# COURSE DESCRIPTION CARD - SYLLABUS

Course name

Electrical and electronic systems

## Course

Field of study

Aviation

Year/Semester

3/5

Area of study (specialization)

Unmanned aerial vehicles

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

## Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

30

## Number of credit points

8

## Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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## 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 structured knowledge of the specificity of electrical and electronic systems used in aviation technology P6S_WG, L1_W06

2. Understands process of analysis, design and construction of electrical and electronic systems in accordance with the requirements of P6S_WG, L1_W07

3. Knows methods and rules for research and testing of electrical and electronic systems P6S_WG, L1_W06

4. Knows how to process electrical measurement signals provided by various types of tools and measuring device P6S_WG, L1_W015

5. Knows how technological processes of building electrical and electronic systems and their components run. P6S_WG, L1_W061.

### Skills

1. Can build, run and test a simple electrical and electronic system according to the assumptions of P6S_UW L_U03

2. Is able to use industry information sources, including application notes, standards, guidelines in Polish and English. Can read and analyze technical diagrams of electrical and electronic systems P6S_UW L_U01

3. Can use computer tools to design and simulate electrical and electronic systems. P6S_UW L_U03

4. Is able to analyze the tested system, drawing appropriate conclusions, proposing improved and reliable technical solutions. P6S_UW L_U03

5. Can use appropriate methods and algorithms for the processing and analysis of electrical measurement signals. P6S_UW L_U102..

### Social competences

1. is able to look critically at all technical aspects of the designed and constructed system making conclusions motivating to its improvement P6S_KK L_K02

2. is aware of his/her social role, fulfilling duties, formulating and transferring reliable scientific and technical knowledge P6S_KK L_K02

3. knows and can act in a responsible and entrepreneurial way in the field of electrical and electronic engineering, also taking into account the social effects P6S_KK L_K03

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture

Assessment of the knowledge and skills demonstrated in the written test of a test and accounting nature (the written test sheet contains information necessary to perform accounting tasks). The test pass threshold is 50%. Rewarding grades from laboratory classes as well as presence and activity during the lecture.

Lab

Entrance tests and rewarding knowledge necessary to implement the problems posed in the area of laboratory tasks. Assessment of skills related to the implementation of the measurement task. Assessment of reports on the exercises performed during the classes and after their completion. Assessment of the knowledge demonstrated on the written test in the field of the content of the laboratory classes (quizzes and accounting tasks).

Project

Assessment of the design of the selected electrical and electronic system is made basis on a report from course of individual phases of its implementation. Additionally, the activity and interesting, innovative solutions to a given problem will be rewarded.

## Programme content

Lecture

Lecture topics include an introduction to the basic electrical electronic systems of flying objects. The beginning of the course includes presentation of specialized 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. Moreover, methods of measurement and analysis of measurement errors of tested systems and sensors will be presented. The course participants will learn the methods of simulation, design and manufacturing technology of electronic circuits dedicated to applications in flying objects.Abc

Laboratory

Laboratory classes are carried out in fifteen 90-minute meetings, in 6 sub-groups depending on the size of the group. The topics of the laboratory classes are divided into three parts.

a) Topics of the first part include: getting to know with the instruments and measurement techniques used during laboratory classes, introduction to the design of printed circuit boards with the use of EDA software, presentation to the equipment of stands for performing assembly works of electronic components and assembly of a simple prepared printed circuit board.

b) In the second part, laboratory exercises are performed on the basic passive and active electrical and electronic components, electronic circuits, paying attention to their practical application.

c) The third part is the study of electronic measurement systems used in flying objects such as: barometric altitude measurements, speed measurements with a prantel tube, supply current measurement systems, contact and non-contact temperature measurements.

Project

The project parts of the course will be carried out over fifteen 90-minute meetings. The following activities will be undertaken in sequence during the classes.

a) Definition project sentences, individual or group, depending on the complexity of the problem

b) Presentation of the subsequent stages of the implementation of selected projects

c) Performing individual assembly and testing works of the electronic system selected and designed by the students. Individual assembly and testing of a simple electronic circuit ("work with a soldering iron")

d) Preparation of technical documentation of the implementation

## Teaching methods

1. Lectures shall be conducted using multimedia presentations illustrated by simulation examples and the necessary mathematical calculations at the blackboard.

2. Laboratory exercises in part a) there is a presentation of the laboratory equipment, calculations at the blackboard, presentation and presentation of the principles of designing printed circuit boards by means of EDA software

In part b) and c) there are experiments carried out in teams: connection of the measuring system, carrying out the indicated measurements, elaboration of the measurement results, preparation of the report

3. Design of electrical and electronic systems in large part performed individually. Presentation by students of subsequent stages of their work. Practical individual assembly of an electrical and electronic system: start-up and testing, preparation of technical documentation of the completed project.)

## Bibliography

Basic

1. A. Filipkowski, Układy elektroniczne analogowe i cyfrowe , WNT 1993

2. Z. Kulka , M. Nadachowski, Wzmacniacze operacyjne i ich zastosowania cz. 1 i 2 WNT 1983

3. U. Tietze, Ch. Schenk, Układy półprzewodnikowe, WNT, Warszawa 2007

4. J. Zakrzewski, Czujniki i przetworniki pomiarowe, Wyd. Politechniki Śląskiej, Gliwice 2004

5. J. Rydzewski, Pomiary oscyloskopowe, WNT, Warszawa, 2007.

6. K. Booth, Optoelektronika, WKiŁ, Warszawa, 2001.

7. Aircraft Electrical and Electronic Systems Principles, operation and maintenance, Mike Tooley, David Wyatt, Boca Raton : Routledge : Taylor & Francis Group, 2008

Additional

8. J. Jakubiec, J. Roj, Pomiarowe przetwarzanie próbkujące, wyd. Politechniki Śląskiej, Gliwice 2000

9. Denton J. Dailey, Electronic Devices and Circuits, copyright 2001 by Prentice-Hall, Inc., Upper Sadle River, New Jersey 07548, USA. Warszawa 2002.

10. Bibliografia wyszukana przez studenta ze źródeł drukowanych i elektronicznych

11. S. Tumański, Technika pomiarowa, WNT 2007.

12. W. Kester, Przetworniki A/C i C/A: teoria i praktyka, BTC, 2012.

13. W.E. Ciążyński, Rzeczywiste wzmacniacze operacyjne w zastosowaniach, Wyd. PŚ, Gliwice, 2012.

14. B. Carter, R. Mancini, Wzmacniacze operacyjne: teoria i praktyka, BTC, 2011.

15. Ch. Kitchin, L. Counts, Wzmacniacze operacyjne i pomiarowe: przewodnik projektanta, BTC, 2009.

16. Z. Nawrocki, Wzmacniacze operacyjne i przetworniki pomiarowe, Wyd. PWr, Wrocław, 2008.

17. R.A. Pease, Projektowanie układów analogowych: poradnik praktyczny, BTC, Warszawa, 2005.

18. L. Hasse, Zakłócenia w aparaturze elektronicznej, Radioelektronik, Warszawa,1995.

19. Aviation Electronics Technician - Basic, NAVEDTRA 14028, 2003.

20. www.electropedia.org

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 200 | 8,0 |
| Classes requiring direct contact with the teacher | 90 | 3,5 |
| Student's own work (literature studies, preparation for classes, preparation for tests,) [1] | 1100 | 4,5 |

[1] delete or add other activities as appropriate