COURSE DESCRIPTION CARD - SYLLABUS

Course name
Real-time systems [S1AiR1E>SCR2]

Course

Field of study
Automatic Control and Robotics

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

1 Knowledge Student has knowledge in mathematical fields of logic and discrete mathematics necessary to description and analysis of sequential and discrete systems, description of control algorithms and stability analysis of dynamical systems. [K1_W01 (P6S_WG)] Has also systematized knowledge of methods and technics of procedural and object programming. [K1_W10 (P6S_WG)] 2 Skills Is able to obtain information from bibliography, databases and other sources; has the ability to self- educate in order to improve and update professional competences. [K_U01 (P6S_UU)] Is able to document and present the results of an engineering task. Is able to communicate using specialized terminology. Can take part in a debate - present, assess and discuss various opinions and positions. [K_U03 (P6S_UK)] 3 Social competencies The graduate is ready to critically evaluate his or her knowledge. The graduate understands the need for and knows the possibilities of continuous learning - improving professional, personal and social competences, the graduate is able to inspire and organize the learning process of others. [K_K01 (P6S_KK)] The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures. [K_K04 (P6S_KR)]

Course objective

Acquaintance of the basic knowledge about real-time applications and supporting them real-time operating systems

Course-related learning outcomes

Knowledge:
Has a structured knowledge of computer architectures, computer systems and networks and operating systems including real-time operating systems [K1_W9 (P6S_WG)].
Knows and understands to an advanced degree the theory and methods in the architecture and programming of microprocessor systems, knows and understands selected high- and low-level microprocessor programming languages; knows and understands the principle of operation of basic peripheral modules and communication interfaces used in microprocessor systems [K1_W13 (P6S_WG)].
Knows and understands typical engineering technologies, principles and techniques of construction of simple automation and robotics systems; knows and understands the principles of selection of executive systems, computational units and measurement and control elements and devices [K1_W20 (P6S_WG)].
Skills:
Can interpret with understanding the design technical documentation and simple technological diagrams of automation and robotics systems [K1_U2 (P6S_UW)].
Be able to use selected rapid prototyping tools for automation and robotics systems [K1_U13 (P6S_UW)].
Is able to select the type and parameters of the measurement system, control unit and peripheral and communication modules for the selected application and integrate them in the form of the resulting measurement and control system [K1_U22 (P6S_UW)].
Is able to construct an algorithm to solve a simple measurement and control task and implement, test and run it in a selected programming environment on a microprocessor platform [K1_U27 (P6S_UW)].
Social competences:
Is ready to critically assess his/her knowledge; understands the need for and knows the possibilities of continuous training - improving professional, personal and social competence, is able to inspire and organize the learning process of others [K1_K1 (P6S_KK)].
The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratories:
verification of assumed learning outcomes is carried out by:
i. assessment of student"s preparation for individual laboratory exercises (a given series of laboratory exercises is preceded by a test, i.e. the so-called entrance ticket),
ii. continuous assessment, for students group (oral answers), rewarding the increase in the ability to use known principles and methods,
iii. getting extra points for activity during classes, especially for:
i. discusson on additional aspects of the issue,
ii. effectiveness of applying the acquired knowledge for solving a given problem,
iii. comments related to participation
iv. indicating students" perceptive difficulties enabling ongoing improvement of the didactic process

Programme content

Laboratories:
Creating tasks and methods of scheduling them. Study of real-time task scheduling algorithms, multiprocessor scheduling. Principles of creating real-time applications: Real-time systems on the PLC platform.

Course topics

Laboratories:
Concurrent programming

Study of the RMS (Rate Monotonic Scheduling) algorithm
Study of the EDF (Earliest Deadline First) algorithm
Comparison of RMS and EDF algorithms
Study of the LLF (Least Laxity First) algorithm
Study of the MLLF algorithm
Comparison of LLF and MLLF algorithms
Multiprocessor scheduling - EDF and LLF algorithms
Real-time systems on the PLC platform.

Teaching methods

Laboratories: In-depth checking of reports on the exercises carried out. Discussing comments and mistakes. Verification of written software.

Bibliography

Basic
1. Alan Burns, Andy Wellings: Analysable Real-Time Systems: Programmed in ADA. Createspace Independent Pub. 2016.
2. Gupta, A., Chandra, A.K. Luksch, P.: Real-Time and Distributed Real-Time Systems: Theory and Applications. CRC Press, 2016.
3. Chetto, M. (Editor): Real-time Systems Scheduling 1. Fundamentals. J. Wiley & Sons, 2014.
4. Silberschatz, A., Galvin, P.B., Gagne, G.: Operating System Concepts Essentials, 2nd Edition. J. Wiley & Sons, 2010
2. Ben-Ari, M.: Principles of Concurrent and Distributed Programming 2nd Edition, Addison Wesley, 2005..
Additional
1. Cottet, F., Delacroix, J., Mammeri, Z., Kaiser, C.: Scheduling in real-time systems J.Wiley &Sons, 2002.
2. Luca Aceto, Anna Ingolfsdottir, Kim G. Larsen, Jiri Srba. Reactive Systems: Modeling, Specification, and Verification. Cambridge Press, 2007.
3. Buttazzo, G. "Hard Real-time Computing Systems: Predictable Scheduling Algorithms and Applications", Second Edition, Springer, 2005.
4. Jane W. S. Liu: Real-time systems. Pearson, 2000.

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00