Amsterdam, 2003.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 50 | 2,00 |
| Classes requiring direct contact with the teacher | 30 | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 20 | 1,00 |