SYLLABUS

1. Information about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3	Department	Bases of Electronics
1.4	Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5	Cycle of study	Master
1.6	Program of study / Qualification	Integrated Circuits and Systems (CSI)
1.7	Form of education	Full time
1.8	Subject code	14.10

2. Information about the subject

2.1	Subject name					Game Theory					
2.2	Subject area					Theoretical area Methodological area Analytic area					
2.3	Course responsible					Sl. dr. ing. Paul Faragó					
2.4	Application responsible					Sl. dr. ing. Paul Faragó					
2.5	Year of study	I	2.6	Semester	1	2.7	Assessment	E	2.8	Subject category	DOB

3. Estimated total time

An/ Sem	Subject name	No. weeks	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credits
			[h/week]				[h/semester]						
				S	L	P		S	L	P			
II/I	Game Theory	14	2	0	1	1	28	0	14	14	74	130	5

3.1	Number of hours per week	4	3.2	from which lecture	2	3.3	laboratory / project	2
3.4	Total hours in the curriculum	56	3.5	from which lecture	28	3.6	laboratory / project	28

Individual study	Ore
Manual, lecture material and notes, bibliography	20
Supplementary study in the library, online specialized platforms and in the field	20
Preparation for seminars / laboratories, homework, reports, portfolios and essays	20
Tutoring	10
Exams and tests	4
Other activities	-

3.7	Total hours of individual study	74
3.8	Total hours per semester	130
3.9	Number of credit points	5

4. Pre-requisites (where appropriate)

4.1	Curriculum	Not applicable
4.2	Competence	Knowledge of elementary mathematics, set theory, functions. Intermediate Microsoft Excel and Matlab.

5. Requirements (where appropriate)

5.1	For the lecture	On-site: Cluj-Napoca, On-line: Microsoft Teams
5.2	For the applications	On-site: Cluj-Napoca, On-line: Microsoft Teams

6. Competenţe specifice acumulate

Professional competences	– development of strategic thinking and rational strategic behavior, – formulation of strategic reasoning, – analysis and interpretation of motivation, negotiation, auction and election settings, – identification of game models in real situations and formulation of appropriate strategies to for result optimization, – modeling of strategic interactions, – formulation of strategies to manage conflictual situations, – usage of software tools for game theory-based representation, modeling and formulation of strategies.
Transversal competencies	– development of oral and written communication skills, – teamwork, problem solving and decision making, – learning autonomy, effective use of information sources and communication resources, and assisted professional training

7. Subject objectives (as results from the key competences gained)

7.1	General objectives	Development of Game Theory skills
7.2	Specific objectives	Knowledge and understanding of elementary game theory concepts: player, information, strategy, outcome, solution, Development of skills and abilities for strategic analysis, interpretation and reasoning.

8. Contents

8.1. Lecture (Syllabus)		Teaching methods	Remarks
1	Introduction to game theory. Game definition, movement order, representation, types of interactions, information content, Nash equilibrium.	Exposition, discussions	On-site: Video-projector and blackboard. Online: Microsoft Office 365 – Teams, OneNote, Whiteboard
2	Elements of utility theory		
3	Simultaneous move games. Strategic reasoning: dominance, best response, Pareto optimality, equilibrium, mixing, the Minimax theorem.		
4	Simultaneous move games with multiple players.		
5	Sequential move games. Applications: strategic moves.		
6	Imperfect information games. Applications: signaling games.		
7	Repeated games. Stochastic games. Applications: bargaining.		
8	Games with incomplete information. Applications: auctions.		
9	Normal form games. Algorithms for determining equilibria.		
10	Normal form games. Solution concepts: trembling hand perfect equilibrium, rationalizability, evolutionary stable strategies.		
11	Game analysis using fuzzy reasoning.		
12	Game analysis using genetic algorithms.		

13	Graphical interpretation of normal form games. Game analysis using neural networks.		
14	Applications of game theory in artificial neural networks and deep learning.		
8.2. Aplicaţii (seminarii)		Teaching methods	Remarks
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8.3. Applications (laboratory)		Teaching methods	Remarks
1	Classification of games.	Demonstration and didactical experimentation, didactical exercise, teamwork	On-site: Video-projector and blackboard. Online: Microsoft Office 365 – Teams, OneNote, Whiteboard
2	Simultaneous move games. Nash equilibrium. Strategies for simultaneous move games. Minimax theorem.		
3	Coordination games. Genetic algorithms.		
4	Coordination games. Fuzzy logic.		
5	Sequential games. Strategic moves.		
6	Election games. Voting.		
7	Game theory in artificial neural networks.		
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8.4. Applications (project)		Teaching methods	Remarks
1	Structure, organization and project content. Presentation of the project thematic.	Demonstration and didactical experimentation, didactical exercise, teamwork	On-site: Video-projector and blackboard. Online: Microsoft Office 365 – Teams, OneNote, Whiteboard
2	Allocation of the project assignments.		
3	Software tools for game theory-based modeling, reasoning and decision making.		
4	Detailed element modeling I		
5	Detailed element modeling II		
6	Detailed element modeling III		
7	Project presentation and evaluation		
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References

1) A. K. Dixit, B. J. Nalebuff, ARTA STRATEGIEI. Ghidul jucatorului pentru succesul in afaceri si in viata, Risoprint, 2018
2) A. K. Dixit, B. J. Nalebuff, The Art of Strategy – A Game Theorist's Guide to Success in Business and Life, W. W. Norton & Company, 2008
3) K. Leyton-Brown, Y. Shoham, Essentials of Game Theory, Morgan & Claypool, 2008
4) E. Prisner, Game Theory Through Examples, Mathematical Association of America, 2014
5) T. C. Schelling, The Strategy of Conflict, Harvard University Press, 1981
6) E. Rasmusen, Games and Information: An Introduction to Game Theory, 4th Edition, Wiley-Blackwell, 2006
7) M. J. Osborne, A. Rubinstein, A Course in Game Theory, MIT Press, 1994

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The skills acquired will be necessary for employees working in the fields of developing (programming) and usage of multimedia applications.

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Lecture		The level of theoretical knowledge and skill acquisition		Summative written exam (theoretical topics, solving problems)		E, max 10p, 50%
Laboratory		The level of skill acquisition		Continuous formative assessment Project presentation		P, max 10p, 50%
10.4 Minimum required performance criteria						
Obtaining a minimum grade of 5 for the written exam and for the assessment of the applied activities						

Date of filling in: 27.03.2023

Applications responsible
Șl. dr. ing. Paul FARAGÓ

Lecture responsible
Șl. dr. ing. Paul FARAGÓ

Date of approval in the Department of

Head of Department
Prof. dr. ing. Sorin HINTEA

Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology

Dean

Prof. dr. ing. Ovidiu-Aurel POP