SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Automation and Computer Science
1.3	Department	Automation Department
1.4	Field of study	Systems Engineering
1.5	Cycle of study	Research Master's
1.6	Program of study/Qualification	Cyber Physical Systems
1.7	Form of education	Full time
1.8	Subject code	9.00

2. Data about the subject

2.1	Subject name			Operating Systems and Networks in Cyber-Physical Systems	
2.2	Course responsible/lecturer			Assoc. prof. Enyedi Szilárd – Szilard.Enyedi@aut.utcluj.ro	
2.3	Teachers in charge of seminars			Assoc. prof. Enyedi Szilárd – Szilard.Enyedi@aut.utcluj.ro	
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment	E
2.7 Subject category	Formative category				DA
	Optionality				DI

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	1	3.3 Project	0
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	14	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	20
(b) Supplementary study in the library, online and in the field	20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	13
(d) Tutoring	2
(e) Exams and tests	3
(f) Other activities	0

3.8 Total hours of individual study (sum (3.7(a)…3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	-
4.2	Competence	Computer usage basics.

5. Requirements (where appropriate)

5.1	For the course	-
5.2	For the applications	Laboratory attendance is mandatory.

6. Specific competences

Professional competences	**C3** Innovative design of complex control systems, industrial networks and related hardware and software components, using domain-specific tools. **C3.1** Identification and description of advanced techniques, methods, methodologies and technologies for the analysis, design and implementation of computer applications based on programmable equipment and embedded systems. **C3.2** The use of concepts, principles, techniques, methodologies and advanced technologies of analysis, design and implementation of computer applications based on programmable equipment and embedded systems. **C3.3** The creation and use of new solutions appropriate to the context for the realization of IT application projects based on programmable equipment and embedded systems. **C 3.4** Comparative evaluation, including experimental, of solution alternatives for optimizing the performance of IT applications based on programmable equipment and embedded systems.
Cross competences	**CT1** Demonstrating knowledge of the economic, ethical, legal and social context of exercising the profession for identifying tasks, planning activities and opting for responsible decisions, culminating in the conception, drafting and presentation of a scientific paper. **CT2** Clear and concise description of the activity flow, tasks and results in the domain, obtained either by assuming the role of leader / project head or as a member of a research team, thanks to: the ability to synthesize information in the field, global overall vision, communication skills with collaborators, the ability to define activities by stages.

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

7.1	General objective	The general objective of this course is transmitting the basic notions with respect to installing and maintenance of operating systems and networks for CPS.
7.2	Specific objectives	The students will learn: • methods to install, optimize and secure operating systems in CPS; • techniques to configure and maintain networks for CPS.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Operating systems: Introduction.	2	Presentation and reading from course notes and references, questions and answers face-to-	
Systems at cloud, fog, edge levels.	2		
Servers, embedded computers and sensors.	2		
Operating systems variants for CPS.	2		
Package management solutions for applications.	2		
Accounts and permissions.	2		
Optimizing for performance or for low consumption.	2		

File systems.	2	face and online, case studies.	
Accessing the network.	2		
Securing the collected, stored and transmitted data.	2		
Optimizing the network connection for easy access or for data protection.	2		
Automating operations with scripts.	2		
Availability of operating systems in CPS.	2		
Virtualization. Containerization.	2		

Bibliography

1. Nardelli, P.H.J. *Cyber-Physical Systems: Theory, Methodology, and Applications*; Wiley : IEEE Press: Hoboken, NJ, 2022; ISBN 9781119785194
2. Miclea, L.; Enyedi, S.; Vălean, H.; Fărcaș, F.; Damian, M. *Sisteme de operare și rețele pentru începători RH8+W2K*; U. T. Press: Cluj-Napoca, 2005; ISBN 9789736621550
3. *Cyber-Physical System Design with Sensor Networking Technologies*; Zeadally, S., Jabeur, N., Institution of Engineering and Technology, Eds.; IET control engineering series; The Institution of Engineering and Technology: London, United Kingdom, 2016; ISBN 9781849198240
4. *Cyber-Physical Systems. a Comprehensive Guide*; Sharma, N., Awasthi, L.K., Mangla, M., Sharma, K.P., Kumar, R., Eds.; Chapman & Hall/CRC cyber physical systems; First edition.; Chapman & Hall/CRC Press: Boca Raton, 2022; ISBN 9781032065489 9781032065465
5. Tanenbaum, A.S.; Feamster, N.; Wetherall, D. *Computer Networks*; Sixth edition, global edition.; Pearson: Harlow, United Kingdom, 2021; ISBN 9781292374062.

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
Installing operating systems for CPS.	2	Documentation reading, presentation and exemplification, individual exercises on the computer, problem solving within a team.	
Managing the application packages.	2		
Permissions and access.	2		
Configuring network access.	2		
Configuring services.	2		
Virtualization and containerization.	2		
Optimizing and securing the system and the network access.	2		

Bibliography

1. Nardelli, P.H.J. *Cyber-Physical Systems: Theory, Methodology, and Applications*; Wiley : IEEE Press: Hoboken, NJ, 2022; ISBN 9781119785194
2. Miclea, L.; Enyedi, S.; Vălean, H.; Fărcaș, F.; Damian, M. *Sisteme de operare și rețele pentru începători RH8+W2K*; U. T. Press: Cluj-Napoca, 2005; ISBN 9789736621550
3. *Cyber-Physical System Design with Sensor Networking Technologies*; Zeadally, S., Jabeur, N., Institution of Engineering and Technology, Eds.; IET control engineering series; The Institution of Engineering and Technology: London, United Kingdom, 2016; ISBN 9781849198240
4. *Cyber-Physical Systems. a Comprehensive Guide*; Sharma, N., Awasthi, L.K., Mangla, M., Sharma, K.P., Kumar, R., Eds.; Chapman & Hall/CRC cyber physical systems; First edition.; Chapman & Hall/CRC Press: Boca Raton, 2022; ISBN 9781032065489 9781032065465

5. Tanenbaum, A.S.; Feamster, N.; Wetherall, D. *Computer Networks*; Sixth edition, global edition.; Pearson: Harlow, United Kingdom, 2021; ISBN 9781292374062.

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

The course is essential in cyber-physical systems and familiarizes students with the most used operating systems and networks for CPS. The theoretical knowledge and the applications presented develop the students' ability to install, configure and manage the operating systems and networks found in computing systems in most engineering fields that have a tangent to cyber-physical systems. The material is continuously adapted to the requirements of potential employers and to the feedback of already employed graduates.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Questions from the material presented at the course.	Written exam / online exam using Teams/Moodle.	50%
10.5 Seminars /Laboratory/Project	Theoretical and practical questions from the material presented at the laboratories.	Written/online laboratory project / colloquium using Teams.	40%
10.6 Minimum standard of performance			
Mark M>=5, M=0, 5*E+0,4*C+ 0,1*p, where E= exam (minimum result 50%), C=colloquium (minimum result 50%), p=course attendance.			

Date of filling in: 16.03.2023		Title Surname Name	Signature
	Lecturer	Assoc. prof. dipl. eng. Szilárd ENYEDI, PhD	
	Teachers in charge of applications	Assoc. prof. dipl. eng. Szilárd ENYEDI, PhD	

Date of approval in the Automation Department
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Head of department
Prof. dipl. eng. Honoriu VĂLEAN, PhD

Date of approval in the Faculty of Automation and Computer Science

Dean
Prof. dipl. eng. Liviu MICLEA, PhD

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