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

Tradiție și Excelență prin
Cultură - Știință - Inovație din 1581

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

SYLLABUS

Process Modelling and Artificial Intelligence

University year 2025 - 2026

1. Information regarding the programme

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

2. Information regarding the discipline

2.1. Name of the discipline	**Process Modelling and Artificial Intelligence**				Discipline code		**CME7312**
2.2. Course coordinator	Lecturer Dr. Eng. Timis Elisabeta Cristina						
2.3. Seminar coordinator	Lecturer Dr. Eng. Timis Elisabeta Cristina						
2.4. Year of study	I	2.5. Semester	1	2.6. Type of evaluation	E	2.7. Discipline regime	DF/Compulsory

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

3.1. Hours per week	**4**	of which: 3.2 course	**2**	3.3 laboratory	**2**
3.4. Total hours in the curriculum	56	of which: 3.5 course	28	3.6 laboratory	28
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
Learning using manual, course support, bibliography, course notes (SA)					25
Additional documentation (in libraries, on electronic platforms, field documentation)					18
Preparation for labs, homework, papers, portfolios and essays					20
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

4.1. curriculum	Basic science, mathematics, or engineering knowledge
4.2. competencies	The use of Microsoft Office and programming in MATLAB English language knowledge

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

5. Conditions

5.1. for the course	• The course room must facilitate video-projection. • The course could take place online as well, employing Microsoft Teams in the limits allowed by the University regulations. • Students must switch off the mobile phones during courses. • Audio and/or video recording during the course is not allowed. • Students are allowed to enter and exit at the courses anytime according to their needs; the active participation in courses contributes to the final evaluation. • The lecturing and the practical implementation of the following topics: (a) PLS modelling of a complex system; (b) PCA and multivariate methods for fault detection; may be organized online or on site with the help of an invited lecturer (Dr. Eng. Zina Sabrina Duma).
5.2. for the lab activities	• The laboratory room must facilitate video-projection and workstations featuring MATLAB. • The laboratory activities could take place online as well, employing Microsoft Teams, providing students use computers featuring MATLAB or use MATLAB online. • Students should switch off the mobile phones during laboratories. • Audio and/or video recording during the laboratory is not allowed. • Students should be present at the laboratories, as they are compulsory according to Art. 29 of "Statutul Studentului din Universitatea Babes-Bolyai", revised at 13.01.2013. • The deadline for presenting the homework/projects will be agreed between the lecturer and the students and tasks will be posted as Microsoft Teams Assignments. Delays are accepted in the cases when well-founded reasons are proven before the deadline. In case of presenting the homework with delay, the grade will be penalized (0.5p/week). • The lecturing and the practical implementation of the following topics: (a) PLS modelling of a complex system; (b) PCA and multivariate methods for fault detection; may be organized online or on site with the help of an invited lecturer (Dr. Eng. Zina Sabrina Duma).

6. Specific competencies acquired

Professional/essential competencies	• Define the language and identification of concepts for mathematical modelling and programming for the process engineering applications. • Skills to analyse systems of different types belonging to various fields of activity. • Capability to adapt modelling tools to processes of different complexity and category. • The use of information technology techniques for data processing, modelling and simulation of chemical and biochemical processes using conventional and artificial intelligence methods. • Understanding and interpreting the time and space evolution of chemical and biochemical systems using modelling methods originating from practical systems and implementing the artificial intelligence instruments. • Understanding and explaining the operation of chemical process engineering equipment and installations using dynamic mathematical models and data processing. • The development of dynamic mathematical models for systems with lumped and distributed parameters and their implementation in simulators.

Facultatea de Chimie şi Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poştal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

Transversal competencies	• Performing research and design activities in working groups or independently, using specific techniques and conforming to ethical rules. • The development of skills for self-evaluation of performance and self-assessment of needs for continuous professional improvement based on permanent knowledge update related to the activity field and connected fields. • The correlation of own capabilities with the labour market needs. • Communicating own points of view clear and concisely using conventional and non-conventional information technology instruments. • Giving and receiving feedback with respect to professional activity. • Identifying opportunities for continual learning and efficient usage of learning resources and techniques for individual development.

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

7.1 General objective of the discipline	The development of capabilities to build, optimize and validate dynamic and steady state models for systems with lumped and distributed parameters using the analytical/numerical methods and the artificial intelligence approaches.
7.2 Specific objective of the discipline	The development of competencies (1) to understand and explain the time and space evolution of process engineering systems, (2) to conceptualize and represent systems in the form of mathematical models and (3) to build simulation tools to illustrate the systems behaviour.

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. Introduction to modelling. Modelling goal and model application areas. Modelling steps in process engineering. Balance volumes for engineering applications. Scalar and vector fields. Intensive and extensive properties. Case studies.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.2. Short comparison on the conventional process modelling and data-driven modelling. Conventional modelling. General formulation of the conservation principles: integral and differential form. Case studies.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.3. A logical methodology to model development. Models' classification. Case studies.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.4. Constitutive relationships in process modelling. Transfer and reaction rates. Thermodynamics. Balance volume relations. Equipment and control relations. Case studies.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.5. Modelling lumped parameter systems (LPS). Form of the general conservation equation. Writing balance equations for the conservation of mass, energy, and momentum.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.6. Modelling lumped parameter systems (DPS), part I. Balance volumes representation. General conservation	Lecture, explanation, conversation, description, exemplification,	

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

equation for DPS. The use of microscopic balance volumes. Initial conditions. Boundary conditions. Case studies.	problematization, debate	
8.1.7. Modelling DPS, part II. Classification of DPS models. The use of coupled LPS models to represent DPS. Case study.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.8. LPS and DPS model analysis. Analysis of ODE, DAE and PDE. Degrees of Freedom analysis, Differential Index, model stiffness. Also, probably, one of the following (organized online or on site with the help of an invited lecturer): (a) PLS modelling of a complex system; (b) PCA and multivariate methods for fault detection.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.9. LPS and DPS model solving. Methods for solving ODE, DAE and PDE. Analytical vs. numerical solutions. Implementation with the help of software. Also, probably, one of the following (organized online or on site with the help of an invited lecturer): (a) PLS modelling of a complex system; (b) PCA and multivariate methods for fault detection.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.10. Short introduction to AI. Turing test. Milestones in the field of AI. A selection of AI techniques and applications. Automated Reasoning. Models using fuzzy logic. Case Based Reasoning. Case studies.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.11. Machine Learning (ML) introduction. Types of learning. ML Applications. ML in process systems engineering. Methodology.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.12. Artificial Neural Networks (ANNs), part 1. Neuron. ANN structures. Building ANNs. ANN learning and generalization.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.13. ANNs, part 2. Widely discussed applications of ANNs. Applications of ANNs in the field of process systems engineering. Widespread types of ANNs and newer developments.	Lecture, explanation, conversation, description, exemplification, problematization, debate	
8.1.14. Automated Reasoning. Fuzzy Logic. Case Based Reasoning. Data mining (DM). Process engineering applications. Open-source DM software and applications.	Lecture, explanation, conversation, description, exemplification, problematization, debate	

Bibliography

1. Timis, E.C., 2024, Process Modelling and Artificial Intelligence: Microsoft PowerPoint slide show performed during course classes.
2. CAPE Centre, University of Queensland, Hungarian Academy of Sciences, 2013. Course CHEE3007: Process modelling and dynamics, available online: https://www.coursehero.com/sitemap/schools/2697-Queensland/courses/9008835-CHEE3007/, accessed on 02.04.2020.
3. Hangos K.M., Cameron I.T., 2001, Process Modelling and Model Analysis, Volume 4, 1st Edition, Academic Press, pp. 543.
4. Russell, S., Norvig, P., 2021. Artificial Intelligence: A Modern Approach 4th edition [AIMA], Pearson Education, http://aima.eecs.berkeley.edu/
5. Agachi, P.S., Cristea, V.M., Csavdari, A., Szilagyi, B., 2024. Advanced Process Engineering Control. Berlin, Boston: De Gruyter. https://doi.org/10.1515/9783110789737
6. Agachi, P.S., Cristea, V.M., Makhura, E., 2020. Basic Process Engineering Control. Berlin, Boston: De Gruyter. https://doi.org/10.1515/9783110647938
7. Agachi, P.S., Nagy, Z.K., Cristea, V.M., Imre-Lucaci, A., 2006, Model Based Control - Case Studies in Process

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

Engineering, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.
8. Al Aani, S., Bonny, T., Hasan, S.W., Hilal, N., 2019, Can machine language and artificial intelligence revolutionize process automation for water treatment and desalination? Desalination, 258, 84-96.
9. Andasari, V. 2015. Numerical Methods and Modeling in Biomedical Engineering, Course at Boston University, http://people.bu.edu/andasari/courses/Fall2015/be503703Fall2015.html
10. Ani, E.C., 2009. Minimization of the experimental workload for the prediction of pollutants propagation in rivers. Mathematical modelling and knowledge re-use. Acta Universitatis Lappeenrantaensis 355, Lappeenrannan teknillinen yliopisto, Digipaino, Lappeenranta, Finland, pp. 189, available online: http://urn.fi/URN:ISBN:978-952-214-830-8
11. Awogbemi, O., Kallon, D.V.V., 2022. Application of Tubular Reactor Technologies for the Acceleration of Biodiesel Production. Bioengineering 9, 347. https://doi.org/10.3390/bioengineering9080347
12. Bagheri, M., Akbari, A., Mirbagheri, S.A., 2019. Advanced control of membrane fouling in filtration systems using artificial intelligence and machine learning techniques: A critical review, Process Safety and Environmental Protection, 123, 229-252.
13. Brunton, S.L. and Kutz, J.N., 2019, Data Driven Science & Engineering. Machine Learning, Dynamical Systems, and Control, University of Washington, pp. 552. https://databookuw.com/ and http://databookuw.com/databook.pdf Available also as video course by Brunton, S.L., 2022. Intro to Data Science (https://www.youtube.com/playlist?list=PLMrJAkhIeNNQV7wi9r7Kut8liLFMWQOXn); Control Bootcamp (https://www.youtube.com/playlist?list=PLMrJAkhIeNNR20Mz-VpzgfQs5zrYi085m)
14. Darmiana, M.D., Monfareda, S.A.H., Azizyana, G., Snyderb, S.A., Giesyd, J.P., 2018. Assessment of tools for protection of quality of water: Uncontrollable discharges of pollutants, Ecotoxicology and Environmental Safety, 161, 190–197.
15. Dincer I., Ezan M.A., 2018. Fundamental Aspects of Thermodynamics and Heat Transfer. In: Heat Storage: A Unique Solution for Energy Systems. Green Energy and Technology. Springer, Cham, 1-34.
16. Califf, M.E., 2010. Introduction to Artificial Intelligence, ITK 340, Course at Illinois State University.
17. Ceccaroni, L., 2008, Artificial Intelligence Introduction, Course at Universidad Politecnica de Cataluna.
18. desJardins, M., 2005. Principles of Artificial Intelligence. Course at University of Maryland, Baltimore, http://www.cs.umbc.edu/courses/graduate/671/fall05/slides/c1_intro.ppt
19. Finn, T., 2016. Introduction to Artificial Intelligence, Course at University of Maryland, Baltimore, https://www.csee.umbc.edu/courses/undergraduate/471/spring19/01/notes/01_introduction/01.pdf
20. Howard, P., 2005. Partial Differential Equations in MATLAB 7.0. Lecture Notes. Course at Texas A&M University, http://www.tem.uoc.gr/~marina/pdemat.pdf and also https://www.math.tamu.edu/~phoward/
21. Itti, L., 2005. Artificial Intelligence. Course at University of Southern California, http://iLab.usc.edu/classes/2005cs561
22. Ismini, L., 2017. Introduction to Deep Learning, http://times.cs.uiuc.edu/course/510f17/ppt/deep-learning.pptx, part of Zhai, Z.X., 2017, Advanced Information Retrieval, Course at University of Illinois at Urbana-Champaign, http://times.cs.uiuc.edu/course/510f17/schedule.html
23. Ling, W., 2017. Deep Neural Networks are our Friends, Oxford Deep NLP 2017 course, https://github.com/oxford-cs-deepnlp-2017/lectures/raw/master/Lecture%201b%20-%20Deep%20Neural%20Networks%20Are%20Our%20Friends.pdf
24. Liu, Y., Zhao, T., Ju, W., Shi, S., 2017. Materials discovery and design using machine learning, Journal of Materiomics, 3, 3, 159-177.
25. Maclin, R., 2001. Machine Learning, Course at University of Minnesota Duluth, https://www.d.umn.edu/~rmaclin/cs5751/index.html, text after Mitchell T., 1997, Machine Learning, McGraw Hill.
26. Maloof, M., 2017, Articial Intelligence: An Introduction, Course at Georgetown University.
27. Matuszek, P., 2010. Artificial Intelligence. Introduction and Intelligent Agents. Course at Villanova University, Philadelphia.
28. Pokutta, S., 2016. Machine Learning in Engineering Applications and Trends, NASA Workshop Machine Learning Technologies and Their Applications to Scientific and Engineering Domains Workshop, http://www.nianet.org/wp-content/uploads/2016/06/Pokutta_20160816_NASA.pdf
29. Sipos, A., Cristea, V.M., Mudura, E., Imre-Lucaci, A., Bratfalean, D., 2014, Modelarea, simularea si conducerea avansată a bioproceselor fermentative, Vol. II. Editura Universităţii “Lucian Blaga”, Sibiu.

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

30. Subasi, A., 2011-2012, Machine Learning Course Introduction, International Burch University.
31. Visa, A., 2005. Neural Computation Introduction. Course at Tampere University of Applied Sciences, available online: http://www.cs.tut.fi/~avisa/2806nn1.ppt
32. Wei, J., Chu, X., Sun, X.Y, Xu, K., Deng, H.X., Chen, J., Wei, Z., Lei, M., 2019. Machine learning in materials science, InfoMat, 1, 338–358.
33. Welling, 2007. Introduction to AI, Course at University of California, Irvine, available online: http://www.ics.uci.edu/~welling/teaching/ICS171spring07/ICS171spring07.html
34. Yanikoglu, B., 2017. Machine Learning, Course at Sabanci University, Turkey, http://people.sabanciuniv.edu/berrin/cs512/lectures/ (1-ml-ch1-intro.pdf and 7-nn1-intro.ppt.pdf)
35. Zabihi, R., Mowla, D., Karami, H.R., 2019, Artificial intelligence approach to predict drag reduction in crudeoil Pipelines, Journal of Petroleum Science and Engineering 178, 586–593.
36. Zhang, Z., Qi, H., 2018. Neural Network Background, in Pattern Recognition, Course at University of Tennessee, Knoxville, http://web.eecs.utk.edu/~hqi/ece471-571/syllabus.htm and http://web.eecs.utk.edu/~qi/ece471-571/lecture16_nn_background.pptx

Other online resources

37. http://aima.eecs.berkeley.edu/slides-pdf/
38. http://www.alanturing.net/turing_archive/pages/Reference%20Articles/TheTuringTest.html
39. https://plato.stanford.edu/entries/turing-test/

Note. Bibliography items may be found at one of the following: (1) the “Lucian Blaga” Central Library of Babes-Bolyai University; (2) online on the scientific databases available from the intranet of Babes-Bolyai University and “Lucian Blaga” Central Library; (3) online using specified links; (4) online on the Microsoft Teams group dedicated to the discipline.

8.2 Laboratory	Teaching methods	Remarks
8.2.1. Getting knowledge on MATLAB functions and s-functions. Getting knowledge on Simulink. Recap model writing and programming in MATLAB, including Simulink.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students’ presentations, inter-evaluation, evaluation	
8.2.2. Write and solve functions for systems with 1 and 2 ODE. Implement in parallel in MATLAB and Simulink. Compare results.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students’ presentations, inter-evaluation, evaluation	
8.2.3. Application of the model development logical methodology to LPS, part I: e.g., liquid accumulation in a tank; continuous stirred tank reactor (CSTR) systems; evaporator.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students’ presentations, inter-evaluation, evaluation	
8.2.4. Application of the model development logical methodology to LPS, part II: e.g., liquid accumulation in a tank; continuous stirred tank reactor (CSTR) systems; evaporator	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students’ presentations, inter-evaluation, evaluation	
8.2.5. Application for modelling DPS, part I. The use of MATLAB PDE Toolbox, pdepe solver for 1D dynamic PDE (FEM). The 1D heat transfer in a long metal rod. 1D modelling of a system with 2 output variables.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students’ presentations, inter-evaluation, evaluation	
8.2.6. Application for modelling DPS, part II. The use of MATLAB PDE Toolbox with GUI Interface for 2D PDE. Models of heat equation in a metal plate and along a long metal rod.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students’ presentations, inter-evaluation, evaluation	
8.2.7. Model development, calibration and verification using field data, LPS or DPS case study. Part I. Model	Implementation of case studies, coaching via dialog, application building, learning by	

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

development, implementation, solve the model with initial parameters (scalar), plot and analyse results.	discovery, teamwork, students' presentations, inter-evaluation, evaluation	
8.2.8. Model development, calibration and verification using field data, LPS or DPS case study. Part II. Parameter optimization exemplified on scalars, calibration and verification. Or the implementation of one of the following (organized online or on site with the help of an invited lecturer): (a) PLS modelling of a complex system; (b) PCA and multivariate methods for fault detection.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students' presentations, inter-evaluation, evaluation	
8.2.9. Model development, calibration and verification using field data, LPS or DPS case study. Part III. Parameter optimization exemplified on dynamic series testing multiple techniques (including AI). Calibration using the models formulated for parameters and verification. Or the implementation of one of the following (organized online or on site with the help of an invited lecturer): (a) PLS modelling of a complex system; (b) PCA and multivariate methods for fault detection.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students' presentations, inter-evaluation, evaluation	
8.2.10. The exploration and improvement of a predefined case study using MATLAB Fuzzy Logic.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students' presentations, inter-evaluation, evaluation	
8.2.11. The implementation of an industrial drying process decision support tools using the MATLAB Fuzzy Logic Toolbox.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students' presentations, inter-evaluation, evaluation	
8.2.12. Case study on parameter estimation models. ANN design, training and implementation using Neural Networks Toolbox, part I.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students' presentations, inter-evaluation, evaluation	
8.2.13. Case study on parameter estimation models. ANN design, training and implementation using Neural Networks Toolbox, part II.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students' presentations, inter-evaluation, evaluation	
8.2.14. The implementation of a case study (it can be proposed by students) using mathematical modelling, AI techniques exemplified during sections 8.2.1 to 8.2.13. Or the exemplification of a model employed for industrial process simulation and control using Mimic and/or DeltaV.	Implementation of case studies, coaching via dialog, application building, learning by discovery, teamwork, students' presentations, inter-evaluation, evaluation	

Bibliography

1. All course bibliography
2. Berk, Z., 2009. Chapter 21 - Evaporation, In Food Science and Technology, Food Process Engineering and Technology, Academic Press, 429-458.
3. Glover, W.B., 2004. Chemical Engineering Progress, AIChE, December 2004, 26-33, https://lcicorp.com/test_design/selecting_evaporators_for_process_applications/
4. Shi, Z., 2019. Advanced Computing Seminar. Data Mining and its Industrial Applications. Chapter 6. Neural Networks, University of South Australia, http://www.intsci.ac.cn/en/shizz/dm.html
5. Sipos, A., Cristea, V.M., Mudura, E., Imre Lucaci A., Bratfalean, D., 2014. Modelarea, simularea si conducerea avansată a bioproceselor fermentative, carte de specialitate; Editura Universităţii "Lucian Blaga" din Sibiu; Vol. II.

Facultatea de Chimie şi Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poştal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

6. Xue, D., Chen Y., 2009. Solving applied mathematical problems with MATLAB. Chapman & Hall/CRC, Boca Raton, USA.
7. Partial Differential Toolbox, Matlab, User Guide.
8. COMSOL Mutiphysiscs 3.1, UserGuide.
9. Neural Network Toolbox, Matlab, User Guide.
10. Fuzzy Logic Toolbox, Matlab, UserGuide.

Note: titles of the bibliography items may be found at one of the following: (1) the “Lucian Blaga” Central Library of Babes-Bolyai University; (2) online on the scientific databases available from the intranet of Babes-Bolyai University and “Lucian Blaga” Central Library; (3) online using specified links; (4) online on the Microsoft Teams group dedicated to the discipline.

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

- The course content preparation was initially performed by referring to elements presented in similar courses at national and international universities and by changing opinions with professors from ETH Zurich, within the institutional partnership project “Advanced process engineering for Master and joint PhD education”, IB7420-111104.
- Feedback from industry (Azomures, Compania de Apa Somes, Emerson, and Rompetrol) has been used to comply with expected competencies desired by potential employers.
- Later changes regard newer developments in the course field, the economic sector and/or are related to the sustainable development.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Final examination consisting in solving a modelling and/or AI problem (steps described in a doc or pdf report according to instructions provided at the beginning of the semester, a Power Point presentation and the model files as implemented in the specific software) followed by presenting the problem and answers to questions on that specific problem. It will evaluate the way knowledge of the course has been acquired, the way of thinking, correctness, the presentation and the argumentation for the solutions to the problem.	Oral examination.	50%
10.5 Laboratory	Correctness of answers as proof of understanding and applying the knowledge taught during laboratory and the active participation to laboratory activities. The quality and accuracy of solving the laboratory projects/ problems/ exercises / tasks, including homework.	The results of homework and projects started in class and finished at home must be presented according to the specific agreed schedule.	50%

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

10.6 Minimum standard of performance
• The ability to apply conventional modelling methods and artificial intelligence methods to chemical, biochemical and process engineering case studies (e.g. CSTR and PFR type). • The capacity to write mathematical models in MATLAB. • Capability to present and critically analyse own approach for solving mathematical modelling and AI problems. • The use of computer and English language for continuous learning. • 5 is the minimum grade accepted to pass the evaluation. • The consequence of the attempted fraud and / or plagiarism are followed by the exclusion of the student from the exam.

11. Labels ODD (Sustainable Development Goals)

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Date: 31.03.2025	Signature of course coordinator	Signature of laboratory coordinator
	Lecturer Dr. Ing. Elisabeta Cristina Timiş	Lecturer Dr. Ing. Elisabeta Cristina Timiş

Date of approval: ...21.04.2025	Signature of the head of department
	Prof. Dr. Ing. Graziella Liana Turdean