



Jordan University of Science and Technology

Faculty of Engineering

Department of Aeronautical Engineering

Undergraduate Curriculum for the B.Sc. Degree in Unmanned Aerial Vehicles Technology

2025

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Vision:

To be a leading program in UAV Technology, driving innovation and shaping the future of aerial systems for societal and industrial advancement.

Mission:

To provide high-quality education and hands-on training in unmanned aerial systems, fostering innovation, research, and technical expertise.

Program Objectives:

The educational objectives of the UAV Technology Program at JUST are to produce graduates who:

1. Will demonstrate proficiency in designing, developing, operating, and maintaining advanced UAV systems, including drones and fixed-wing UAVs.
2. Will apply creative and critical thinking to solve complex technical challenges and drive innovation in UAV technologies for diverse applications.
3. Will uphold professional standards, including ethical practices, safety regulations, and environmental considerations, while contributing to the UAV industry.
4. Will engage in lifelong learning, adapt to evolving technologies, and assume leadership roles in advancing UAV systems for industrial and societal benefit.

Study Plan for a bachelor's degree in UAV Technology

Numbering and coding system of courses of the study plan.

Course Coding

A code of three letters and three numbers is given to each course offered by the program, as shown below:

Department			Level/year	Field	Sequence
U	A	V	X	Y	Z

Course Numbering

- The UAV Technology courses are tabulated and numbered in such a manner to recognize each course regarding its subject area, year or level, and semester offered.
- Ex. UAV XYZ: The **UAV** symbol in the course number denotes UAV Technology, and (XYZ) is a 3-digit number as follows:

A. The first digit (X) denotes the yearly level of the course according to the students' study plan as follows:

Code	Level/year
1	First year
2	Second year
3	Third year
4	Fourth year
5	Fifth year

B. The second digit (Y) denotes the course field subject as follows:

Second number	Field
0	UAV Foundations
1	Mechanics and Structures
2	Aerodynamics and Flight Mechanics

3	Electronics and Embedded Systems
4	UAV Sensors, Navigation, and Guidance
5	Control and System Dynamics
6	Propulsion and Energy Systems
7	Maintenance, Safety, Ethics, and Regulatory Frameworks
8	Integration, Testing, and Prototyping
9	Projects, Special Topics & Training

C. The third digit (Z) denotes the course sequence in its subject area (Odd numbers represent the first semester and even numbers represent second-semester courses). Example: UAV 201 means:

UAV	2	0	1
Program	2nd-year level	UAV Foundations	1st-semester sequence/offering

Framework for UAV Technology B.Sc. Degree (135 Credit Hours)

The Bachelor of Science (B.Sc.) degree in Unmanned Aerial Vehicles (UAV) Technology in the Faculty of Engineering at JUST is awarded in accordance with the Statute stated in the JUST regulations for B.Sc. awarding issued by the Deans' Council based on the 1987 adjusted law for awarding scientific degrees and certifications at JUST and after the successful completion of 135 credit hours (C.H.). 135 C.H. are distributed as shown in Table (1).

Table 1: Distribution of credit hours

Classification	Credit hours		
	Compulsory	Elective	Total
University requirements	16	9	25
Faculty requirements	22	0	22
Program requirements	82	6	88
Total	120	15	135

Degree Requirements:**University Requirements (25 Credit Hours)**

Students are required to study a total of 25 credit hours (16 compulsory and 9 electives), as follows:

a- Compulsory University Requirements: (16 Credit Hours)

Table 2: University compulsory courses (16 credit hours)

Course No.	Course title	Credit hours	Theoretical	Practical	Prerequisite or co-requisite
MS 100 ⁽¹⁾	Military sciences	3	3	-	-
ARA 101	Arabic language	3	3	-	-
HSS 110	Social responsibility	3	3	-	-
HSS119	Introduction to Engineering Innovation and Entrepreneurship	2	2	-	-
LG 112	English language 2	3	3	-	LG 99 (Pass) or passing the placement exam with a score of 50%
HSS129	General skills	2	2	-	-

(1) This course is required from Jordanian students only; non-Jordanian students can take a substitute for this course from the university elective courses.

Notice: All non-Arabic speaking students in the university are required to study the following courses shown in Table (3):

Table 3: Courses for non-Arabic Speaking Students

Course No.	Course title	Credit hours	Theoretical	Practical
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ARB 101A	Fundamentals of Arabic Language for non-Arabic speaking students (as a substitute for the course ARB 101)	3	3	-
HSS 110A	Social responsibility (in English) (as a substitute for the course HSS 110)	3	3	-

b- University Elective: (9 Credit Hours)

A total of 9 credit hours is required.

Faculty Requirements: (22 Credit Hours)

The faculty course requirements include a total of 22 credit hours, as shown in Table (4)

Table 4: Faculty of Engineering requirements

Course No.	Course title	Credit hours	Theoretical	Practical	Prerequisite or co-requisite
Math 101	Calculus 1	3	3	-	---
Math 102	Calculus 2	3	3	-	Math 101
Phys 101	General Physics 1	3	3	-	---
Phys 102	General Physics 2	3	3	-	Phys 101
Chem 101	General Chemistry 1	3	3	-	---
NE 114	Programming for Engineers	3	2	2	---
UAV 203	Mathematics for Technology	3	3	-	Math 102
ME 200	Engineering Drawing - A	1	-	3	---
Total		22	20	5	

Program Requirements: (88 Credit Hours)

The course requirements include a total of 90 credit hours divided into two groups:

a) Program Compulsory Courses (82 credit hours): Students have to take 82 credit hours from Table (5):

Table 5: Program compulsory courses (82 credit hours)

Course Number	Course Name	Cr. hr.	Theoretical	Practical	Prerequisite or Co-requisite
AE 204	Solid Modeling	2	-	4	ME 200
AE 214	Strength of Materials	3	3	-	ME 215 (PASS)
EE 212	Electric Circuit Analysis	3	3	-	Phys 102, Pre/Co UAV 203
EE 213	Electrical Circuits Lab	1	-	3	EE 212 (PASS)
EE 321	Electronic Circuits for Non-EE Students	3	3	-	EE 212
EE 322	Electronic Circuits Lab for Non-EE Students	1	-	3	EE 213, EE 321
ME 215	Engineering Mechanics	3	3	-	Phys 101
UAV 201	Introduction to UAV Systems and AI Applications	3	3	-	ME 100, NE 114
UAV 212	UAV Materials and Structures	3	3	-	Pre/Co AE 214, Chem 101
UAV 222	Thermo-Fluids	3	3	-	Chem 101 (PASS) ME 215 (PASS), UAV 203
UAV 262	UAV Power Systems	3	-	6	UAV 201, EE 212
UAV 271	UAV Ethics and Regulatory Frameworks	2	2	-	Pre/Co UAV 201
UAV 313	Strength of Materials and Structural Testing Lab	1	-	3	UAV 212
UAV 321	Aerodynamics for UAVs	3	3	-	UAV 201, UAV 222
UAV 322	Aerodynamics Lab	1	-	3	UAV 321

UAV 331	Digital Logic and Microprocessors	3	-	6	EE 212, NE 114
UAV 332	Embedded Systems and Microcontrollers	3	3	-	UAV 331, EE 321
UAV 341	UAV Avionics and Sensors	3	-	6	UAV 201, Pre/Co EE 321
UAV 342	Guidance, Navigation, and Control (GNC) Systems	3	-	6	UAV 341
UAV 343	Remote Sensing and GIS Applications	3	-	6	UAV 201
UAV 362	UAV Propulsion Systems	3	3	-	UAV 321 (PASS), EE 321
UAV 382	UAV Design and Prototyping	3	-	6	UAV 321
UAV 390	Practical Training*	3	-	40	Completion of 95 credit hours
UAV 412	UAV Airframe Design and Structures	1	-	3	UAV 313, UAV 382
UAV 421	Propulsion Systems Lab	1	-	3	UAV 362
UAV 431	Embedded Systems and Programming Lab	1	-	3	UAV 332
UAV 441	AI-Enhanced Cybersecurity and Communication Systems for UAVs	3	3	0	UAV 342
UAV 443	UAV Communication Systems Lab	1	-	3	Pre/Co UAV 441
UAV 451	UAV Mission Planning	3	-	6	UAV 341
UAV 452	UAV Control Systems	2	2	-	ME 215 (PASS), EE 212
UAV 453	UAV Artificial Intelligence	3	3	-	UAV 341
UAV 454	Autonomous Flight Control Lab	1	-	3	Pre/Co UAV 452
UAV 456	UAV Ground Control Stations Lab	1	-	3	Pre/Co UAV 452
UAV 472	UAV Maintenance and Repair Lab	1	-	3	Pre/Co UAV 452

UAV 482	UAV Payload Integration and Operation Lab	1	-	3	UAV 451
UAV 491	Graduation Project I	1	-	2	Completion of 95 C.H.
UAV 492	Graduation Project II	3	-	6	UAV 491
TOTAL		82	40	130	

*Eight weeks of practical training in an institution working in the field of aeronautical engineering and accredited by the Deanship of the Faculty of Engineering upon the recommendation of the department.

b) Program Elective Courses (6 credit hours): The student should study 6 credit hours from the technical electives listed in Table (6).

Table 6: UAV Technology Technical Electives

Course No.	Course title	Credit hours	Theoretical	Practical	Prerequisite or Co-requisite
UAV 411	Advanced Composites for UAVs	3	3	-	UAV 313
UAV 455	UAV Autonomy and Machine Learning	3	3	-	UAV 341
UAV 458	Advanced UAV Mission Applications	3	3	-	UAV 451
UAV 473	Entrepreneurship in UAV Technology	3	3	-	UAV 201
UAV 474	UAV Safety and Maintenance	3	3	-	UAV 341
UAV 481	UAV Swarm Technologies	3	3	-	UAV 382
UAV 484	Cybersecurity for UAV Systems	3	3	-	UAV 441
UAV 486	UAV Integration with Air Traffic Management	3	3	-	UAV 382
UAV 493A	Special Topics in UAV- A	3	3	-	Completion of 90 Cr. Hr

UAV 493B	Special Topics in UAV - B	2	2	-	Completion of 90 Cr. Hr
UAV 493C	Special Topics in UAV - C	1	1	-	Completion of 90 Cr. Hr

Study Plan for the B.Sc. Degree in UAV Technology

First Year (Preparatory Year)											
First semester						Second semester					
Course No.	Course Name	Credit Hours	Weekly hours		Prerequisite	Course No.	Course Name	Credit Hours	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
HSS129	General Skills	2	2	-	-	ME 200	Engineering Drawing A	1	-	3	-
ME 100	Engineering Workshops	1	-	3	-	NE 114	Programming For Engineers	3	2	2	-
HSS 119 A	Innovation and Entrepreneurship	2	2	-	-	MATH 102	Calculus 2	3	3	-	MATH 101
MATH 101	Calculus 1	3	3	-	-	Eng 112	English Language 2	3	3	-	LG 99 (Pass) or passing the placement exam with a score of 50%
PHYS 101	General Physics 1	3	3	-	-	MS 100	Military Science	3	3	-	-
CHEM 101	General Chemistry 1	3	3	-	-	PHYS 102	General Physics 2	3	3	-	PHYS 101
ARB101	Arabic Language	3	3	-	-						
Total		17	16	3		Total		16	14	5	

SECOND YEAR											
First semester						Second semester					
Course No.	Course name	Total Credit	Weekly hours		Prerequisite	Course No.	Course name	Total Credit	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
UAV 203	Mathematics for Technology	3	3	-	Math 102	AE 204	Solid Modeling	2	-	4	ME 200
EE 212	Electric Circuit Analysis	3	3	-	Phys 102, Pre/Co UAV 203	EE 213	Electrical Circuits Lab	1	-	3	EE 212 (PASS)
UAV 201	Introduction to UAV Systems	3	3	-	ME 100, NE 114	UAV 262	UAV Power Systems	3	-	6	UAV 201, EE 212
UAV 271	UAV Ethics and Regulatory Frameworks	2	2	-	Pre/Co UAV 201	AE 214	Strength of Materials	3	3	-	ME 215 (PASS)
ME 215	Engineering Mechanics	3	3	-	Phys 101	UAV 222	Thermo-Fluids	3	3	-	Chem 101 (PASS) ME 215 (PASS), UAV 203
HSS110	Social Responsibility	3	3	-	-	UAV 212	UAV Materials and Structures	3	3	-	Pre/Co AE 214, Chem 101
						-	University Elective	3	3	-	-
Total		17	17	-		Total		18	12	13	

THIRD YEAR											
First semester						Second semester					
Course No.	Course name	Total credit	Weekly hours		Prerequisite	Course No.	Course name	Total credit	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
EE 321	Electronic Circuits for Non-EE Students	3	3	-	EE 212	UAV 342	Guidance, Navigation, and Control (GNC) Systems	3	-	6	UAV 341
UAV 343	Remote Sensing and GIS Applications	3	-	6	UAV 201	UAV 382	UAV Design and Prototyping	3	-	6	UAV 321
UAV 341	UAV Avionics and Sensors	3	-	6	UAV 201, Pre/Co EE 321	UAV 362	UAV Propulsion Systems	3	3	-	UAV 321 (PASS), EE 321
UAV 321	Aerodynamics for UAVs	3	3	-	UAV 201, UAV 222	UAV 332	Embedded Systems and Microcontrollers	3	3	-	UAV 331, EE 321
UAV 331	Digital Logic and Microprocessors	3	-	6	EE 212, NE 114	UAV 322	Aerodynamics Lab	1	-	3	UAV 321
UAV 313	Strength of Materials and Structural Testing Lab -	1	-	3	UAV 212	EE 322	Electronic Circuits Lab for Non-EE Students	1	-	3	EE 213, EE 321
							University Elective	3	3	-	-
Total		16	6	21		Total		17	9	18	

SUMMER SESSION					
Course No.	Course name	Total credit	Weekly hours		Prerequisite
			Lecture	Lab	
UAV 390	Practical Training	3	-	-	Completion of 95 credit hours
Total		3	-	-	

FOURTH YEAR											
First semester						Second semester					
Course No.	Course name	Total credit	Weekly hours		Prerequisite	Course No.	Course name	Total credit	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
UAV 451	UAV Mission Planning	3	-	6	UAV 341	UAV 412	UAV Airframe Design and Structures	1		3	UAV 313, UAV 382
UAV 441	Cybersecurity and Communication Systems for UAVs	3	3	-	UAV 342	UAV 452	UAV Control Systems	2	2	-	ME 215 (PASS), EE 212
UAV 453	UAV Artificial Intelligence	3	3	-	UAV 341	UAV 454	Autonomous Flight Control Lab	1		3	Pre/Co UAV 452
UAV 443	UAV Communication Systems Lab	1	-	3	Pre/Co UAV 441	UAV 456	UAV Ground Control Stations Lab	1		3	Pre/Co UAV 452
UAV 421	Propulsion Systems Lab	1	-	3	UAV 362	UAV 482	UAV Payload Integration and Operation Lab	1		3	UAV 451
UAV 431	Embedded Systems and Programming Lab	1	-	3	UAV 332	UAV 472	UAV Maintenance and Repair Lab	1		3	Pre/Co UAV 452
	Technical Elective	3	3	-			Technical Elective	3	3	-	
UAV 491	Graduation Project I	1	-	2	Completion of 95 C.H.	UAV 492	Graduation Project II	3	-	6	UAV 491
						-	University Elective	3	3	-	-
Total		16	9	17		Total		16	8	21	

UAV Technology Program Course Description

UAV 201: Introduction to UAV Systems and AI Applications (3 CH) (Pre: ME 100, NE 114)

This course provides a comprehensive introduction to Unmanned Aerial Vehicle (UAV) systems, covering their design, components, and applications. Students will explore the fundamental principles of UAV operation, including aerodynamics, propulsion systems, avionics, and control systems. The course also introduces basic artificial intelligence applications in UAVs, such as data-driven navigation, object detection, and automation support. It further examines UAV regulations, ethical considerations, and the role of UAVs in industries such as agriculture, surveillance, delivery systems, and disaster management. Through hands-on projects and case studies, students will gain practical knowledge and develop essential skills for understanding and working with UAV technologies.

UAV 203: Mathematics for Technology (3 CH) (Pre: Math 102)

This course develops the mathematical skills necessary for solving engineering and technology problems with direct application to UAV systems and related fields. Topics include algebraic operations, functions, complex numbers, and vectors, followed by an introduction to linear algebra (matrices, determinants, eigenvalues, and eigenvectors) and differential equations (first- and second-order equations, systems of differential equations, and basic solution techniques). Applications focus on modeling and analyzing dynamic systems, signal processing, control systems, and mechanical/electrical components. The course emphasizes both analytical problem-solving and the use of computational tools to prepare students for advanced technical courses.

UAV 212: UAV Materials and Structures (3 CH) (Pre/Co AE 214, Chem 101)

This course introduces the fundamentals of materials science and their application to unmanned aerial vehicles (UAVs). Students will explore the properties and behaviors of materials such as composites, alloys, and polymers, with a focus on their suitability for lightweight and high-performance UAV structures. Topics include material selection, structural analysis, and manufacturing techniques tailored for UAV applications. The course emphasizes the relationship between material properties, structural integrity, and design optimization, addressing durability, weight efficiency, and environmental sustainability.

UAV 222: Thermo-Fluids (3 CH) (Pre: Chem 101 (PASS), ME 215 (PASS), Chem 101 (PASS), UAV 203)

This course provides a comprehensive introduction to the basics of thermodynamics, fluid mechanics, and heat transfer, with a focus on their applications in unmanned aerial vehicles (UAVs). Students will learn the fundamental principles of thermodynamics, including the laws of energy conservation, enthalpy, and entropy, and how they relate to UAV propulsion and power systems. Fluid mechanics topics will cover fluid statics, dynamics, and the behavior of airflows, with an emphasis on UAV aerodynamics. The course also explores heat transfer mechanisms (conduction, convection, and radiation) and their impact on the design and operation of UAV thermal management systems.

UAV 262: UAV Power Systems (3 CH) (Pre: UAV 201, EE 212)

This course focuses on the design, integration, and management of electrical systems within UAVs, with a particular emphasis on batteries, energy storage, and power supply systems. Students will learn how to select, design, and integrate energy storage solutions, including batteries, fuel cells, and hybrid power systems, to ensure efficient power delivery to all UAV subsystems. The course also covers power distribution, voltage regulation, and the safety aspects of energy systems for UAV applications.

UAV 271: UAV Ethics and Regulatory Frameworks (2 CH) (Pre/Co UAV 201)

This course examines the ethical considerations and regulatory frameworks governing the use of Unmanned Aerial Vehicles (UAVs). Students will explore topics such as privacy, safety, security, and environmental impact, with a focus on ethical decision-making in UAV design and operations. The course covers international and national regulations, including airspace management, certification requirements, and legal responsibilities for UAV operators. Case studies and discussions will help students understand the implications of UAV technology in various industries, fostering a sense of accountability and social responsibility. By the end of the course, students will be well-versed in navigating the ethical and legal challenges associated with UAV deployment.

UAV 313: Strength of Materials and Structural Testing Lab (1 CH) (Pre: UAV 212)

This laboratory-based course provides practical experience in understanding the strength of materials and the testing of structural components used in engineering applications, with a focus on unmanned aerial vehicles (UAVs). Students will study the behavior of materials under various loading conditions, including tension, compression, shear, and torsion. The course covers essential testing techniques, such as tensile tests, impact tests, fatigue tests, and bending tests, and their application to the design and analysis of UAV structures.

UAV 321: Aerodynamics for UAVs (3 CH) (Pre: UAV 201, UAV 222)

This course focuses on the aerodynamic principles specifically relevant to the design and flight of Unmanned Aerial Vehicles (UAVs). Students will gain a deep understanding of how aerodynamic forces and moments act on UAVs of various configurations (fixed-wing, rotary-wing, hybrid). The course will cover fundamental aerodynamic concepts, including airfoils, wings, propellers, rotors, and aerodynamic forces and moments. Students will learn about the impact of different flight conditions (speed, altitude, angle of attack) on UAV performance. Advanced topics may include computational fluid dynamics (CFD) for UAV design, aerodynamic stability and control, and the effects of atmospheric conditions on UAV flight.

UAV 322: Aerodynamics Lab (1 CH) (Pre: UAV 321)

This laboratory course complements the theoretical concepts learned in Aerodynamics for UAVs. Students will gain hands-on experience with aerodynamic principles through a series of experiments and simulations. The lab will involve the use of wind tunnels, aerodynamic test rigs, and computational fluid dynamics (CFD) software to investigate the aerodynamic characteristics of various UAV components, including airfoils, wings, propellers, and rotors. Students will learn experimental techniques, data acquisition and analysis, and the interpretation of experimental results. This lab will enhance students' understanding of aerodynamic phenomena and their practical application in UAV design.

UAV 331: Digital Logic and Microprocessors (3 CH) (Pre: EE 212, NE 114)

This course provides an in-depth understanding of the fundamental concepts of digital logic and their application in microprocessor-based systems. Topics include number systems, Boolean algebra, logic gates, combinational and sequential circuits, and memory systems. Students will also explore the architecture, programming, and interfacing of microprocessors.

UAV 332: Embedded Systems and Microcontrollers (3 CH) (Pre: UAV 331, EE 321)

This course introduces the fundamental principles of embedded systems and microcontroller programming, with a focus on their applications in UAVs. Students will learn the architecture and operation of microcontrollers, including key components such as processors, memory, input/output interfaces, and sensors. The course covers embedded system design, real-time operating systems (RTOS), and programming techniques using languages such as C and assembly.

UAV 341: UAV Avionics and Sensors (3 CH) (Pre: UAV 201, Pre/Co EE 321)

This course provides a comprehensive overview of the avionics systems and sensor technologies essential for the operation of unmanned aerial vehicles (UAVs). Students will gain a fundamental understanding of the principles and applications of various avionics components, including flight control systems, navigation and guidance systems, communication systems, and power systems. The course will delve into the diverse array of sensors used in UAVs, such as GPS, inertial measurement units (IMUs), cameras, LiDAR, radar, and other specialized sensors. Students will learn about sensor data acquisition, processing, and integration, as well as their role in enabling critical UAV functionalities like autonomous flight, obstacle avoidance, and target detection. Practical applications of UAV avionics and sensors in different domains, including aerial imagery, precision agriculture, surveillance, and search and rescue, will be explored.

UAV 342: Guidance, Navigation, and Control (GNC) Systems (3 CH) (Pre: UAV 341)

This course focuses on the fundamental principles and applications of Guidance, Navigation, and Control (GNC) systems for Unmanned Aerial Vehicles (UAVs). Students will learn about the design, implementation, and analysis of algorithms and techniques that enable UAVs to autonomously navigate and achieve their mission objectives.

UAV 343: Remote Sensing and GIS Applications (3 CH) (Pre: UAV 201)

This course introduces the principles and applications of remote sensing and Geographic Information Systems (GIS) with a focus on their integration with Unmanned Aerial Vehicle (UAV) technologies. Students will explore remote sensing techniques, data acquisition, image processing, and interpretation using UAV platforms. The course covers GIS concepts, spatial data analysis, and visualization, emphasizing practical applications in areas such as agriculture, environmental monitoring, urban planning, and disaster management.

UAV 362: UAV Propulsion Systems (3 CH) (Pre: UAV 321 (PASS), EE 321)

This course provides a detailed study of the propulsion systems used in Unmanned Aerial Vehicles (UAVs). Students will learn the principles of propulsion, including the design, selection, and integration of engines, motors, propellers, and thrusters in UAVs. The course covers the thermodynamics, aerodynamics, and performance characteristics of different propulsion technologies, such as electric, internal combustion, and hybrid systems. Topics include thrust generation, fuel efficiency, system optimization, and noise reduction. Students will also examine power management and the integration of propulsion systems with UAV flight control and power distribution systems.

UAV 382: UAV Design and Prototyping (3 CH) (Pre: UAV 321)

This course delves into the advanced design, analysis, and prototyping of Unmanned Aerial Vehicles (UAVs). Students will explore aerodynamic optimization, structural analysis, propulsion system selection, and payload integration for complex UAV configurations. The course emphasizes iterative design processes, including simulation, prototyping, and testing. Using advanced tools and software, students will design custom UAVs tailored to specific missions, fabricate components, and perform flight testing.

UAV 390: Practical Training (3 CH) (Pre: Completion of 95 credit hours)

Eight weeks of practical training in an institution (university, company, etc.) that is accredited by the aeronautical engineering department and faculty of engineering at JUST for training purposes in the field of aeronautical engineering. The training should be under the supervision of a staff member. Students must submit a report about their achievements during training in addition to any other requirements assigned by the department.

UAV 411: Advanced Composites for UAVs (3 CH) (Pre: UAV 313)

This course focuses on the cutting-edge application of advanced composite materials in the design and manufacture of Unmanned Aerial Vehicles (UAVs). Students will gain in-depth knowledge of high-performance materials, advanced manufacturing processes, and structural analysis techniques specific to UAV applications.

UAV 412: UAV Airframe Design and Structures (3 CH) (Pre: UAV 313, UAV 382)

This course focuses on the design and analysis of airframe structures for Unmanned Aerial Vehicles (UAVs). Students will learn about the principles of structural mechanics, materials science, and computational methods as applied to UAV airframe design.

UAV 421: Propulsion Systems Lab (1 CH) (Pre: UAV 362)

This laboratory course provides hands-on experience with the principles and operation of propulsion systems used in Unmanned Aerial Vehicles (UAVs). Students will gain practical skills in the selection, testing, and analysis of various propulsion systems, including internal combustion engines, electric motors, and fuel cells. The lab will involve the use of test benches, data acquisition systems, and simulation software to evaluate the performance, efficiency, and emissions characteristics of different propulsion systems. Students will learn about experimental techniques, data analysis, and troubleshooting of propulsion systems. This lab will enhance students' understanding of propulsion systems and their integration into UAV designs.

UAV 431: Embedded Systems and Programming Lab (1 CH) (Pre: UAV 332)

Covers programming and interfacing of embedded systems and microcontrollers for UAVs. Students work with real-time operating systems and UAV-specific applications.

UAV 441: AI-Enhanced Cybersecurity and Communication Systems for UAVs (3CH) (Pre: UAV 342)

This course provides an in-depth understanding of the principles and practices required to secure

communication systems used in Unmanned Aerial Vehicles (UAVs). Students will explore the integration of cybersecurity measures with communication technologies, addressing vulnerabilities specific to UAV networks and learning techniques to secure data transmission, prevent unauthorized access, and ensure reliable operation. The course introduces the role of artificial intelligence in strengthening UAV cybersecurity and communication systems, including AI-based threat detection, anomaly monitoring, and adaptive protection strategies. Topics include the design of secure communication architectures and the implementation of advanced cybersecurity protocols to protect UAV operations from a variety of threats.

UAV 443: UAV Communication Systems Lab (1 CH) (Pre/Co UAV 441)

This laboratory course provides hands-on experience in designing, implementing, and testing communication systems for Unmanned Aerial Vehicles (UAVs). Students will gain practical knowledge in various communication technologies, including wireless protocols, antenna design, and signal processing techniques, specifically tailored for the unique challenges of UAV operation.

UAV 451: UAV Mission Planning (3 CH) (Pre: UAV 341)

This course focuses on the principles and techniques of mission planning for Unmanned Aerial Vehicles (UAVs). Students will learn how to design, organize, and execute UAV missions for various applications, including aerial surveying, mapping, delivery systems, and search-and-rescue operations. The course covers key topics such as flight route optimization, payload configuration, airspace management, weather considerations, and risk assessment. Practical sessions include mission simulation, pre-flight preparation, and post-mission analysis to ensure efficient and effective UAV operations. By the end of the course, students will be equipped to plan and execute UAV missions in compliance with safety and regulatory requirements.

UAV 452: UAV Control Systems (2 CH) (Pre: ME 215 (PASS), EE 212)

This course focuses on the design, analysis, and implementation of control systems for Unmanned Aerial Vehicles (UAVs). Students will learn about the fundamental principles of flight control, stability, and maneuverability, as applied to various types of UAVs (fixed-wing, rotary-wing, and hybrid). The course will cover topics such as Aircraft dynamics and control, Stability and control analysis, Control surface actuation, Control system design, Autopilot design, and Simulation and flight testing.

UAV 453: UAV Artificial Intelligence (3 CH) (Pre: UAV 341)

This course introduces the application of Artificial Intelligence (AI) techniques in the operation and control of Unmanned Aerial Vehicles (UAVs). Students will explore machine learning, computer vision, and reinforcement learning algorithms tailored for UAV autonomy, including object detection, path planning, decision-making, and collision avoidance. The course emphasizes the integration of AI with UAV sensors, actuators, and navigation systems to enable autonomous missions in complex and dynamic environments. Through hands-on projects, students will develop AI-driven solutions to enhance UAV performance in tasks such as autonomous flight, object tracking, and environmental monitoring.

UAV 454: Autonomous Flight Control Lab (1 CH) (Pre/Co UAV 452)

This laboratory course focuses on the practical aspects of developing and implementing autonomous flight control systems for Unmanned Aerial Vehicles (UAVs). Students will gain hands-on experience in: Flight Control Principles, Autopilot Software and Hardware, Autonomous Flight Missions, and Safety and Regulations.

UAV 455: UAV Autonomy and Machine Learning (3 CH) (Pre: UAV 341)

This course explores the integration of autonomy and machine learning (ML) techniques in UAV systems, enabling UAVs to perform complex tasks without human intervention. Students will study how UAVs can autonomously navigate, perceive their environment, and make real-time decisions using machine learning algorithms. The course covers key concepts such as path planning, sensor fusion, object detection, and reinforcement learning, equipping students with the tools and techniques to design intelligent, autonomous UAVs capable of executing missions in dynamic environments.

UAV 456: UAV Ground Control Stations Lab (1 CH) (Pre/Co UAV 452)

This laboratory course focuses on the design, development, and testing of Ground Control Stations (GCSs) for Unmanned Aerial Vehicles (UAVs). Students will gain practical experience in building and operating the critical interface between human operators and UAVs, encompassing hardware and software components.

UAV 458: Advanced UAV Mission Applications (3 CH) (Pre: UAV 451)

This course delves into the advanced mission applications of unmanned aerial vehicles (UAVs) across various industries, including agriculture, environmental monitoring, defense, search and rescue, and logistics. Students will explore the integration of UAV systems with specialized sensors, communication networks, and data processing techniques to support complex missions. Topics include autonomous flight operations, mission planning and optimization, payload management, real-time data analysis, and communication systems. The course also covers the design and implementation of mission-specific UAV configurations tailored for diverse applications. Through case studies and hands-on projects, students will gain practical experience in planning, executing, and optimizing UAV missions, focusing on mission success, safety, and operational efficiency.

UAV 472: UAV Maintenance and Repair Lab (1 CH) (Pre/Co UAV 452)

This laboratory course provides hands-on experience in the maintenance and repair of Unmanned Aerial Vehicles (UAVs). Students will learn the essential skills and techniques necessary to inspect, troubleshoot, and repair various UAV components, ensuring safe and reliable operation.

UAV 473: Entrepreneurship in UAV Technology (3 CH) (Pre: UAV 201)

This course explores the entrepreneurial opportunities and challenges within the rapidly evolving Unmanned Aerial Vehicle (UAV) technology sector. Students will gain a comprehensive understanding of the business aspects of developing and commercializing UAV-related products and services.

UAV 474: UAV Safety and Maintenance (3 CH) (Pre: UAV 341)

This course explores the critical aspects of safety protocols and maintenance practices for Unmanned Aerial Vehicles (UAVs). Students will examine UAV safety standards, risk assessment methodologies, and incident prevention strategies, with a focus on regulatory compliance and operational best practices. The course also covers maintenance procedures, including pre-flight and post-flight inspections, troubleshooting, diagnostics, and repair of UAV components. Emphasis is placed on practical skills development through hands-on workshops and case studies to ensure reliable and safe UAV operation. By the end of the course, students will be equipped with the knowledge and skills required for effective UAV safety management and maintenance.

UAV 481: UAV Swarm Technologies (3 CH) (Pre: UAV 382)

This course explores the principles, algorithms, and technologies behind the coordination and operation of UAV swarms. Students will learn how multiple UAVs can work autonomously in a decentralized manner to perform complex tasks such as surveillance, search and rescue, environmental monitoring, and military operations. The course covers the design and implementation of swarm algorithms, communication protocols, and distributed decision-making techniques, with a focus on real-world applications and challenges in swarm robotics.

UAV 482: UAV Payload Integration and Operation Lab (1 CH) (Pre: UAV 451)

This laboratory course focuses on the practical aspects of integrating and operating various payloads on Unmanned Aerial Vehicles (UAVs). Students will gain hands-on experience in: Payload Selection and Integration, Identifying appropriate payloads for specific UAV missions (e.g., cameras, sensors, LiDAR, communication relays), Understanding payload interfaces and compatibility with different UAV platforms, Designing and implementing payload integration solutions, including mounting mechanisms, power systems, and data acquisition systems, Troubleshooting integration challenges and optimizing payload performance, Payload Operation and Data Acquisition, Planning and executing flight missions with integrated payloads, Operating ground control stations and flight planning software, Collecting and managing flight data from various payload sources, Post-processing and analyzing collected data using relevant software tools, Safety and Regulations, Understanding and adhering to relevant aviation regulations and safety protocols for UAV operations with payloads, Implementing safety measures for payload integration and operation, and Conducting pre-flight and post-flight inspections.

UAV 484: Cybersecurity for UAV Systems (3 CH) (Pre: UAV 441)

This course introduces students to the critical field of cybersecurity in unmanned aerial vehicle (UAV) systems, addressing the unique challenges and risks associated with their operation in both commercial and military environments. Topics include secure communication protocols, data encryption, authentication methods, and intrusion detection systems to safeguard UAV operations from cyber threats. Students will study vulnerabilities in UAV hardware, software, and communication networks, exploring techniques for securing control systems, payloads, and sensitive mission data. The course also covers risk management strategies, cyber-attack response protocols, and the legal and ethical considerations of cybersecurity in UAV operations.

UAV 486: UAV Integration with Air Traffic Management (3 CH) (Pre: UAV 382)

This course explores the integration of Unmanned Aerial Vehicles (UAVs) into existing Air Traffic Management (ATM) systems, focusing on the regulatory, operational, and technological challenges of ensuring safe and efficient UAV operations within controlled airspace. Students will learn about the frameworks and protocols used for UAV airspace integration, including detect and avoid (DAA) systems, UAV

traffic management (UTM) systems, and the interaction between manned and unmanned aircraft. The course will also cover safety, security, and communication requirements essential for the seamless operation of UAVs in shared airspace.

UAV 491: Graduation Project I (1 CH) (Pre: Completion of 95 credit hours)

Provides students the opportunity to individually explore an UAV technology problem or issue within their field of study and apply their education to solving the problem for the benefit of the local community and society as a whole. Students produce a short report that documents the application of previous learning, experience, and knowledge to the problem at hand and evaluates the results.

UAV 492: Graduation Project II (3 CH) (Pre: UAV 491)

Students perform the experimental and/or practical phases associated with solving the UAV technology problem addressed in Graduation Capstone Project I. Students produce a full technical report that documents the research, design, results, analysis, and recommendations of the study, followed by a final presentation and defense.

UAV 493A: Special Topics in UAV - A (3CH) (Pre: Completion of 90 Cr. Hr)

This course explores emerging concepts, technologies, and applications in Unmanned Aerial Vehicles (UAVs) beyond the standard curriculum. Topics vary by semester. Title and course contents of the topic must be approved by the Department's Council and pre-announced by the Department of Aeronautical Engineering.

UAV 493B: Special Topics in UAV - B (2CH) (Pre: Completion of 90 Cr. Hr)

This course explores emerging concepts, technologies, and applications in Unmanned Aerial Vehicles (UAVs) beyond the standard curriculum. Topics vary by semester. Title and course contents of the topic must be approved by the Department's Council and pre-announced by the Department of Aeronautical Engineering.

UAV 493C: Special Topics in UAV - C (1CH) (Pre: Completion of 90 Cr. Hr)

This course explores emerging concepts, technologies, and applications in Unmanned Aerial Vehicles (UAVs) beyond the standard curriculum. Topics vary by semester. Title and course contents of the topic must be approved by the Department's Council and pre-announced by the Department of Aeronautical Engineering.