UNIVERSITATEA BABEŞ-BOLYAI
BABEŞ-BOLYAI TUDOMÁNYEGYETEM
BABEŞ-BOLYAI UNIVERSITÄT
BABEŞ-BOLYAI UNIVERSITY
TRADITIO ET EXCELLENTIA

Tradiție și Excelență prin
Cultură - Știință - Inovație din 1581

Facultatea de Chimie și Ingin
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SYLLABUS

Acquisition and treatment of experimental data

University year 2025 – 2026

1. Information regarding the program

1.1 Higher education institution	Babeş–Bolyai University of Cluj–Napoca
1.2 Faculty	Chemistry and Chemical Engineering
1.3 Department	Chemical Engineering
1.4 Field of study	Chemical Engineering
1.5 Study cycle	Master
1.6 Study program / Qualification	Advanced Chemical Process Engineering / Master
1.7. Form of education	Full-time education

2. Information regarding the discipline

2.1 Name of the discipline	**Acquisition and processing of experimental data**				Discipline code	**CME7313**	
2.2 Course coordinator	Assoc. Prof. dr. Sorin-Aurel Dorneanu						
2.3 Seminar coordinator	Assoc. Prof. dr. Sorin-Aurel Dorneanu						
2.4. Year of study	**I**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	DS / Compulsory

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					21
Additional documentation (in libraries, on electronic platforms, field documentation)					21
Preparation for seminars/labs, homework, papers, portfolios and essays					21
Tutorship					3
Evaluations					3
Other activities:					-

3.7 Total individual study hours	69
3.8 Total hours per semester	125
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	• Not the case
4.2. competencies	• Not the case

5. Conditions (if necessary)

5.1. for the course	• Students should switch off the mobile phones during courses. • The support for courses, in electronic format, as well as other bibliographic materials, can be downloaded online, from the MS-Teams platform, at least one day before the course. • In order to be able to participate actively in the teaching process, the students are obliged to study the course support available on the internet before the course. • If possible, the student will come with personal mobile computers having installed the corresponding software applications. • The students must attend a minimum of 8 courses out of 14 (i.e. 50%+1), otherwise they will not be admitted to the exam.

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5.2. for the seminar /lab activities	• Students should switch off the mobile phones during seminars.
	• The laboratory works/seminars have a duration of 4 hours, being scheduled to take place, for each group, once every two weeks, according to the schedule.
	• If possible, the student will come with personal mobile computers having installed the corresponding software applications.
	• Most of the laboratory works/seminars have a frontal character, as such the presence of students at the laboratory/seminar is mandatory, and the laboratory works/seminars from which the students were absent can be recovered, only in a separate meeting, with a fee, scheduled and held at the end of the semester, outside of the normal laboratory/seminar hours!
	• Before each seminar/laboratory, the student will download from internet (the MS-Teams platform) and should read the corresponding seminar/laboratory supports.
	• Excepting for the first laboratory/seminar session, the validation of the following laboratory/seminar sessions is conditioned by:
	  • Studying and deepening the 2 courses prior to the laboratory work/seminar;
	  • Download from the Internet, unzip, study and deepen the Lab/seminar support related to the current session. Attention: It is NOT necessary to print the supports!!! They will be available online and can be downloaded to personal computers.
	  • The deepening of the 2 courses prior to the seminar/laboratory work and the laboratory/seminar support related to the current session will be evaluated before each laboratory, through a quick written test (5 minutes), grid type, which verifies the acquisition of the notions of basis of the course, respectively the title and purpose of the current laboratory work/seminar, the way of working and, where applicable, of data processing.
	  • The failure to pass the previously mentioned fast tests causes the respective laboratory/seminar to be invalidated. Even so, the students who do not pass these tests (minimum grade 5) can attend or even participate in the laboratory/seminar, but will be considered absent.
	• The students must participate at a minimum number of 6 laboratories out of 7, otherwise they will not be admitted to the exam.
	• The access in the lab with food and drinks is forbidden.

5.3. for the consultations	• The consultations will take place physically, at the date, time and place communicated to the students by the teaching staff and displayed on the FCIC website. • If, within 20 minutes from the start of the consultations, no student shows up and no student announces their intention to participate to the consultations (by email, phone, SMS, etc.), the consultation session is considered completed, the teaching staff can carry out other activities and the students cannot invoke the fact that they were not received for consultations. • Alternatively, the students can request online consultations, through the MS-Teams platform, at the date and time agreed between the teaching staff and the students.

6. Specific competencies acquired

Professional competencies	• Defining the language and identification of advanced concepts for mathematical modelling and programming for the process engineering applications • Understanding and explaining the operation of the chemical process engineering equipment and installations using complex dynamic mathematical models and statistical data processing • Developing dynamic mathematical models with lumped and distributed parameters and their implementation in simulators used for the process performance assessment in order to identify operation and control solutions for economic benefits, improved energetic efficiency and safety while reducing the negative impact on the environment • Utilisation of the mathematical models for technological design and their implementation in automatic control systems in order to obtain the optimal solutions for economic benefits, improved energetic efficiency and safety while reducing the negative impact on the environment • Utilisation of the advanced analysis and synthesis concepts of process, equipments and units for the process engineering. • Creative utilisation of the professional knowledge, of the analysis and synthesis methods and concepts in the new chemical process development. • Integrate utilisation of the chemical process analysis and synthesis for the development of the process and innovative products development. • Creative utilisation of the analysis and synthesis for the elaboration of innovative products and technologies. • Utilisation of the professional knowledge in order to establish the research strategy and the programme for experiments and simulations, explanation and treatment of data.
Transversal competencies	• Execution of the professional duties in accordance with the fixed needs and dead-lines, respecting the professional ethics and moral, following a pre-fixed work plan. • Solving the required duties in accordance with the fixed general objectives by the integration in the work group. • Planning, monitoring and assuming professional duties of underline group. Proving the coordination capabilities, analytical thinking, adaptability and flexibility, collaboration with team members. • Auto-evaluation of professional performances and establish the needs of continuous learning, documentation in the work fields in correlation with the labor market

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To get familiar with the facilities and the advantages offered by the automatic acquisition and treatment of experimental and process data
7.2 Specific objective of the discipline	• Acquisition of knowledge concerning the main modalities of interconnection between the experimental/industrial equipment and computers. • Acquisition of knowledge concerning the equipment dedicated to data acquisition and chemical experiments/processes control. • Initiation in the using of dedicated software applications for the acquisition and treatment of experimental and process data. • Acquisition of the basic theoretical knowledge for the analysis and synthesis of the industrial processes.

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. **Modern sensors used in the experiments and chemical processes monitoring. Recapitulation: numbers and logical gates.** Analog and digital signals and transducers. TEDS. Unified signals. Numbers in computing systems. Basic logical gates and combinational circuits.	Lecture giving, explanation, conversation	2 hours, weekly
8.1.2. **Basic hardware knowledge**. Applications of sequential circuits. Essential components and structural models. Connectors, interfaces, busses, I/O operations.	Lecture giving, explanation, conversation	
8.1.3. **Specific hardware for the acquisition and generation of**	Lecture giving, explanation,	

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the electrical signals. Modern converters for electrical signals - models and features.	conversation, exemplification	
8.1.4. **Optimization of the data acquisition systems structure and parameters.** Devices for signal adaptation and processing. Optimal resolution and amplification. The type and characteristics of the data acquisition board.	Lecture giving, explanation, conversation, exemplification	
8.1.5. **Usual applications for the electrical signals acquisition and generation.** Channels configuration, buffer, triggering, synchronization..	Lecture giving, explanation, conversation, exemplification	
8.1.6. **Advanced functions for data processing in LabView.** The filtering, integration, derivation, processing and analysis of the signal, advanced mathematical functions.	Lecture giving, explanation, conversation, exemplification.	
8.1.7. **The using of the MS-Excel and ORIGIN software for the import, displaying and basic treatment of the acquired data.** Import, calculus, graphical representations, statistical analysis, linear regressions, plots and data export.	Explanation, conversation, description, debate, exemplification, questioning	
8.1.8. **The using of the MS-Excel and ORIGIN software for the advanced treatment of the experimental data.** Partial linear regressions, nonlinear regressions.	Lecture giving, explanation, conversation, exemplification.	
8.1.9. **The using of LabVIEW for the advanced fitting of the experimental data.** Selecting of the fitting range, Partial linear regressions, nonlinear regressions.	Lecture giving, explanation, conversation, exemplification.	
8.1.10. **The implementation of the self-adaptive concept in the experiments control.** Multi-step programs, self-adaptive control, optimization of experimental parameters, sequential data saving.	Lecture giving, explanation, conversation, exemplification.	
8.1.11. **The implementation of the electrochemical investigation techniques using data acquisition systems.** Cyclic voltammetry, square wave voltammetry, potential step.	Lecture giving, explanation, conversation, exemplification.	
8.1.12. **Complex techniques for electrochemical processes investigation using devices equipped with microcontroller.** Potentiometric and spectrometric titration. Spectroelectrochemistry.	Lecture giving, explanation, conversation, description, questioning, debate, exemplification.	
8.1.13. **The implications of the acquisition and treatment of data in the monitoring, control and calibration of the experimental setups.** Precision, reproducibility, multiple parameters, data correlation, automatic calibration.	Lecture giving, explanation, conversation, description, questioning, debate, exemplification.	
8.1.14. **Trends in the development of data acquisition systems.** Modern interfaces (PCI-Express, USB 3.0, PXI, wireless, LAN), autonomous programmable devices.	Lecture giving, conversation, description, debate, exemplification.	

Bibliography

1. S.A. Dorneanu, *Acquisition and treatment of experimental data*, Course support in electronic format.
2. J. Fraden, *Handbook of Modern Sensors - Physics, Designs and Applications*, Springer, New York, 2010
3. D. Page, *A Practical Introduction to Computer Architecture*, Springer-Verlag, London, 2009.
4. Measurement Computing Corp., *Data acquisition handbook*, Norton, MA, SUA, 2012
5. National Instruments, *LabVIEW 2015 Help*.
6. Microsoft, *Microsoft Excel Help*
7. OriginLab, *Origin Documentation*

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8.2 Seminar / laboratory	Teaching methods	Remarks
8.2.1. **Data types and their conversion into computer systems.** Numerical applications. Basic mathematical functions Applications of the Boolean functions on the complex logic circuits design. Strings manipulation.	Explanation, conversation, description, questioning	The seminary hours were distributed in 7 sessions of 4 hours, one session every 2 weeks.
8.2.2. **Management and primary processing of the acquired data.** Data tables, dimensions, concatenation, indexing. Clusters manipulation. Structures.	Explanation, conversation, description, questioning, exemplification.	
8.2.3. **Practical examples of saving and advanced displaying of data using LabView.** Handling and graphical presentation of data. Saving and reading of data.	Explanation, conversation, description, questioning, exemplification.	
8.2.4. **Practical examples of usual functions for the acquisition and generation of the analog and digital signals. P**arameters setup, trigger, synchronization, buffer size.	Explanation, conversation, description, questioning, exemplification.	
8.2.5. **Applications concerning the import, treatment, displaying and interpretation of the acquired data using MS-Excel and ORIGIN**. Import, calculus, graphical representation, statistical analysis, linear and non-linear regressions, data and graphics export.	Explanation, conversation, description, questioning, exercise.	
8.2.6. **Practical examples of experiments based on self-adaptive control.** Multi-step programs, self-adaptive control, optimization of the experimental parameters, sequential data processing, charge and discharge cycles, Zn-Br_2 redox flow battery.	Experiment, Explanation, conversation, description, questioning	
8.2.7. **Practical examples of advanced data acquisition and processing recorded by complex investigation techniques.** Potentiometric titration and spectrometry. Spectroelectrochemistry. Derivation. Peaks detection. Normalization.	Explanation, conversation, description, questioning, exercise.	

Bibliography

1. S.A. Dorneanu, *Acquisition and treatment of experimental data*, Seminary supports in electronic format
2. S. Sumathi, P. Surekha, *LabVIEW based Advanced Instrumentation Systems*, Springer, New York, 2007.
3. National Instruments, *Getting Started with LabVIEW*, Austin, Texas, USA, 2013.
4. National Instruments, *LabVIEW 2015 Help*.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- By instructing the theoretical and practical concepts of Acquisition and treatment of experimental data course, the students will get the knowledge in accordance with the competencies included in the Diploma Supplement and the qualifications from ANC.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	The correctness of answers and the argumentation of wrong answers – acquiring and correct understanding of the concepts included in the course. Correct solving of the numerical applications.	Written examination at the end of the semester. The exam will be of grid type and will include also numerical applications. Passing the exam is not conditioned on solving the numerical applications. The access to the exam is not conditioned, but its validation is conditioned on participation in at least 8 courses out of the 14 assigned and at least 6 laboratory works/seminars out of the 7 provided.	80 %

		Even if the student has not met the minimum standards of attendance, he can participate, eventually, to the exam, acquiring the status of audient. These grades can be recognized and the taken exam will be validated only after the student meets the minimum standards of attendance. In addition, the audient student can re-come through all course and laboratory/seminar activity and retake the exam for a possible grade increase. The intent to cheat on the exam is punishable by removal from the exam. Exam fraud is punishable by expulsion according to the ECST regulation of UBB.	
10.5 Seminar/lab activities	The correctness of numerical and software applications - acquiring and correct understanding of the concepts included in the seminaries. Laboratory/seminar activity	The software and numerical applications corresponding to the seminar/ laboratory activities will be evaluated at the end of each session of practical activity.	20%
10.6 Minimum performance standards			
➢ Grade 5 both in laboratory / seminar works and exam ➢ Knowledge about the modalities of process/experimental data acquisition, the computer hardware and software components, the main equipment for process/experimental data acquisition and the main software application for process/experimental data acquisition and treatment.			

11. Labels ODD (Sustainable Development Goals)

Date
01.04.2025

Signature of course coordinator
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Signature of seminar coordinator
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Date of approval
21.04.2025
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Signature of the head of department
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