COURSE DESCRIPTION CARD - SYLLABUS

Course name
Drone detection and neutralization systems [S1Lot2-BSP>SDiND]

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

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge: 1. Basics of mathematics, chemistry and physics. Skills: 1. Using literature (textbooks, internet), ability to perceive lecture content Social competences: 1. Awareness of the need to deepen engineering knowledge and its place in everyday life.

Course objective

Familiarization with drone detection and neutralization systems

Course-related learning outcomes

Knowledge:
has an extended and in-depth knowledge of mathematics and physics useful for formulating and solving complex technical tasks related to aviation and modeling real problems
has an ordered, theoretically founded general knowledge covering key issues in aerodynamics and body flow
has a structured and theoretically founded general knowledge in the field of key technical issues and detailed knowledge in the field of selected issues related to air transport

Skills:
can obtain information from various sources, including literature and databases, both in Polish and in English, integrate them properly, interpret and critically evaluate them, draw conclusions and exhaustively justify their opinions
can, when formulating and solving tasks related to civil aviation, apply appropriately selected methods, including analytical, simulation or experimental methods

Social competences:
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 serious loss of health and even life
can think and act in an entrepreneurial way, incl. finding commercial applications for the created system, 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: written exam;
project: execution of the Design of the detection and neutralization system for the indicated object;

Programme content

1.detection systems based on:
a) shape detection;
b) sound detection;
c) detecting the communication signal;
2. neutralization systems based on:
a) mesh neutralization;
b) neutralization with the e-m impulse;
c) laser neutralization;
d) neutralization by GPS disturbance;

Course topics

Introduction to counter-drone systems:
Drone definitions and classifications.
Types of threats posed by drones.
Legal basis for the use of counter-drone systems.
Overview of drone detection and neutralization technologies.
Drone detection technologies:
Radar systems: Principle of operation, radar types, range, accuracy, signal analysis.
Acoustic systems: Use of microphones to detect drone sound, sound source localization, spectral analysis.
Optical systems: Visual and thermal cameras, image recognition, object tracking.
Radio systems: Analysis of radio signals emitted by drones and their controllers, identification of communication protocols.
Sensor integration: combining different technologies to increase detection efficiency and reliability.
Drone neutralization technologies:
Signal jamming: Methods of disrupting drone-operator communication, side effects on other devices.
Taking control of a drone: Methods of attacking drone control systems, risk of unforeseen consequences.
Physical defense: Use of netting, water cannons, other means of physically neutralizing drones.
Applications of anti-drone systems:
Protection of critical facilities: Airports, power plants, military facilities, prisons.
Protection of mass events: Concerts, matches, public gatherings.
Military and police applications: Fighting terrorism, crime.
Legal and ethical aspects:
Rights and obligations regarding the use of counter-drone systems.
Privacy and data security issues.

Ethical dilemmas related to drone neutralization.
Planning and implementing counter-drone systems:
Risk assessment and selection of appropriate technologies.
System design and installation.
Testing and maintenance.
The future of counter-drone systems:
New technologies and trends in development.
The role of artificial intelligence.
Challenges and perspectives.

Teaching methods

Lecture: informative (conventional), information transfer in a systematic way

Bibliography

Basic:
1. Drony dla początkujących, Terry Kilby, Belinda Kilby,
2. Drony, Wiktor Wyszywacz,
3. Rozporządzenie wykonawcze UE 2019/945

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50