Subject programme

1. Subject name / subject module: **Real-time operating system**
2. Lecture language: **English**
3. The location of the subject in study plans**:**
   - Area or areas of the studies: **Computer Engineering and Mechatronics**
   - Degree of the studies: **1st degree studies**
   - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **Institute of Informatics and Mechatronics**
   - The person responsible for the subject: **Danel Roman, dr inż.**
   - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method:

Teaching activities with the tutor																						
Mode of study	Form of classes																					Total
		SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				24	28	2																2
Part-time studies																						
Credit rigor				Graded assignment																		

6. Student workload – ECTS credits balance:

   1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work

Activity (please specify relevant work for the subject)	**Hourly student workload (full-time studies/part-time studies)**
Participation in lectures	-
Participation in laboratory classes	24
Preparation to laboratory classes	16
Independent study of the subject	8
Participation in an exam / graded assignment	-
Total student workload (TSW)	52
ECTS credits	2
* Student's workload related to trainings	52
Student's workload in classes requiring direct participation of academic teachers	24

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:
   - Recommended admission requirements – none.
   - Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence:

Specific learning outcomes for the subject		**Form**	**Teaching method**	**Methods for testing of (checking, assessing) learning outcomes**
Outcome symbol	**Outcome description**			
Knowledge				
K_W04	**Student has basic knowledge in the field of operating systems, its architecture and features and components. Student understands basic principle of system processes, tools and methods. Student knows the specific tasks and issues of real-time operating systems**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_W06	**Student knows and understands selected specific issues in the field of monitoring and administration of operating systems with focus on RTOS.**			
Skills				
K_U03	**Student has experience with basic tools for monitoring and administration of RTOS.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**

9. Assessment rules / criteria for each form of education and individual grades

0% - 50%	ndst	**80% - 86%**	db
51% - 70%	dst	**87% - 93%**	db+
71% - 79%	dst+	**94% - 100%**	bdb

Activity	Grades	Calculation	To Final
Tasks done during laboratory classes	dst, db, bdb, db (3,4,5,4)	arithmetic mean (3,4,5,4) * 90%	3,6
Attendance	on 70% of all classes	70% * 5 -> 3,5 * 10%	0,35
Final result			3,95
Grade		3,95/5 = 79%	**db (4.0)**

10. The learning contents with the form of the class activities on which they are carried out (Laboratory work)

1. Introduction to real-time systems.
2. Introduction to the Building (BR) environment.
3. Advanced BR usage, Introduction to OpenWRT environment.
4. Execute advanced interprocess communication on Linux.
5. QEMU as a system modeling tool. Communication with Linux I/O devices, an essential introduction to driver development.
6. Advanced Linux adaptation techniques for real-time operation.
7. SOC and MPSoC - Real-time engagement utilizing FPGAs tightly integrated with the CPU.
8. Introduction to embedded drivers.
9. Organization of embedded driver software.
10. Design embedded driver software.
11. Sequencing tasks in real-time systems.

11. Required teaching aids

a. Lecture - multimedia projector.

b. Laboratory classes - specialist laboratory.

c. Exercises - a room adapted for conducting classes in the form of exercises / workshops, multimedia projector.

12. Literature:

a. Basic literature:

- Coolin, J.: Real-time Operating Systems Book 1 - Theory. Lindentree Associates: 2019.
- Coolin, J.: Real-time Operating Systems Book 2 - Practice. Lindentree Associates: 2019.

b. Supplementary literature:

- Coolin, J.: Software Engineering for Real-time Operating Systems Volume 1 - Foundations. Lindentree Associates: 2018.
- Coolin, J.: Software Engineering for Real-time Operating Systems Volume 2 - Design and Developing. Lindentree Associates: 2018.

c. Internet sources:

- Real-time operating system (RTOS): Components, Types, Examples. Available at https://www.guru99.com/real-time-operating-system.html

13. Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)

14. Teachers implementing particular forms of education

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Danel Roman, dr inż.
3. Training	
4. Project classes	
5. Workshop classes	