COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electronic systems of flying vehicles [S2AiR1E-ISLiSA>EUOL]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/2

Area of study (specialization)
Smart Aerospace and Autonomous Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge: before taking this course, each student should poses basic knowledge in mathematics, physics, electrical engineering and electronics. Skills: student should possess the ability to solve basic problems regarding the simple electrical and electronic circuits, should also possess basic utilization skills in simulation software, as well as the ability to acquire additional information from various sources. Social competencies: the prospective student should be ready for team work activities during the course. Additionally, one should present following social skills: honesty, responsibility, persistence, curiosity and creativity.

Course objective

- Extension of students' knowledge in the scope of design and testing of electronic systems. - Introduction to the design of selected electronic systems used in flying objects. - Introduction to a PCB design software and simulation of electronic circuits. - Development of the ability to work in small teams.

Course-related learning outcomes

Knowledge
1. Extensive and in-depth knowledge in selected areas of mathematics useful for formulating and solving

complex tasks in the field of control theory, optimizing, modelling, identifying and processing signals.
2. Understands methods employed to design specialized analog and digital electronic systems.
3. Theoretical detailed knowledge related to control systems and control and measuring systems.
4. Well-established detailed knowledge of specialized microprocessor systems designed for control systems and measurement systems.
Skills
1. Ability to evaluate information from literature, databases and other information sources (in Polish and English).
2. Language skills at B2+ level related to automatics and robotics in accordance with the requirements set out for level B2+ Common European Framework of Reference for Languages.
3. Ability to select and integrate elements of a specialized measuring and control system, including a control unit, an execution system, a measuring system as well as periferal and communication module.
4. Ability to propose improvements (enhancements) to existing design solutions and models of automatics and robotics elements and systems.
5. Ability to develop an algorithm for solving a complex measurement and computational-control task, and to implement, test and run it in a chosen programming environment on a microprocessor platform.
Social competences
1. Understanding the need to continue self-education and knows the possibilities of further education - raising professional, personal and social competences, is able to inspire and organize self-education of others.
2. Awareness of responsibility for their own work, is able to collaborate and cooperate in a team, and take responsibility for the jointly performed tasks; is able to lead a team, set goals and assign priorities to realize a specific task.
3. Awareness of the necessity to approach technical aspects professionally, to acquaint themselves in detail with documentation and environmental conditons in which devices and elements will operate.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
A) Lectures: Rating is decided upon the written exam (in the form of a printed sheet) consisting of a selection test and calculation tasks. The test comprise from 10 to 20 meritorious questions. Three different answers are provided for every question, where one of them is correct and other two - incorrect. Selection of two correct answers gives 1 point for a question. Each calculation task contains sub-items. Each sub-item, depending on the difficulty, is rated from 1 to 2 points. The rating of a given task is the sum of points of particular sub-items. A final rating FR is obtained according to the rule: FR = TR*0.7+LR*0.3, where TR is a rating received from the written exam, and LR is a final rating received from the laboratory exercises (FR < 3.0 implies negative final mark from the course),
B) Laboratory exercises: Final rating results from the overall quality assessment of the tasks realized by the students (assessment concerns technical quality of the obtained results, quality of the laboratory exercise report, and a defense of the tasks in the form of answers to detailed questions related to meritorious topics covered by the laboratory exercises).

Programme content

The topics of the lectures include an introduction to basic electronic systems of small flying objects.

Course topics

The beginning of the course contains a presentation of specialized measuring equipment necessary for practical electronics work. Next, selected elements of electronic systems will be discussed, including their control and measuring functions. In addition, the methods of measuring and analyzing errors of measuring the analyzed systems and sensors will be presented. Course participants will learn about design methods, technology for making electronic circuits dedicated to applications in flying objects.
Laboratory classes are realized within fifteen 90 minutes meetings, 4 or 6 sub-groups depending on the cardinality of the group. The topics of laboratory classes are divided into four parts.
a) The subject of the first part is: getting acquainted with measuring instruments and techniques used during laboratory classes, introduction to the design of printed circuit boards using EDA software, presentation of the equipment for work stations for assembling electronic components and assembly of the first, simple prepared printed board.

b) In the second part, laboratory exercises are performed on the basic passive and active electronic components, electronic systems, paying attention to their practical application.
c) Part three is a testing of electronic measuring systems used in flying objects such as: barometric height measurements, speed measurements using a Prantl tube, power supply measuring systems, contact and non-contact temperature measurements.
d) In the last part is conducted individual assembly work and testing of the electronic system selected and designed by the students.
As part of the laboratory exercieses design and assembly work are carried out - individual assembly and testing of a simple electronic circuit (exercieses with soldering station).

Teaching methods

Lectures are performed using multimedia presentations illustrated with simulation examples and necessary mathematical calculations on the blackboard.
As part of the laboratory exercises in part a) the presentation of laboratory equipment is carried out, calculations on the board, presentation of the principles of designing printed circuit boards using EDA software.
In parts b) and c) experiments are carried out in teams: connection of the measuring system, carrying out the indicated measurements, processing of measurement results, preparation of the report.
The last part of the laboratories d) is: practical, individual assembly of the electronic system, launch and testing, preparation of technical documentation of the completed project.

Bibliography

Basic
1. Electronic devices : conventional current version, Thomas L. Floyd, Pearson Education Limited, cop. 2014.
2. Electronics: a systems approach, Neil Storey, Pearson Education, 2017.
3. Mechatronics : electronic control systems in mechanical and electrical engineering, William Bolton, Pearson Education Limited, cop. 2015.
4. Aviation Electronics Technician - Basic, NAVEDTRA 14028, 2003.
Additional
1. The art of electronics, Paul Horowitz, Winfield Hill, Oxford University Press 2018.
2. Sensors and Transducers 3rd Edition, Ian Sinclair, Newnes 2001.
3. Aircraft Electrical and Electronic Systems Principles, operation and maintenance, Mike Tooley, David Wyatt, Boca Raton : Routledge : Taylor & Francis Group, 2008.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	53	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	47	2,00