



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 2021	Academic year of realisation of subject			2023/2024		
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_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		
	[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_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_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		

Subject contents	<p>Definitions, division, categories, classes Lift Force Operating principles of BSP according to Category Construction Materials BLDC motors - principles of operation, parameters ESC regulators - parameters, principle of operation, control Propulsion unit and its efficient use. Accumulators, distribution, characteristics Dedicated batteries (used in RTF kits) Safe use of batteries and chargers Charging and chargers - principles, types, construction Radio path elements and propagation of radio waves IMU, GYRO, BARO - basic sensorics IMU/AHRS unit and its influence on BSP behaviour Satellite navigation systems used on BSP Optical navigation Anti-collision sensors, classification, principle of operation, specification Collision avoidance algorithms Handling of special situations Influence 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.</p>											
Prerequisites and co-requisites	Create a pilot profile at https://drony.ulc.gov.pl/											
Assessment methods and criteria	<table border="1" data-bbox="448 593 1487 696"> <thead> <tr> <th data-bbox="448 593 798 629">Subject passing criteria</th> <th data-bbox="801 593 1141 629">Passing threshold</th> <th data-bbox="1144 593 1487 629">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 633 798 663">Laboratory</td> <td data-bbox="801 633 1141 663">80.0%</td> <td data-bbox="1144 633 1487 663">50.0%</td> </tr> <tr> <td data-bbox="448 667 798 696">Laboratory</td> <td data-bbox="801 667 1141 696">80.0%</td> <td data-bbox="1144 667 1487 696">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory	80.0%	50.0%	Laboratory	80.0%	50.0%
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Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Wiktor Wyszycwacz, Drony, Poligraf Brzezina Łąka, 2, 2021 2. MICHAŁ KĘDZIELSKI, ANNA FRYSKOWSKA, DAMIAN WIERZBICKI, OPRACOWANIA FOTOGRAOMETRYCZNE Z NISKIEGO PUŁAPU, WOJSKOWA AKADEMIA TECHNICZNA, 2014 3. https://ardupilot.org/copter/docs/introduction.html 4. https://www.curtiswrightds.com/applications/platform-experience/unmanned-architecture.html 										
	Supplementary literature	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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)											