



DISCIPLINE ACADEMIC SHEET
ACADEMIC YEAR 2025 – 2026

1. PROGRAMME DATA

1.1. Higher Education Institution	UNIVERSITY OF CRAIOVA
1.2. Faculty	Automation, Computers and Electronics
1.3. Department	Computers and Information Technology
1.4. Field of Study	Computers and Information Technology
1.5. Study level	L(License / Undergraduate)
1.6. Organizational form	IF
1.7. Study Program (name/code) /Qualification	Computers / L2060101010

2. Discipline data

2.1 Discipline Name	Modelling and Simulation						
2.2 Course Activities Holder	Lect. PhD. Constantin-Renato IVANESCU						
2.3. Practical Activities Holder	Lect. PhD. Constantin-Renato IVANESCU						
2.4. Study Year	3	2.5. Semester	5	2.6. Evaluation type	V	2.7. Discipline regime	DOB

3. Estimated total time (hours per semester of teaching activities)

3.1. Number of hours per week	4	in which: 3.2 course	2	3.3. sem./lab./pr.	0/2/0
3.4. Total hours of curriculum	56	in which: 3.5 course	28	3.6. sem./lab./pr.	0/28/0
Time distribution - hours/week					
Study after manual, course support, bibliography and notes					12
Additional documentation in library, on specialized electronic platforms and field					12
Training seminars / labs, homework, portfolios and essays					12
Tutorial					4
Examinations					2
Other activities					2
3.7. Total hours per individual activities					44
3.8. Total hours per semester					100
3.9. Number of credits					4

4. Preconditions (where appropriate)

4.1. of curriculum	Basic knowledge acquired during the previous years of study are necessary, in: ▪ Procedural and structured programming ▪ Programming methods and techniques ▪ Algorithms and Data Structures ▪ Object Oriented Programming ▪ Special Chapters in Mathematics ▪ Computer Architecture
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4.2. of competence	None.
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5. Conditions (where appropriate)

5.1. of the course	Presentations are held in the University course rooms, which are provided with the necessary equipments (video, audio if necessary). The textbook authored by the course activities holder was published in 2004 and updated on an annual basis. All information is available online on the course page, and that includes documentation, presentations, sample evaluations (past exams), quizzes, seminar problems a.s.o. At the end of each class the concepts introduced are discussed. Monthly quizzes are also proposed and discussed, together with homework that usually ends a course chapter, containing problems fundamental to fully understand the notions presented.
5.2. of laboratory	The laboratory activities take place in a laboratory room – the general rule is one student per workstation. Students are working towards the implementation of “toy” projects, learn to use the facilities of specialized software for simulation, under the guidance of a qualified instructor. Software tools used during laboratory hours are mainly simulators (CPN Tools, PNSim etc.). Homework is proposed, with problems from each topic in discussion (the deadline for student submitting solutions is usually two weeks).

6. COURSE OBJECTIVES – expected learning outcomes that are supported by completing and passing the course

Knowledge	Student/Graduate: 1. Describes and explains the fundamental concepts of modeling and simulation of discrete-event dynamical systems. 2. Identifies and understands mathematical foundations related to probability, random processes, and queueing theory. 3. Recognizes the role and applicability of Petri nets and Markov models in analyzing complex systems.
Skills (Abilities)	Student/Graduate: 1. Applies analytical and simulation methods to model and evaluate discrete-event systems. 2. Uses specialized simulation software (e.g., CPN Tools, PNSim) to implement and test system models. 3. Designs and executes small-scale simulation projects, integrating theoretical and practical knowledge.
Responsibility and autonomy	Student/Graduate: 1. Works independently and in teams to solve modeling and simulation problems. 2. Demonstrates responsibility in completing homework and projects within deadlines. 3. Evaluates and interprets simulation results critically, proposing possible improvements to the system model.

7. Content

<i>7.1. Course</i>	Teaching methods	Allocated time (hours)
1: Introduction. Discrete-Event Dynamical Systems (DEDS, DES)	Course hours (lectures) are offered in the form of interactive presentations,	2

2: Mathematical Foundations of Simulation. Probability and statistics.	using computers and specialized hardware (video, PPT). At the end of each class the concepts introduced are discussed. Monthly quizzes are also proposed and discussed, together with homework that usually ends a course chapter, containing problems fundamental to fully understand the notions presented.	2
3: Input Data Modeling (1): Random Number Generation		2
4: Input Data Modeling (2): Random Variate Generation		2
5: Discrete-Event Dynamical System Models		2
6: Logic Modeling and Supervisory Control of DES		2
7: Dynamic Modeling using Petri Nets. The Analysis of Petri Nets.		2
8: Model Synthesis using Ordinary and Generalized Petri Nets		2
9: Markov Chains and Markov and semi-Markov Generalized Processes		2
10: Queueing Systems and Queueing Networks		2
11: Discrete Event System Simulation		2
12: Sequential Discrete Event Simulation Survey		2
13: Simulation Verification and Validation. Output Analysis		2
14: Accelerating Simulations. Parallel and Distributed Simulation. Gradient Techniques		2
Bibliography:		
1. Banks, J., Carson, J. S., Nelson, B. L., and Nicol, D. M. Discrete-Event System Simulation, 5th ed., Pearson, 2010.		
2. Law, A. M. Simulation Modeling and Analysis, 5th ed., McGraw-Hill Education, 2015.		
3. Cassandras, C. G., and Lafortune, S. Introduction to Discrete Event Systems, 3rd ed., Springer, 2021.		
4. Ross, S. M. Simulation, 6th ed., Academic Press, 2013.		
5. Jensen, K., and Kristensen, L. M. Coloured Petri Nets: Modelling and Validation of Concurrent Systems, Springer, 2009.		
6. CPN Tools documentation, https://cpntools.org/ (accessed 2026).		

7.2. Laboratory	Teaching methods	Allocated time (hours)
1: Analytical Modeling Discrete-Event Dynamical Systems	Problem implementation, presentation according to the topic of each weekly session. Integration of all knowledge in a semester homework (hardware/ software/ integrative “project”). The topic of the project is taken from a list proposed by the instructor at the debut of the semester. Project delivery is accompanied by report and presentation.	2
2: Probability and random processes (rev.)		2
3: Queueing Systems		2
4: Queueing Networks		2
5: Petri Nets		2
6: Approximate Techniques		2
7: Simulation Models for Discrete-Event Dynamical Systems		2
8: Random Number Generation Methods		2
9: Random Variate Generation Methods		2
10: Basic Design of a Simulator		2
11: Detailed Design and Implementation of a Simulator		2
12: Simulation Languages and Environments		2
13: Accelerating Simulations through Parallel and Distributed Simulation. Gradient Techniques		2
14: Accelerating Simulations through Gradient Techniques		2
Bibliography:		
1. Law, A. M. Simulation Modeling and Analysis, 5th ed., McGraw-Hill Education, 2015.		
2. Banks, J. et al. Discrete-Event System Simulation, 5th ed., Pearson, 2010.		
3. Jensen, K., and Kristensen, L. M. Coloured Petri Nets, Springer, 2009.		
4. CPN Tools documentation, https://cpntools.org/ (accessed 2026).		

8. Correlating the content of the discipline with the expectations of representatives from the epistemic community, professional associations and representative employers in the field related to the program

Course and application contents are in accordance with similar items from other universities in the country and abroad. Gained competences are convergent with the requirements of major employers, being the result of periodic discussions with representatives of the local companies active in the IT field.

9. Evaluation

Activity Type	9.1. Evaluation criteria	9.2. Evaluation methods	9.3. Final mark weight
9.4. Course	Concepts understanding; problem correct solving; ability to connect concepts as they are taught; gain of analysis and synthesis skills.	Final written assessment Quizzes Homework	40% 20% 20%
9.5. Laboratory	L: Individual activity but also as a team member.	NotaLab = 50%*Nota1 + 50%*Nota2 Nota1: Mark for individual presentation of own work in laboratory and at home. Nota2: Mark for individual activity during classes	20%
9.6. Minimum standard of performance - To pass, the student must obtain at least 50% of the continuous-assessment score (quizzes, homework and laboratory assignments), at least 50% of the final written-assessment score, and a final grade of at least 5.			

Date of Completion	Signature of the Course Activities Holder,	Signature of the Practical Activities Holder,
01.10.2025	Lect. PhD. Constantin-Renato IVANESCU	

Date of Approval in the Department	Signature of the Department Director,
03.10.2025	Ș.I.dr.ing. Nicolae ENESCU

Date of Approval in the Faculty	Signature of the Dean,
	Prof.dr.ing. Dorin ȘENDRESCU