COURSE DESCRIPTION CARD - SYLLABUS

Course name

Autonomous aircrafts

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 studies

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

30

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

prof. dr hab. inż. Piotr Skrzypczyński

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Wydział Automatyki, Robotyki i Elektrotechniki

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

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ul. Piotrowo 3A, 60-965 Poznań

Prerequisites

Knowledge: Basic information, introduction to autonomous systems, electronics, mathematics, statistics and probability, construction of an unmanned aerial vehicle, introduction to programming of unmanned systems

Skills: Is able to analyze the interdependencies between the effects and causes of phenomena and events resulting from the laws of physics.

Social competences: Prepared for teamwork.

Course objective

Familiarization with the construction and development of autonomous systems.

Course-related learning outcomes

Knowledge

1. has ordered, theoretically founded general knowledge in the field of technology and various means of air transport, about the life cycle of means of transport, both hardware and software, and in particular about the key processes taking place in them

2. has an ordered, theoretically founded knowledge in the field of engineering graphics and machine construction: technical drawing, object projection, basic principles of engineering graphics, the use of CAD (Computer Aided Design) graphic programs in the construction of machines

3. has detailed knowledge related to selected issues in the field of manned and unmanned aircraft construction, 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

Skills

1. is able to obtain information from various sources, including literature and databases, both in Polish and in English, integrate them properly, interpret them and make a critical evaluation, draw conclusions and exhaustively justify the opinions they formulate

2. can assess - at least in a basic scope - various aspects of the risk associated with a logistics undertaking in air transport

3. is able to design means of transport with appropriate external requirements (e.g. regarding environmental protection)

4. can analyze objects and technical solutions, can search in catalogs and on manufacturers' websites, ready components of machines and devices, including means and devices, assess their suitability for use in their own technical and organizational projects

Social competences

1. understands that in technology, knowledge and skills very quickly become obsolete

2. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of faulty engineering projects that have led to serious financial and social losses, or to a serious loss of health and even life

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

A) In the scope of the lecture, the assumed learning outcomes are verified by passing the test. It has a test form and consists of 31 questions randomly selected from the database of issues discussed during the lecture. 16 points are required to pass. The test is a single choice test and each correct answer to the question is 1 point.

B) In terms of the laboratory, the current progress during the classes will be assessed. Work during the classes will be assessed by the teacher depending on the advancement of the content realized during the classes. The final grade will be a cumulative grade for all completed activities.

B) In terms of the project, a group of students develops a scale autonomous system. The development process will be carried out in the simulator and then on the real platform. The evaluation is determined on the basis of the current progress in the project, the introduction of each subsequent functionality designated for the project results in obtaining a higher rating.

Programme content

1. Introduction to autonomous systems

2. Optical distance sensors (laser scanners, depth / ToF cameras)

3. Three-dimensional visual perception (stereovision, RGB-D cameras)

4. Location (Kalman filter, particle filter)

5. Simultaneous location and construction of the map

6. Representation of the environment - map building algorithms

7. Traffic planning - the basics

8. Traffic planning - advanced methods

9. Vehicle condition sensors

10. Sensory data fusion

11. Control of the base

12. Control - advanced methods

13. Computer vision - basics

14. Machine learning - basics

Teaching methods

A) Lecture: multimedia presentations (slides) illustrated with examples analyzed on the blackboard and program code fragments implementing selected content described during the lecture

B) Laboratory: Classes will be conducted using a problem-solving approach. The student will receive an introduction to the laboratory, where the relationship between the topic of classes and the content of the lecture will be described. Then, with the help of the teacher, he will solve the next problems that will be presented to him.

C) Project: discussing the project tasks and project maturity requirements for each of the assessment thresholds. Weekly project consultations, during which students receive the tutor's support allowing them to continue work on the project, and the progress of work is assessed.

Bibliography

Basic

1. Lentin Joseph, ROS Robotics Projects, Packt Publishing, 2017

2. Computer Vision: Algorithms and Applications (Texts in Computer Science) 2nd ed. 2022 Edition

3. Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner,Autonomous Driving – Technical, Legal and Social Aspects, Springer,Berlin, Heidelberg, 2016

Additional

1. Marc P. Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 2020

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	90	3,5
Student's own work (literature studies, preparation for classes, preparation for tests,) [1]	60	2,5

[1] delete or add other activities as appropriate