SYLLABUS

Name: ***Distributed Industrial Computer Systems (InfAAu>SI6DICS19)***
Name in Polish:
Name in English: ***Distributed Industrial Computer Systems***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

EGZ

Language:

English

Course homepage:

https://platforma2.polsl.pl/rau2/course/view.php?id=271

Short description:

The primary goal of the DICS course is to acquire skills in the basic practical design and application of industrial, distributed computer systems and their components, including the appropriate selection of devices, networks, and protocols, as well as the fundamentals of programming and engineering problem-solving. It enables students to properly design systems, understand, and resolve potential problems. An additional goal is to enhance soft skills relevant to engineering work.
Form of classes: contact

Description:

ECTS: 2
Total number of hours: 60 (30 contact hours, 30 students' own work hours)
Laboratory: 30h
Students' own work: preparation for classes, elaboration of measurement results, drafting reports, preparation for the exam.
This course examines IT systems operating within and between OT and IT, and provides an introduction to advanced industrial IT systems. It addresses system design and implementation based on specifications and requirements analysis. It covers Industry 4.0-related topics such as digitalization, the use of OT/IT applications and systems, cybersecurity, local system integration, cyber-physical systems, IT system models used in factories, real-time communication, and more.
A strong emphasis is placed on the design and subsequent implementation of industrial information systems for visualization, reporting, monitoring, and control of industrial facilities. Practical exercises highlight the hardware and software components of industrial distributed systems, emphasizing their heterogeneity, complexity, multithreading, and the interdisciplinary nature of the design and implementation process. Conducting the experiments requires extensive computer science knowledge acquired in lectures (computer programming, controller programming, creating and managing distributed real-time components, databases, system software, networks configuration), which allows for the consolidation of this knowledge and the acquisition of appropriate skills. This also requires the acquisition of skills in properly building and managing design and implementation teams, as well as harmonious collaboration within and between groups. Laboratory exercises prepare students for practical engineering activities and the challenges associated with building, implementing, operating, and maintaining distributed information systems used in industry.

Laboratory (experimental classes)
The topics of the laboratory exercises concern:
1. Methods and ways of constructing systems and programming devices
2. Building distributed structures based on controllers and industrial networks
3. Time flow analysis of data
4. Configuring the system nodes
All laboratory exercises are based on the most modern equipment of renowned companies (Siemens, Beckhoff, GEFanuc, Moeller).

Bibliography:

Subject-oriented monographs (available from the Silesian University of Technology Library https://opac.bg.polsl.pl/):
Wybrane zagadnienia projektowania systemów informatyki przemysłowej / Piotr Gaj. - Gliwice : Silesian University of Technology Press, 2016.
Analiza przepływu informacji w komputerowych sieciach przemysłowych / Andrzej Kwiecień ; Politechnika Śląska. Instytut Informatyki. - Wyd. 2 rozsz. - Gliwice : Wydawnictwo Politechniki Śląskiej : Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, cop. 2013.

Scientific articles on the subject (available in the e-resources of the Silesian University of Technology https://www.bg.polsl.pl/ebazy/listaebaz_s3.html)

Thematic literature available online.
IEEE Xplore: https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=Distributed%20Industrial%20Systems%20Networked%20Informatics
Springerlink: https://link.springer.com/search?query=Distributed+Industrial+Systems+Networked+Informatics

Additional literature.
1. Wilamowski B. M. and Irwin J. D., "Technologies" in The Industrial Electronics Handbook: Industrial Communication Systems, 2nd ed. CRC Press, 2011
2. Piotr Gaj, "Wybrane zagadnienia projektowania systemów informatyki przemysłowych", Studia Informatica vol. 37, number 4B (128), Gliwice 2016
3. Popp M., Weber K.: „The rapid way to Profinet"; PNO 2004
4. EPSG Draft Standard 301, Ethernet POWERLINK Communication Profile Specification Version 1.1.0. EPSG 2008
5. IEC, "Industrial communication networks - fieldbus specifications," in International Standard IEC 61158-x, 3rd ed. IEC, August 2010.
6. Kwiecień Andrzej: „Analiza przepływu informacji w komputerowych sieciach przemysłowych"; Studia Informatica z. 22, Gliwice 2002 lub WPKJS Gliwice
7. Kwiecień Roman „Komputerowe systemy automatyki przemysłowej" Helion 2012
8. Maczyński Andrzej, „Sterowniki programowalne PLC. Budowa systemu i podstawy programowania"
9. Solnik Włodzimierz, Zajda Zbigniew "Sieci przemysłowe Profibus DP i MPI w automatyce", Wyd. Politechniki Wrocławskiej

10. Mystkowski Arkadiusz, „Sieci przemysłowe PROFIBUS DP i PROFINET IO”

Learning outcomes:

Course-specific learning outcomes: at the completion of the course, student:
can identify and solve problems in industrial system design at the level of functions with timing constraints and integration with office layers. The student can perform basic data flow analysis in the context of timing characteristics in deterministic and nondeterministic environments. The student can select appropriate hardware and software components and tools and methods for system implementation: K1A_U01.

Assessment methods and assessment criteria:

According to SUT regulation laboratory exercises are obligatory.
Verification of learning outcomes is on the basis of reports from laboratory exercises and the final exam.
To complete the laboratory exercises, the knowledge provided in semester 5 during the lecture series is necessary.
Completion of the course based on laboratory reports and the exam. The 6th semester grade (FG6) is an arithmetic mean of all laboratory exercises. All grades can be adjusted by student activity assessed individually by observation and oral responses.
Final course grade (FCG) is calculated as follows:
FCG = 0,75 *FG6 + 0,25*exam
The exam takes place during the semester 6 exam session.
Exam waiver is possible based on the test grade from 5th semester.
The final exam may be re-taken twice, during the exam session.
Completion of a course when all of the following conditions are met:
* 100% attendance at laboratory classes,
* the final grade (FG6) is greater than or equal to 3.0,
* the exam grade (FC6) is higher or equal to 3.0,
* the requirements of the cycle are met, if any.
The syllabus is valid from the academic year 2025/2026, and its content is not subject to change during the semester.

Practical placement:

not applicable

Course credits in various terms:

Informatics, full-time first degree engineering studies 7 sem. (InfAAu-SI7)

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	2	2020/2021-L	