COURSE DESCRIPTION CARD - SYLLABUS

Course name
Real Time Systems

Course

Field of study
Automatic Control and Robotics

Year/Semester
4/7

Area of study (specialization)
-

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish/english

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
18

Laboratory classes
18

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
Phd eng. Jarosław Warczyński (9 hours)

Responsible for the course/lecturer:
Phd eng Janusz Pochmara (9 hours)

Prerequisites

The student has knowledge in the field of mathematics including elements of discrete mathematics and logic, necessary for: description and analysis of combinational and sequential logic systems, description of control algorithms and analysis of dynamic systems stability

Has structured knowledge in the field of methodology and techniques of procedural and object-oriented programming.

Is able to obtain information from literature, databases and other sources; has self-study skills to improve and update professional competences. Is able to develop documentation and present presentation of results regarding the implementation of an engineering task.

He is ready to critically assess his knowledge. Understands the need and knows the possibilities of continuous training - raising professional, personal and social competences, is able to inspire and organize the learning process of others. Is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the devices and their elements can function, compliance with the principles of professional ethics and respect for the diversity of views and cultures. Functioning and specificity of time systems.

Course objective

The aim goal of the course is to learn the principles of operation and the specifics of real-time systems, real-time operating systems and to learn the methodology for creating real-time applications and to acquire practical skills in creating real-time applications

Course-related learning outcomes

Knowledge

The student has ordered knowledge of computer architectures, computer systems and networks, and operating systems including real-time operating systems [K1_W9 (P6S_WG)];

Knows and understands the theory and methods in the field of architecture and programming of microprocessor systems at an advanced level, knows and understands selected high and low level programming languages [K1_W13 (P6S_WG)];

knows and understands at an advanced level the construction and operating principles of programmable industrial controllers as well as their analog and digital peripheral systems; knows and understands the principle of operation [K1_W19 (P6S_WG)];

Skills

The student is able to use selected tools for rapid prototyping of automation and robotics systems [K1_U13 (P6S_UW)];

He can choose the parameters and settings of the basic industrial controller and configure and program the industrial programmable controller [K1_U18 (P6S_UW)];

Is able to define and formulate a specification of simple engineering tasks in the field of automation and robotics [K1_U23 (P6S_UW)];

The student is able to design and implement a local teleinformatic network (including industrial) by selecting and configuring communication elements and devices (wired and wireless) [K1_U23 (P6S_UW)]

Social competences

The student is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the devices and their components can function; is ready to comply with the principles of professional ethics and to require this from others, respecting the diversity of views and cultures [K1_K5 (P6S_KR)];

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

a) lectures:

based on answers to questions about the material discussed in previous lectures,

b) laboratories:

based on an assessment of the current progress of task implementation,

Main rating:

a) lectures, verification of assumed learning outcomes is carried out by:

i. assessment of knowledge and skills demonstrated during the written lecture exam

ii. assessment of knowledge and skills based on individual discussion of the results of the written exam (additional control questions),

b) 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

Lecture:

specificity of real-time and critical applications. Requirements for real-time operating systems. Real-time system architectures. Hardware platforms: Process computer, PLCs, microcontrollers. Real-time operating systems. Creating tasks and scheduling methods. Real-time task scheduling algorithms: RMS, EDF, LLF, MLLF, MUF, MMUF. Multiprocessor scheduling. Inter-task communication in the operating system. Messages. Interruption and signal handling. Time service. Process synchronization. Rules for creating client / server applications. Basic functions of real-time system administration. Rules for creating real-time applications. Examples of real-time operating systems: QNX system, ECOS system, VxWorks system.

Laboratories: Creating tasks and methods for their ranking. Research on real-time task scheduling algorithms: RMS, EDF, LLF, MLLF, MUF, MMUF. Multiprocessor scheduling. Rules for creating real-time applications: Real-time systems on the PLC platform

Teaching methods

Lectures - a lecture with a multimedia presentation (including drawings, photos, animations, films) supplemented by examples given on the board, taking into account various aspects of the issues presented. Presenting a new topic preceded by a reminder of related content known to students in other subjects,

Laboratories: Programming real-time applications, using system schedulers simulators. The use of PLC controllers and microcontrollers.

Bibliography

Basic

1. Alan Burns, Andy Wellings: Analysable Real-Time Systems: Programmed in ADA. Createspace Independent Pub. 2016.2.

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.

2. Kwiecień, A., Gaj, P. (Red.): Współczesne problemy systemów czasu rzeczywistego. WNT, Warszawa, 2004

3. Silberschatz, A., Galvin, P.B., Gagne, G.: Podstawy systemów operacyjnych. WNT, Warszawa 2006.

4. Szymczyk, P.: Systemy operacyjne czasu rzeczywistego. Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków, 2003.

Additional

1. Cottet, F., Delacroix, J., Mammeri, Z., Kaiser, C.: Scheduling in real-time systems J.Wiley & Sons, 2002.

2. Ułasiewicz J.: System czasu rzeczywistego QNX Neutrino. Wyd. BTC Legionowo, 2007.

3. Sacha, K.: Systemy czasu rzeczywistego. PW, Warszawa, 1998.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	36	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	89	3,5

[1] delete or add other activities as appropriate