COURSE DESCRIPTION

Acquisition and Processing of Experimental Data

Academic year: 2026 - 2027

1. Programme-related data

1.1. Higher Education Institution	Babes-Bolyai University
1.2. Faculty	Chemistry and Chemical Engineering
1.3. Department	Chemical Engineering
1.4. Field	Chemical Engineering
1.5. Level of study	Master
1.6. Degree programme / Qualification	Advanced chemical process engineering / Master
1.7. Form of education	Full time

2. Course-related data

2.1. Course title	**Acquisition and Processing of Experimental Data**			Course code	**CME7313**
2.2. Course coordinator	Assoc. Prof. Sorin-Aurel Dorneanu, PhD				
2.3. Seminar coordinator	Assoc. Prof. Sorin-Aurel Dorneanu, PhD				
2.4. Year of study	I	2.5. Semester	1	2.6. Type of assessment	Exam
2.7. Course status	Compulsory			2.8. Course type	Specialisation subject

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	4	of which: 3.2. course	2	3.3. seminar	2
3.4. Total of hours in the curriculum	56	of which: 3.5. course	28	3.6. seminar	28
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					21
Additional research in the library, on subject-specific electronic platforms, and on-site					21
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					21
Tutoring (professional guidance)					3
Examinations					3
Other activities					-
3.7. Total hours of individual study (IS) and self-taught activities (ST)				69	
3.8. Total hours per semester				125	
3.9. Number of credits				5	

4. Prerequisites (where applicable)

4.1. curriculum-related	Not the case
4.2 skills-related	Not the case

5. Specific conditions (where applicable)

5.1. course-related	• 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.

5.2. seminar-related	• Students should switch off the mobile phones during seminars.
	• The 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.
	• Before each seminar, the student will download from internet (the MS-Teams platform) and should read the corresponding seminar supports.
	• Excepting for the first seminar session, the validation of the following seminar sessions is conditioned by:
	  • Studying and deepening the 2 courses prior to the seminar;
	  • Download from the Internet, unzip, study and deepen the 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 and the seminar support related to the current session can be evaluated before each seminar, 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 seminar, the way of working and, where applicable, of data processing.
	  • The failure to pass the previously mentioned fast tests causes the respective seminar to be invalidated. Even so, the students who do not pass these tests (minimum grade 5) can attend or even participate in the seminar, but will be considered absent.
	• The students must participate at a **minimum number of 6 seminaries 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. consultations related	• 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.

6.1. Competencies resulting from the completion of the degree programme *(as referred to in the curriculum)*[1]

Professional competencies	
Competency code	**Competency**
PC1	Description, analysis and use of elaborate theories and concepts in the fields of chemistry and process advanced chemical engineering
PC2	Technological design of processes, equipment and apparats specific to process engineering for the improvement of performances of biochemical and chemical processes by using computer-assisted instruments (CAD) and principles of long-term development.
PC4	Development of processes, apparatus and equipment specific to process engineering by promoting new solutions for process intensification, optimum operation and control
Transversal competencies	
Competency code	**Competency**
TC1	Independent execution of complex professional assignments and autonomous development of project-research activities by using computer-assisted techniques and by observing the norms of professional ethics and moral conduct

[1] The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes. If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)[2]

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
PC1 **PC4** **TC1**	1. Formulation of solutions to solve complex chemical engineering problems based on knowledge, identification and application of advanced concepts, methods and theories in the field of chemical engineering and chemistry	1. Critical analysis and application of advanced principles, methods, and techniques for the evaluation, design, and development of new products and technologies
PC2 **TC1**	2.Performing a critical analysis based on CAD tools, to identify possible solutions to complex problems of designing equipment and plants in a chemical process	2.Development of integrated projects, based on CAD tools, for the creative development of the design of devices, equipment and plants in the chemical process industries

7. Subject-specific learning outcomes

Knowledge and comprehension
1. Master student knows the main elements used in the design of data acquisition systems
2. Master student understands how to apply modern data acquisition equipment in the monitoring and control of the experimental setups and industrial systems
3. Master student knows basic software for acquisition and treatment of experimental and process data
Specific academic skills
1. Master student can identify and select the adequate and optimal data acquisition equipment in concordance with the controlled (experimental or industrial) process.
2. Master student can select and apply the adequate data treatment algorithms in concordance with specificity of the acquired data.

8. Contents

8.1 Course	**Teaching and learning methods**	**Remarks[3]**
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 the electrical signals**. Modern converters for electrical signals - models and features.	Lecture giving, explanation, 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.	

[2] The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.
[3] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

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 processing 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*

8.2 Seminar / Laboratory	**Teaching and learning 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.**	Explanation, conversation, description, questioning, exercise.	

Potentiometric titration and spectrometry. Spectroelectrochemistry. Derivation. Peaks detection. Normalization.		

Bibliography

1. S.A. Dorneanu, *Acquisition and processing 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. Evaluation

Type of activity	9.1 Evaluation criteria[4]	9.2 Evaluation methods[5]	9.3 Percentage in the final grade
9.4. 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**. 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 courses 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.	80 %
9.5. Seminar/ laboratory	The correctness of numerical and software applications - acquiring and correct understanding of the concepts included in the seminaries. Quality of the individual works	The software and numerical applications corresponding to the seminar/ laboratory activities will be evaluated at the end of each session of practical activity.	20 %
9.6 Minimum standard for passing			
• Grade 5 for both seminars works and exams • 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.			

[4] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

[5] Both final evaluation methods and ongoing evaluation strategies should be established.

10. SDG labels (Sustainable Development Goals)[6]

	○	Sustainable Development Generic Label
		
		
		
○	○	○
◉	○	○
○	○	○
		
		
		No label applies
○	○	○
○	○	○
○	○	○

Date of entry:
27.04.2026

Signature of course coordinator

Assoc. Prof. Sorin-Aurel Dorneanu, PhD

Signature of seminar coordinator

Assoc. Prof. Sorin-Aurel Dorneanu, PhD

Date of approval in the department:
29.04.2026

Semnătura directorului de departament

Prof. dr. habil. ing. Graziella Liana Turdean

[6] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*