GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Real-time Operating Microsystems, PG_00048672		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Grzegorz Lentka	
	Teachers	dr hab. inż. Grzegorz Lentka mgr inż. Dariusz Palmowski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	4.0	16.0	50

Subject objectives

Getting familiar with application, construction, scalability and portablity of real-time operating microsystems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U07] can apply advanced methods of process and function support, specific to the field of study	Analyses time constrains and selects system kernel type and configuration.	[SU4] Assessment of ability to use methods and tools
[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Student defines terminology: operating system, realtime system, system kernel, multitasking, task, process, thread . Identifies operating microsystems specificity (small hardware resources, application area, task severity, reliability). Explains mutual exclusion and intertask communication techniques.	[SW1] Assessment of factual knowledge
[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Uses non-preemptive operating system for co-operative multitasking. Realizes preemptive operating system with intertsk communication based on messages and kernel services.	[SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>1. Introduction: course outline, course grading, references 2. Basic terminology: operating system, realtime system, system kernel, multitasking, task, process, thread 3. Operating microsystems specificity (small hardware resources, applica-tion area, task severity, reliability). 4. Simultaneous vs. concurrent processing. Getting operating microsystem requirements. 5. System resources (memory, CPU time, interrupts, DMA, I/O ports). Efficient memory management techniques. 6. Problems and methods of resource reservation. Shared resource. Shared resource exclusive access. 7. Task management and scheduling. Scheduler. Examples of realization. 8. Methods of inter-task communication and synchronization. 9. Message usage and servicing: mailboxes and queues. 10. Time dependencies realization: task-level response, calling of task periodically, delaying, external events synchronization, timeouts. 11. Configurability and aided debugging. 12. System scalability and resource usage. 13. Portability of operating microsystems. 14. Source code documenting and portability. 15. Example of simple operating microsystem: RTXtiny, FreeRTOS, eCOS. 16. Example of advanced operating microsystem: uC/OS-II, QNX embed-ded, uClinux.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>No requirements</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Exam</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Lab exercises</td><td>0.0%</td><td>30.0%</td></tr>
<tr><td>Activity/homeworks</td><td>0.0%</td><td>10.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. J. J. Labrosse: MicroC OS II: The Real Time Kernel, Newnes 2002 2. J. J. Labrosse: Embedded Systems Building Blocks, Second Edition: Complete and Ready-to-Use Modules in C, CMP 1999</td></tr>
<tr><td>Supplementary literature</td><td>1. Ed Sutter: Embedded Systems Firmware Demystified, CMP 2002</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Starting and testing of an example of application based on FreeRTOS

Scalling of real-time operating microsystem to application requirements</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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