



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Flying robots [S1AiR1E>PO3-RL]

Course

Field of study

Automatic Control and Robotics

Year/Semester

3/6

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

30

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

The student participating in this course should have good programming skills as well as knowledge in signal processing. A proper knowledge in certain fields mathematics, like linear algebra is required. A student should have the ability to develop and work with basic data acquisition and processing mechanisms. Good social skills, ability to do his/her own research and predispositions to teamwork are required as well. A participant should have adequate respect for safety rules regarding operation of UAVs.

Course objective

The aim of the course is to familiarize students with current solutions in the field of flying robots.

Course-related learning outcomes

Knowledge:

Has a basic knowledge of the handling and use of IT tools for the design, rapid prototyping, simulation and visualisation of automation and robotics systems and for recording the design of mechanical constructions [K1_W10 (P6S_WG)].

Has a comprehensive knowledge of the structures and operating principles of analogue and discrete control systems (open-loop and feedback) and linear and simple non-linear analogue and digital controllers

[K1_W16 (P6S_WG)].

Knows and understands to an advanced degree the structure and principles of operation of programmable industrial controllers, as well as their analog and digital peripheral systems; knows and understands the principle of operation of basic communication interfaces used in industrial control systems [K1_W19 (P6S_WG)].

Knows the methods, techniques, tools and materials used in solving simple engineering tasks in the field of automation and robotics [K1_W23 (P6S_WG)].

Skills:

Can determine and use models of simple electromechanical systems and selected industrial processes, and use them for analysis and design of automation and robotics systems [K1_U11 (P6S_UW)].

Be able to use selected rapid prototyping tools for automation and robotics systems [K1_U13 (P6S_UW)].

Is able to select parameters and settings of a basic industrial controller and configure and program an industrial programmable controller [K1_U18 (P6S_UW)].

Is able to evaluate the suitability of routine methods and tools for designing automation and robotics systems, and select and apply the appropriate method and tools [K1_U24 (P6S_UW)].

Be able to design and implement a local ICT network (including an industrial network) by selecting and configuring communication elements and devices (wired and wireless) [K1_U28 (P6S_UW)].

Social competences:

Is aware of the responsibility for his/her own work and is ready to follow the rules of teamwork and take responsibility for jointly implemented tasks; is able to lead a small team, set goals and determine priorities leading to the realisation of the task; is ready to play a responsible professional role. [K1_K3 (P6S_KR)].

Is ready to prioritise in order to complete a task defined by himself or others [K1_K4 (P6S_KO)].

The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: written exam (verification of theoretical knowledge) in the field of program content, additional activities (presentations, outdoor excursions) for extra points.

Laboratory classes: written reports on consequent exercises and practical projects done during classes

Programme content

Getting acquainted with the construction and principle of operation of multicopter flying platforms including legal regulations accompanying it. Programming small scale semi-autonomous UAVs - handling data link, remote control command protocol and video feed. Developing own projects based on gained skills with UAV.

Course topics

- 1 Introduction to unmanned aerial vehicles. Definitions, classification and division by type of construction, performance and degree of autonomy.
2. Fundamentals of flight mechanics of fixed-wing and multi-rotor drones. Parameters and configurations of multi-rotor platforms, design issues related to the selection of engines, rotors, support frames and power sources.
3. Structure of UAV avionics systems and software architecture of flight controllers. Radio protocols used in drone control and telemetry.
4. Algorithms of flight stabilization of multi-rotor drones, mathematical models of drones, control strategies. Sensory systems and state estimation methods.
5. Legal regulations on the use of UAVs in public airspace.
6. Selected drone applications and intelligent diagnostic systems.

Teaching methods

Lecture with multimedia presentation (including: drawings, photos, animations, sound, films) supplemented with examples given on the board. Discussion during lectures included. Laboratory classes based on

practical exercises on hardware and working on in-flight data.

Bibliography

Basic

1. Drony-teoria i praktyka, Bartkiewicz Bartosz , Kruszewski Patryk , Szczepkowski Marek, Kabe 2016
2. Make : Getting started with drones. Terry Kilby, Belinda Kilby, APN Promie, 2016

Additional

1. Handbook of Unmanned Aerial Vehicles, Kimon Valavanis, George Vachtsevanos, Spinger, 2015

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	5,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,50