COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrical and electronic systems [S1Lot2-BSP>SEiE]

Course

Field of study
Aviation

Year/Semester
2/4

Area of study (specialization)
Unmanned Aerial Vehicles

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

5,00

Coordinators

mgr inż. Grzegorz Wilczyński

Lecturers

Prerequisites

Knowledge: Basic knowledge of mathematical analysis, electrical engineering, electronics and metrology. Skills: Uses laws of electrical engineers to analyze electric and electronic circuits of direct and alternating current. Have basic skills to using simulation software and efficiently obtain additional information from various sources. Social competences: understands the need to improve their qualifications and is ready to work in a team.

Course objective

Getting to know a construction and operation of basic electrical and electronic systems used in flying objects, especially in unmanned aerial vehicles. Acquiring ability to analyze and design, build and test electrical and electronic systems.

Course-related learning outcomes

Knowledge:
1. has detailed knowledge related to selected issues in the field of construction of manned and unmanned aircraft, in the field of on-board equipment, control systems, communication and recording systems, automation of individual systems, has basic knowledge of flight simulation training devices and simulation methods used to solve air transport issues

2. has detailed knowledge related to selected issues in the field of construction of aircraft propulsion systems and design of their components
3. has basic knowledge in the field of generating and processing signals in the form of currents, voltages and electromagnetic fields

Skills:
1. is able to obtain information from various sources, including literature and databases, both in Polish and English, integrate it properly, interpret and critically evaluate it, draw conclusions, and comprehensively justify the opinions formulated by him/her
2. is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them
3. is able to communicate using various techniques in a professional environment and other environments using a formal record of construction, technical drawing, concepts and definitions of the scope of the field of study studied

Social competences:
1. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of malfunctioning engineering projects that have led to serious financial and social losses or to serious loss of health or even life
2. is able to think and act in an entrepreneurial manner, including finding commercial applications for the system being created, taking into account not only the business benefits but also the social benefits of the conducted activity

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture
Assessment of knowledge and skills demonstrated in a written test of a test and calculus nature (the written test sheet contains information necessary to perform calculus tasks). The test pass threshold is 50%. Rewarding the grade from laboratory classes and presence and activity during the lecture.
Laboratory
Entry tests and rewarding knowledge necessary to complete the problems posed in the area of laboratory tasks. Assessment of skills related to the implementation of the measurement task.
Assessment of reports on exercises performed during and after classes.
Assessment of knowledge demonstrated in the written test on the content of laboratory classes (test questions and calculus tasks).
Project
The assessment of the selected electrical and electronic system project is made based on a report on the course of individual phases of its implementation. Additionally, activity and interesting, innovative proposals for solutions to a given problem will be rewarded.

Programme content

Lecture
The lecture topics include an introduction to basic electrical systems of flying objects. The beginning of the course includes a presentation of specialist measuring equipment necessary for practical work with electrical and electronic devices. Then, selected elements of electrical and electronic systems will be discussed, including their control and measurement functions. In addition, methods of measurement and error analysis of the analyzed systems and sensors will be presented. Participants of the course will learn about simulation methods, design and manufacturing technologies of electronic systems dedicated to applications in flying objects. Laboratory classes are carried out during fifteen 90-minute meetings, in 6 subgroups depending on the size of the group. The topics of laboratory classes are divided into three parts.
a) The topics of the first part are: familiarization with the measuring instruments and techniques used during laboratory classes, introduction to the design of printed circuit boards using EDA software, presentation of the equipment of stations for performing assembly work on electronic components and assembly of a simple prepared printed circuit board.

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b) The second part consists of laboratory exercises concerning basic passive and active electrical and electronic components, electronic systems, paying attention to their practical application.
c) The third part is an examination of electronic measuring systems used in flying objects such as: barometric altitude measurements, speed measurements using a Prantl tube, supply current measurement systems, contact and non-contact temperature measurements.
The design part of the subject will be carried out during fifteen 90-minute meetings. During classes, the following activities will be undertaken in sequence.
a) Formulating design tasks, individual or group, depending on the complexity of the problem
b) Presentation of subsequent stages of implementation of selected projects
c) Individual assembly and testing of an electronic system selected and designed by students. individual assembly and testing of a simple electronic circuit ("work with a soldering iron")
d) Preparation of technical implementation documentation

Course topics

Lecture:
1. introduction to basic electrical systems of flying objects
2. presentation of specialist measuring equipment necessary for practical work with electrical and electronic devices
3. Discusse of elements of electrical and electronic systems, including their control and measurement functions
4. methods of measurement and error analysis of the analyzed systems and sensors
5. simulation methods, design and manufacturing technologies of electronic systems dedicated to applications in flying objects
Laboratory:
1. familiarization with the measuring instruments and techniques used during laboratory classes,
2. introduction to the design of printed circuit boards using EDA software,
3. presentation of the equipment of stations for performing assembly work on electronic components and assembly of a simple prepared printed circuit board.
4. exercises concerning basic passive and active electrical
5. electronic components,
6. electronic systems, paying attention to their practical application.
7. examination of electronic measuring systems used in flying objects
barometric altitude measurements, speed measurements using a Prantl tube, supply current measurement systems, contact and non-contact temperature measurements.
Project:
1. Formulating design tasks, individual or group, depending on the complexity of the problem
2. Presentation of subsequent stages of implementation of selected projects
3. Individual assembly and testing of an electronic system selected and designed by students.
4. individual assembly and testing of a simple electronic circuit ("work with a soldering iron")
5. Preparation of technical implementation documentation

Teaching methods

1. Lectures are given using multimedia presentations illustrated with examples of simulations and necessary mathematical calculations on the board.
2. As part of laboratory exercises in part a) there is a presentation of laboratory equipment, calculus classes at the board, presentation and presentation of the principles of designing printed circuit boards using EDA software In parts b) and c) subtractive experiments are carried out in teams: connecting the measuring system, carrying out the indicated measurements, developing measurement results, preparing a report
3. The design of electrical and electronic systems is largely performed individually. Presentations by students of the subsequent stages of their work. Practical individual assembly of the electrical, electronic system: start-up and testing, preparation of technical documentation of the completed project.

Bibliography

Basic:
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6. K. Booth, Optoelectronics, WKiŁ, Warsaw, 2001.
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Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	135	5,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	75	3,00