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. File systems.	2	Presentation and reading from course notes and references, questions and answers face-to-face and online, case studies.	
Systems at cloud, fog, edge levels.	2		
Virtualization. Containerization.	2		
Package management solutions for applications.	2		
Servers, embedded systems and IoT platforms.	2		
Accounts and permissions. Public and private keys.	2		
Systems interconnection model. Solutions for addressing.	2		
Accessing the network.	2		

Securing the network.	2		
Optimizing the network.	2		
Network media.	2		
Power delivery in the network.	2		
Decentralized solutions.	2		
Case-specific networks and operating systems.	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.; Fărcaş, F.; Damian, M. *Sisteme de operare şi reţele 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. Servers, virtualization, containerization. File systems.	2	Documentation reading, presentation and exemplification, individual exercises on the computer, problem solving within a team.	
Embedded operating systems. Operating systems for microcontrollers.	2		
Permissions and access. Key based authentication.	2		
Network layers. Addresses and names.	2		
Network media. Copper and fiber. Wired and wireless networks. Communications in IoT and CPS.	2		
Power delivery in networks. Power economy in IoT.	2		
Decentralized solutions.	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.; Fărcaş, F.; Damian, M. *Sisteme de operare şi reţele 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 conceive, design, 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:		**Title Surname Name**	**Signature**
16.06.2024	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 _____	Head of department Prof. dipl. eng. Honoriu VĂLEAN, PhD
Date of approval in the Faculty of Automation and Computer Science _____	Dean Prof. dipl. eng. Mihaela Dinsoreanu, PhD