GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Automation systems and UAV construction, PG_00053255		
Field of study	Geodesy and Cartography		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
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		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Burdziakowski	
	Teachers		

Lesson types and methods of instruction

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 basic topics in the subject are: BSP - introduction and history BS categories, platforms, Propulsion systems, Power sources, Construction and functions of remote control apparatus, On-board computers, Positioning, orientation and navigation systems, BSP anti-collision systems, Navigation and communication devices and their vulnerability to external factors, Ground based flight control station, Camera in flight, Operation, Performance of BSP, Planning for take-off, flight and landing in manual and automatic flight .

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	Knows how to identify landing sites taking into account the error of measurement systems. Be able to determine flight time taking into account external factors Be able to identify hazards along a sample route	[SK5] Assessment of ability to solve problems that arise in practice
[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	Able to design a simple 3D component to build a BSP. Be able to perform a simple printing of a BSP component.	[SU1] Assessment of task fulfilment
[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	Be able to identify the components of the BSP structure. Can program the basic functions of the BSP. Can configure the BSP for flight. Be able to operate the GCS.	[SU1] Assessment of task fulfilment
[K6_W01] has basic 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 BSP flight. Knows and defines the basic elements of BSP construction Knows and understands the construction of the cameras used on the BSP	[SW2] Assessment of knowledge contained in presentation

Subject contents	Definitions, division, categories, classesLift ForceOperating principles of BSP according to CategoryConstruction MaterialsBLDC motors - principles of operation, parametersESC regulators - parameters, principle of operation, controlPropulsion unit and its efficient use.Accumulators, distribution, characteristicsDedicated batteries (used in RTF kits)Safe use of batteries and chargersCharging and chargers - principles, types, constructionRadio path elements and propagation of radio wavesIMU, GYRO, BARO - basic sensoricsIMU/AHRS unit and its influence on BSP behaviourSatellite navigation systems used on BSPOptical navigationAnti-collision sensors, classification, principle of operation, specificationCollision avoidance algorithmsHandling of special situationsInfluence of external factors on BSP flight performance.Errors of measurement systems in the planning of take-off, flight and landing of the BSP.Identification of hazards along the flight path.
Prerequisites and co-requisites	Create a pilot profile at https://drony.ulc.gov.pl/

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory	80.0%	50.0%
Laboratory	80.0%	50.0%

Recommended reading

Basic literature	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
Supplementary literature	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
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

1. Perform basic maneuvers on the simulator
2. Connect the servo and program the griper
3. Install the BSP firmware
4. Review the BSP technology (modules)
5. Present the results of work
6. Design 3D parts in Fusion 360 software
7. 3D printing

Work placement

Flight practice in a simulator. Practice flying in the training BSP (after mastering the maneuvers in the simulator)

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