GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Automation systems and UAV construction, PG_00053255		
Field of study	Systemy automatyki i budowa BSP		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Geodesy -> Faculty of Civil and Environmental Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Burdziakowski	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	15.0	0.0	0.0	60

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	60	15.0	75.0	150

Subject objectives

The aim of the course is to teach and test students' mastery of topics related to the construction of unmanned aerial vehicles and elements of UAV flight automation.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_K02] is ready to solve problems related to the profession of geodesy and cartography engineer and to assess risks and effects of the performed activity	Can identify landing sites, taking into account measurement system errors. Can determine flight time, taking into account external factors. Can identify hazards on a sample flight route.	[SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce
[K6_U04] can use contemporary geodetic instruments, including automation of measurements, data transmission and processing in a computer-instrument system with the use of computer networks	Can identify the components of a UAV. Can programme the basic functions of a UAV. Can configure a UAV for flight. Can operate a GCS.	[SU1] Ocena realizacji zadania
[K6_W01] has knowledge and understands the concepts of physics which allow to use optical and immersive instruments as well as positioning and satellite imaging	Knows and understands the physics of UAV flight. Knows and defines the basic components of a UAV. Knows and understands the construction of cameras used on UAVs.	[SW2] Ocena wiedzy zawartej w prezentacji
[K6_U05] is able to develop a simple algorithm and prepare a simple program in object-oriented language taking into account the geodetic specifics and the specificity of spatial information systems	Can design a simple 3D element for BSP construction. Can perform simple printing of a BSP element.	[SU1] Ocena realizacji zadania

Subject contents	Course content – lecture Definitions, classification, categories, classes Lifting force Principles of operation of UAVs by category Construction materials BLDC motors principle of operation, parameters ESC controllers parameters, principle of operation, control Drive unit and its effective use. Batteries, classification, characteristics Dedicated batteries (used in RTF kits) Safe use of batteries and chargers Charging and chargers - principles, types, construction Radio track components and radio wave propagation IMU, GYRO, BARO - basic sensors Discussion of the IMU/AHRS unit and its impact on UAV behaviour Satellite navigation systems used on UAVs Optical navigation Anti-collision sensors, classification, operating principle, specifications Anti-collision algorithms Procedures in special situations Impact of external factors on UAV flight performance. Errors in measurement systems in planning the take-off, flight and landing of UAVs. Identification of hazards along the flight path. Course content – exercises UAV Programing Course content – laboratory Uav Programing, 3D printing and design.
Prerequisites and co-requisites	

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lab</td><td>80.0%</td><td>50.0%</td></tr>
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</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Wiktor Wyszywacz, Drony, Poligraf Brzezia Łąka, 2, 2021
2. MICHAŁ KĘDZIERSKI, ANNA FRYŚKOWSKA, DAMIAN WIERZBICKI, OPRACOWANIA FOTOGRAMETRYCZNE Z NISKIEGO PUŁAPU, WOJSKOWA AKADEMIA TECHNICZNA, 2014
3. https://ardupilot.org/copter/docs/introduction.html
4. https://www.curtisswrightds.com/applications/platform-experience/unmanned-architecture.html</td></tr>
<tr><td>Supplementary literature</td><td>1. Adam Juniper, The complete guide to drones: choose, build, photograph, race, 30 maja 2018
2. Audronis Ty, Drony. Wprowadzenie, Helion, 2015
3. Daniel Tal, John Altschuld, Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation, Willey, 2020</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Perform basic manoeuvres on the simulator
2. Connect the servo mechanism and programme the gripper operation
3. Install the BSP firmware
4. Review the BSP technology (modules)
5. Present the results of your work
6. Design 3D elements in Fusion 360
7. 3D printing</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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