# SYLLABUS

## 1. Program Information

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| 1.1 Higher education institution | Technical University of Cluj-Napoca |
| 1.2 Faculty | Faculty of Automation and Computer Science |
| 1.3 Department | Department of Automation |
| 1.4 Field of study | Automation, Applied Informatics and Intelligent Systems |
| 1.5 Cycle of studies | Bachelor |
| 1.6 Study Programme/Qualification | Intelligent Automation Systems (dual, in English language) |
| 1.7 Form of education | IF – full-time education |
| 1.8 Course code | 19.00 |

## 2. Course information

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|---|---|---|---|---|---|---|
| 2.1 Course title | **Process Modelling** | | | | | |
| 2.2 Course lecturer | *S.L. dr. ing. Dora Morar* *dora.sabau@aut.utcluj.ro* | | | | | |
| 2.3 Seminar / Laboratory / Project Lecturer | *Ing. Roxana Sav (Emerson)* | | | | | |
| 2.4 Year of study | 2 | 2.5 Semester | 1 | 2.6 Type of assessment | | |
| 2.7 Course status | Formative category *(DF, DS, DC)* | | | | | DS |
| | Optionality *(DOB, DOP, DFac)* | | | | | DOB |

## 3.Total estimated time

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | of which: | HEI | Lecture | 2 | Seminar | 0 | Laboratory | 0 | Project | 0 |
| | | | CO | | 0 | | 0 | | 1 | | 0 |
| 3.2 Number of hours per semester | | of which: | HEI | Lecture | 28 | Seminar | 0 | Laboratory | 0 | Project | 0 |
| | | | CO | | 0 | | 0 | | 14 | | 0 |

| 3.3 Distribution of time allocation (hours per semester) for: | HEI | CO |
|---|---|---|
| (a) Study based on textbook, course support, bibliography, and notes | 25 | 3 |
| (b) Additional documentation in library, specialized electronic platforms, and fieldwork | 16 | 3 |
| (c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays | | 2 |
| (d) Tutoring | 3 | 1 |
| (e) Examinations | 3 | 2 |
| (f) Other activities: | | |
| 3.4 Total individual study hours (sum (3.3(a)... 3.3(f))) | 47 | 11 |
| 3.5 Total hours per semester (3.2+3.4) | 75 | 25 |
| 3.6 Number of credits per semester | 3 | 1 |

*(HEI = Higher Education Institution, CO = Company)*

## 4. Prerequisites (where applicable)

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| 4.1 Curriculum Prerequisites | • Physics, Chemistry, Mathematical Analysis |
| 4.2 Competency Prerequisites | • Numerica Calculus<br>• Linear Algebra<br>• Understanding chemical processes |

## 5. Conditions (where applicable)

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| 5.1. Course Organization Conditions | • Access to a projector, internet connection, and Microsoft Office or equivalent tools. |
| 5.2. Seminar / Laboratory / Project organization conditions | • Laboratory is mandatory |

**6. Specific Competencies Acquired**

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| Professional Competencies | • PC02 Analyse test data<br>• PC05 Conduct quality control analysis<br>• PC08 Design automation components<br>• PC12 Gather technical information<br>• PC19 Prepare production prototypes<br>• PC26 Use information technology tools<br>• PC27 Execute analytical mathematical calculations<br>• PC30 Design control systems<br>• PC32 Perform data analysis |
| Transversal Competencies | • TC01 Apply knowledge of science, technology and engineering<br>• TC02 Think analitically<br>• TC05 Interpret mathematical information |

**7. Learning outcomes**

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| Knowledge: | • The student describes the fundamental principles and purposes of process modeling across engineering domains;<br>• The student explains the mathematical foundations used to represent physical, chemical and biochemical systems;<br>• The student classifies and differentiates types of models used in chemical and biochemical process modeling. |
| Skills: | • The students construct mathematical models for various chemical and biochemical processes;<br>• The students analyze and evaluate process behaviors by simulating models. |
| Responsibility and autonomy: | • The student independently formulate modeling strategies;<br>• The students collaborate and communicate effectively in multidisciplinary teams to develop, analyze and improve models. |

**8. Course Objectives**

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| 8.1 General objective of the course | • Understanding, developing and analyzing models of physical, chemical and biochemical systems of industrial importance. |
| 8.2 Specific objectives | • Explaining key principles of process modeling and its applications;<br>• Select and apply appropriate modeling techniques for different processes;<br>• Assess model assumptions and limitations critically;<br>• Modeling, simulating and analyzing chemical and biochemical systems; |

**9. Contents**

| 9.1 Lectures | No. of hours | Teaching methods | Obs. |
|---|---|---|---|
| C1. Fundamentals of process modelling | 2 | Slide presentation, explanation and demonstrations, case studies and discussions | |
| C2. Mathematical representation of physical systems | 2 | | |
| C3. Modelling principles in electrical, mechanical and hydraulic domains. | 6 | | |
| C4. General concepts regarding chemical and biochemical processes | 2 | | |
| C5-C8 Modeling of chemical processes (classification of models, analysis and modeling, examples) | 6 | | |
| C9-C12 Modeling of biochemical processes (classification of models, analysis and modeling, examples) | 6 | | |
| C13 Analogies | 2 | | |
| C14 Constructing mathematical models using data obtained through experiments | 2 | | |

Bibliography


1. Cameron Ian T., Katalin H. *Process modelling and model analysis*. Vol. 4. Elsevier, 2001.
2. K. Ogata, Modern Control Engineering, 5th edition, Prentice Hall, Pearson, 2010.
3. Amiya K. Jana *Chemical process modelling and computer simulation*. PHI Learning, 2018.
4. Ghasem N. *Modeling and simulation of chemical process systems*. CRC Press, 2018.


| 9.2 Seminar / laboratory / project | Hours HEI | Hours CO | Teaching methods | Obs. |
|---|---|---|---|---|
| Basic elements about process simulators. Introduction to MIMIC and HYSYS – differences, benefits, applicability. | | 4 | Simulations, case studies, teamwork | |
| Modeling and simulation of chemical processes. Process simulators | | 4 | | |
| Modeling and simulation of biochemical processes. Process simulators | | 4 | | |

Bibliography


7601 - Mimic Dynamic Simulation
7602 - Mimic Advanced Fluid Modeling Objects
7631 - Dynamic Simulation Introduction
7632 - DeltaV Mimic Introduction
Aspen HYSYS Dynamics: Introduction to Dynamic Modeling


**10. Correlation of course content with the expectations of the epistemic community representatives, professional associations, and major employers in the field related to the program**

The course prepares students to solve engineering problems efficiently and meet industry demands by focusing on practical model skills and interdisciplinary applications.

**11. Evaluation**

| **Activity Type** | **Evaluation criteria** | **Evaluation methods** | **Weight in final grade** |
|---|---|---|---|
| 11.1 Lecture | Acquired theoretical knowledge about the modeling concepts for industrial processes. | Written exam | C=50% |
| 11.2 Seminar/ Laboratory/Project | Aquisition and proper understanding of the issues addressed during the practical activity. | Written/practical test Continous formative evaluation | L=50% |
| 11.3 Minimum Performance Standard | | | |
| C > 5, L > 5, Final grade = 0.5*C + 0.5*L | | | |

| Date of completion: | Lecturers | Title First Name LAST NAME | Signature |
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| | Course | S.l.dr.Ing Dora MORAR | |
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| Date of approval by the Department of Automation Council<br>24.11.2025<br><br>Date of approval by the Faculty of Automation and Computer Science Council<br>28.11.2025 | Director of the Department of Automation<br>Prof.dr.ing. Honoriu VĂLEAN<br><br>Dean<br>Prof.dr.ing. Vlad MUREȘAN |