SYLLABUS

1. Information regarding the programme

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 programme / Qualification	Advanced Chemical Process Engineering / Chemist Engineer

2. Information regarding the discipline

2.1 Name of the discipline		**Acquisition and treatment of experimental data – 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	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 and seminars. • Students should read before the course support available on internet. • If possible, the student will come with personal mobile computers having installed the corresponding software applications.
5.2. for the seminar /lab activities	• Students should switch off the mobile phones during courses and seminars. • Before each seminar, the student will download from internet an

	should read the corresponding seminar supports.
	• If possible, the student will come with personal mobile computers having installed the corresponding software applications.
	• The access in the lab with food and drinks is forbidden.

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 equipments and computers. • Acquisition of knowledge concerning the equipments 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.** Analog and digital transducers. TEDS. Unified signals.	Lecture giving, explanation, conversation	
8.1.2. **Basic hardware knowledge**. 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. Interfaces for data acquisition - models, structure and features.	Lecture giving, explanation, conversation, description, 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. **Advanced applications for the electrical signals acquisition and generation.** Advanced configuration, virtual channels, buffer, triggering, synchronization, simultaneous processes.	Lecture giving, explanation, conversation, description, exemplification	
8.1.6. **Advanced applications for managing and displaying data in LabVIEW.** Dynamic data - structure and handling. Graphical representation of dynamic data.	Lecture giving, explanation, conversation, description, exemplification,	
8.1.7. **Advanced functions for data processing in LabView.** Filtering, integration, derivation, advanced signal processing and analysis, advanced mathematical functions.	Explanation, conversation, description, debate, exemplification, questioning	
8.1.8. **LabVIEW advanced applications for data saving on HDD.** Insert labels, additional fields, saving, reading, path, manage files and directories.	Lecture giving, explanation, conversation, description, exemplification, questioning	
8.1.9. **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, description, questioning, debate, exemplification.	
8.1.10. **Trends in the development of data acquisition systems.** Modern interfaces (PCI-Express, USB 3.0, PXI, wireless, LAN), autonomous programmable devices.	Lecture giving, explanation, conversation, description, debate, exemplification.	
8.1.11. **Complex techniques for electrochemical processes investigation using devices equipped with microcontroller.** Potentiometric and spectrometric titration. Spectroelectrochemistry.	Lecture giving, explanation, conversation, description, debate, exemplification.	
8.1.12. **The using of the MS-Excel software for the import, treatment, displaying and interpretation of the acquired data.** Import, graphical representations, (non)linear regressions, statistical analysis.	Lecture giving, explanation, conversation, description, debate, exemplification.	
8.1.13. **The using of the ORIGIN software for the import, treatment, displaying and interpretation of the acquired data. I. The data import and displaying**. Import, generation of graphical representations, graphs parameters.	Lecture giving, explanation, conversation, description, debate, exemplification.	
8.1.14. **The using of the ORIGIN software for the import, treatment, displaying and interpretation of the acquired data. II. Treatment and analysis of data**. Linear and non-linear regressions, statistical analysis, data and graphics export.	Lecture giving, explanation, conversation, description, debate, exemplification.	
Bibliography		
1. S.A. Dorneanu, Acquisition and treatment of experimental data, Course support in electronic format.		
2. Daniel Page, A Practical Introduction to Computer Architecture, Springer-Verlag, London, 2009.		

	Teaching methods	Remarks
3. National Instruments, LabVIEW 2015 Help. 4. Microsoft, Microsoft Excel Help 5. OriginLab, Origin Documentation		
8.2 Seminar / laboratory	Teaching methods	Remarks
8.2.1. **Data types and their conversion into computer systems.** Numerical applications. Applications of the Boolean functions on the complex logic circuits design.	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.** Structures, tables, dimensions, concatenation, indexing, basic mathematical functions.	Explanation, conversation, description, questioning, exemplification.	
8.2.3. **Practical examples of advanced functions for the acquisition and generation of the analog and digital signals.** Advanced parameters setup, trigger and pre-trigger, synchronization, buffer size, simultaneous processes.	Explanation, conversation, description, questioning, exemplification.	
8.2.4. **Practical examples of advanced treatment and displaying of data using LabView.** Handling and graphical presentation of the dynamic data. Filtering, regression, advanced processing and analysis of the acquired signals, advanced mathematical functions.	Explanation, conversation, description, questioning.	
8.2.5. **Practical examples of the experiments 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	
8.2.6. **Advanced acquisition and processing of the data obtained by complex investigation techniques.** Potentiometric titration and spectrometry. Spectro-electrochemistry. Derivation. Peaks detection. Normalization.	Explanation, conversation, description, questioning, exercise.	
8.2.7. **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.	

Bibliography

1. S.A. Dorneanu, Acquisition and treatment of experimental data, Seminary supports in electronic format
2. Transaction in Measurement and Control - Volume. 2 - Data Acquisition, Putman Publishing Company and OMEGA Press LLC, Stamford, Connecticut, USA, 1998.
3. Smith S.W., The Scientist and Engineer's Guide to Digital Signal, CTP, San Diego, 1999.
4. S. Sumathi, P. Surekha, LabVIEW based Advanced Instrumentation Systems, Springer, New York, 2007.

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 requested by possible employment sectors settled by RNCIS.

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.	Written examination (colloquium) at the end of the semester. The test, of grille type, include also numerical applications. Access to examination is conditioned by the participation at the seminaries (at least 80 % from the total number of hours). Examination fraud: the student is expelled from the exam according the ECTS regulations	80 %
	Correct solving of the numerical applications.		
10.5 Seminar/lab activities	The correctness of numerical and software applications - acquiring and correct understanding of the concepts included in the seminaries.	The software and numerical applications corresponding to the seminar content must be transmitted by mail to the examiner before the colloquium.	20%
	Laboratory/seminar activity		

10.6 Minimum performance standards

- ➢ Grade 5 both in laboratory / seminar works and exams
- ➢ Knowledge about the modalities of process/experimental data acquisition, the computer hardware and software components, the main equipments for process/experimental data acquisition and the main software application for process/experimental data acquisition and treatment.

Date

26.02.2018

Signature of course coordinator

....

Signature of seminar coordinator

....

Date of approval

Signature of the head of department

26 februarie 2018