MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN
NON-PROFIT JOINT-STOCK COMPANY
"ALMATY UNIVERSITY OF POWER ENGINEERING AND TELECOMMUNICATIONS NAMED AFTER GUMARBEK DAUKEYEV"
Institute of Communication and Space Engineering

Gumarbek Daukeyev
Energo University

"AGREED"
Director
QAZAQ AIRO LLP
_____R.V. Saifulin
"___"_____2025

"APPROVED"
Rector of AUPET
named after Gumarbek Daukeev
_____G. S. Nygymetov
"___"_____2025

MODULAR EDUCATIONAL PROGRAM
"6B07135 – DRONES AND AUTONOMOUS SYSTEMS"

Heads of the educational program Orazaly Y.Y.
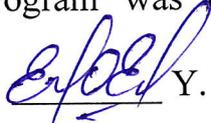
Duration of study - 4 years
Awarded academic degree - Bachelor of Engineering and Technology
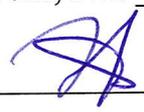Qualification level according to the National Qualifications Framework: Level 6

Almaty 2025

The educational program has been developed in accordance with the laws and regulatory documents of the Republic of Kazakhstan: the State Compulsory Standard of Higher Education, the State Compulsory Standard of Postgraduate Education (Resolution of the Government of the Republic of Kazakhstan dated August 23, 2012 No. 1080), the Model Rules for the Activities of Organizations of Higher and Postgraduate Education (Resolution of the Government of the Republic of Kazakhstan dated May 17, 2013 No. 499), and the Rules for Organizing the Educational Process under the Credit-Based Learning System (Order of the Ministry of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152).

The educational program was developed by the Department of "Space Engineering."
Program Supervisor: Y. Y. Orazaly.

The educational program was reviewed and approved at the meeting of the Department of "Space Engineering" (protocol; No. _9_ dated "_18.04_" 2025 y.).

Head of the Department of SE: _____ S. Tolendiuly

The educational program was reviewed and approved at the meeting of the Academic and Methodological Council of the Institute of Communication and Space Engineering (protocol No. _8_ dated "_29_" _04_ 2025).

Director of ICSE: _____ A. O. Omarbekova.

The educational program was reviewed and approved at the meeting of the Academic Council of AUPET named after Gumarbek Daukeyev (protocol No. _11_ dated "_13_" _05_ 2025).

List of Abbreviations and Acronyms

HE – Higher Education
SCSE – State Compulsory Standard of Education
EQF – European Qualifications Framework
NOC – National Occupational Classifier
RK – Republic of Kazakhstan
NQF – National Qualifications Framework
NQS – National Qualifications System
GEM – General Educational Module
EP – Educational Program
GED – General Education Disciplines
CC – Core Component
UC – University Component
BD – Basic Disciplines
SD – Specialized Disciplines
IET – Individual Educational Trajectory
SQF – Sectoral Qualifications Framework
PS – Professional Standard
PGE – Postgraduate Education
ON – Competencies
LO – Learning Outcome
CW – Course Work
CRW – Calculation and Graphic Work
SRWS – Student Research Work
CED – Catalog of Elective Disciplines

1. Passport Data of the Educational Program "6B07135 – DRONES AND AUTONOMOUS SYSTEM"

№	Field Name	Notes
1	Registration Number	6B07100071
2	Code and Classification of the Field of Education	6B07 – Engineering and Manufacturing Industries
3	Code and Classification of the Field of Training	6B071 – Engineering and Engineering Activities
4	Educational Program Group	B067 – Air Transport and Technologies
5	Name of the Educational Program	6B07135 – Drones and Autonomous Systems
6	Type of Program	New Program;
7	Program Objective	Comprehensive training of a new generation of specialists capable of combining fundamental knowledge in aerodynamics, electronics, software engineering, and artificial intelligence with practical skills in design, digital modeling, piloting, and maintenance of unmanned aerial vehicles and autonomous robotic systems. Graduates will be able to develop innovative solutions for civil, industrial, and environmental applications, lead interdisciplinary teams, and analyze the economic efficiency of projects.
8	Program Mission	The "Drones and Autonomous Systems" educational program trains highly qualified specialists for the design, development, operation, and support of unmanned aerial vehicles (UAVs) and autonomous robotic systems in diverse fields — from agriculture and environmental monitoring to logistics and security. The program integrates a strong foundation in mathematics and physics with specialized courses in electrical engineering, electronics, sensor systems, and control, as well as advanced modules in artificial intelligence, computer vision, navigation, and GIS. Particular emphasis is placed on practical and project-based work: piloting FPV drones, developing hardware and software solutions, ground infrastructure, and addressing ethical and legal aspects of deploying autonomous systems.
9	ISCED Level	ISCED 6 – Bachelor's Degree or Equivalent
10	NQF Level	6
11	SQF Level	6
12	Distinctive Features of the Program	The program is developed based on the Professional Standard: "Geodesy and Cartography." Full-time.
	Partner University (Joint Program)	None
	Partner University (Double Degree Program)	None
13	List of Competencies	ON1 – Ability to formulate scientific problems, plan theoretical and practical research, and select appropriate methods for data collection and analysis. Proficiency in using bibliographic and patent databases, verifying information reliability, and presenting results in a clear manner to both the scientific community and industry partners.
14	Results	ON2 – Ability to make engineering decisions considering market conditions, sustainable development, and

| | | environmental and legal regulations. Skills in analyzing a project's business model, assessing entrepreneurial risks, profitability, and potential societal and environmental impacts of implementing drone technologies.

ON3 – Application of mathematical methods—from linear algebra to statistics—to solve engineering problems. Capability to build analytical and numerical models, calculate system stability, and use optimization techniques. Proficiency in employing programming mathematical libraries for aerodynamics, navigation, and big data analysis.

ON4 – Understanding of key physical processes affecting UAV performance: aerodynamics, mechanics, thermal and electromagnetic phenomena. Ability to conduct calculations validated by experiments and simulations, analyzing the effects of temperature, vibration, humidity, and other factors on component reliability.

ON5 – Design of power circuits, sensor systems, and power electronics; performing simulations and ensuring compliance with standards. Competence in selecting components by power, weight, and cost parameters, calibrating sensors, documenting tests, and ensuring measurement quality and accuracy.

ON6 – Writing modular code in C++ and Python, working with microcontrollers and single-board computers. Conducting hardware-in-the-loop testing, optimizing performance, reducing power consumption, and ensuring software resilience against cyberattacks and failures.

ON7 – Development of real-time data processing systems, training neural networks, and applying compression and model acceleration techniques. Implementing object recognition and tracking algorithms, evaluating their accuracy and reliability, scaling solutions on cloud platforms, and analyzing model performance.

ON8 – Designing and calculating radio channels, selecting suitable modulations, protection codes, and communication protocols for UAV platforms. Considering noise and losses, calculating energy budgets, and implementing encryption, authentication, and interference-resistant systems.

ON9 – Developing control regulators, performing stability and sensitivity analyses, conducting hardware testing on benches, analyzing resulting time diagrams and spectra, and preparing recommendations to improve control and trajectory accuracy.

ON10 – Integrating satellite, inertial, visual, and barometric measurements into a unified navigation system. Designing geospatial data, using maps and GIS to plan routes considering terrain and weather conditions, developing obstacle-avoidance algorithms, and predicting positioning errors.

ON11 – Selecting composites, metals, and polymers based on mechanical properties, corrosion resistance, and cost; calculating mass–center–inertia parameters. Designing |

		frames, fairings, and payload mounts; analyzing thermal conditions and electromagnetic compatibility; selecting power sources and cooling systems. Applying FEA/CFD to optimize structural strength and aerodynamics, planning vibration stand tests and preparing certification documentation. ON12 – Applying systems engineering methods for project management. Using CAD/CAM/CAE tools to create digital twins, defining KPIs, managing schedules, resources, and changes. Coordinating teams, conducting prototype verification, and ensuring reliable operation of UAV systems. **(Appendix 2.1)**
15	Mode of study	Full-time
16	Language of instruction	kazakh, russian, english
17	Total credits	240
18	Awarded academic degree	Bachelor of Engineering and technology
19	License attachment for the field of training	License No. KZ80LAA00018161 Date of license issuance 05.05.2020
20	Program accreditation	None
	Name of accreditation body	-
	Accreditation validity period	-
21	Information on disciplines:	Information on UC/EC GED, BD, and SD **(appendix 2.2)**

2. Matrix of Correlation Between Learning Outcomes of the General Education Program and the Acquired

№	Course Title,	ON1	ON2	ON3	ON4	ON5	ON6	ON7	ON8	ON9	ON10	ON11	ON12
1	Philosophy												
2	Foreign language (scientific English) I												
3	Foreign language (scientific English) 2												
4	Kazakh (Russian) Language 1												
5	Kazakh (Russian) Language 2												
6	Information and Communication Technologies (in English)												
7	Module of Socio-Political Knowledge (Sociology, Political Science)												
8	Physical training												
9	Physical training												
10	Physical training												
11	Physical training												
12	History of Kazakhstan												
13	The module of socio-political knowledge (cultural studies, psychology)												
14	Calculus I			✓									
15	Calculus II			✓									
16	Sustainable Development: Ethics, Inclusion and Safety		✓	✓									
17	Differential equations												
18	Probability theory and elements of mathematical statistics			✓									
19	Physics1				✓								
20	Physics2				✓								
21	Basics of computer drafting												
22	Theoretical Foundations of Electrical Engineering (I)				✓	✓							
23	Theoretical Foundations of Electrical Engineering (II)				✓	✓							
24	Mechanics				✓							✓	
25	Introduction into speciality		✓										
26	Artificial intelligence							✓					
27	Basics of radio communication								✓				
28	Metrology, standartization and sertification					✓						✓	

No.	Course name											
29	Big Data Basics							✓				
30	Automatic control systems						✓		✓			
31	Economics and law, entrepreneurship and financial literacy		✓									✓
32	Object-oriented programming						✓					
33	Flight dynamics				✓							
34	Industrial internship											
35	Navigation systems and GIS							✓		✓		
36	Application of UAV		✓								✓	
37	Fundamentals of scientific research and academic writing	✓										
38	Systems Engineering	✓										✓
39	Machine Learning							✓				
40	FPV drone piloting									✓		
41	Undergraduate practice											
42	Structural materials										✓	✓
43	Fundamentals of microelectronics					✓	✓					
44	CAD/CAM/CAE Design										✓	✓
45	Design of payloads and unmanned vehicle power systems					✓	✓			✓		
46	Electronics and Sensor Systems					✓	✓			✓		
47	Mathematical and computer modeling			✓					✓			
48	Hardware and Software Design					✓	✓					
49	UAV ground maintenance infrastructure		✓						✓			
50	Unmanned Systems Project Management		✓									✓
51	Digital data processing							✓		✓		
52	Computer vision						✓			✓		
53	Aviation law and safety		✓									✓
54	Ethics and legal regulation of UAV		✓									✓
55	Linear algebra			✓								