الجامعة التقنية الشمالية

Northern Technical University

بكالوريوس تقنيات هندسة الطائرات المسيرة

Bachelor's degree in Unmanned Aerial Vehicle Engineering Techniques

لجنة الاعداد:

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1. Vision and Mission Statement

Vision:

To be a leader and achieve excellence in teaching and developing drone engineering technologies at the national and regional levels, by preparing qualified and innovative technical personnel capable of keeping pace with technological advancements and meeting labor market demands in the fields of drone design, manufacturing, programming, and safe operation.

Mission:

To provide high-quality technical education in the field of drone engineering and technologies, integrating theoretical knowledge with practical training, and keeping pace with scientific and technological developments, with the aim of preparing graduates qualified to work efficiently in diverse professional environments and capable of contributing to the development of smart and sustainable solutions in this vital field.

The department offers courses in areas such as fundamentals of electrical circuits, control and automation, engineering design, industrial design, advanced manufacturing, and other related fields. The dpartment help the student and encourage them to in all electrical Field Technologies.

2. Graduate Objectives

The field of Unmanned Aerial Vehicle Engineering Techniques is considered one of the modern disciplines that revolves around the design, development, and maintenance of drone devices and equipment used in diagnosis, treatment, monitoring, and analysis. Among the main objectives of the Unmanned Aerial Vehicle engineering techniques department are:

1- To prepare specialized personnel capable of designing, operating, and maintaining drone systems.
2- To develop technical knowledge and skills in the fields of navigation, communications, remote control, and sensing.
3- To support scientific research and innovation in drone technologies and their civil and military applications.
4- To promote the practical uses of drones in fields such as agriculture, reconnaissance, surveillance, and logistics
5- Contributing to community service through the localization of modern technologies and meeting the needs of the labor market.

3. Job Description of Graduates

Graduates of the department possess the necessary theoretical knowledge and practical skills in the design, operation, maintenance, and programming of unmanned aerial vehicle (UAV) systems, in addition to the ability to employ them in modern civil and military applications.

4. Areas of Work and Main Tasks

1- UAV Operation: Piloting and controlling aircraft remotely or via pre- programmed systems.

2- Maintenance and Repair: Diagnosing mechanical and electronic faults, and maintaining propulsion, navigation, and communication systems.

3- Design and Development: Participating in the design of aircraft structures, control systems, and autonomous flight software.

4- Mission Management: Planning and executing aerial missions (surveillance, geographic surveying, aerial photography, smart agriculture, logistics services).

5- Systems Integration: Connecting UAVs with sensor systems, artificial intelligence, and data analysis.

6- Research and Development: Contributing to projects developing UAV technologies and their future applications.

7- Training and Consulting: Qualifying personnel in the operation and maintenance of UAVs and providing technical support to.

5. Job Opportunities for Graduates

1- Drone Manufacturing and Maintenance Companies

2- Research Centers and Universities

3- Security and Military Sectors

4-Logistics and Delivery Companies

5-. Agricultural and Environmental Institutions

6- Aerial Photography, Surveying, and Remote Sensing Companies

6. Scientific and practical description

UAVs Department combines several scientific and engineering disciplines, including:

- **1. Aerodynamics**
  Study of how air flows around the drone to generate lift and control motion. This includes wing design, drag reduction, and flight efficiency.
- **2. Flight Mechanics and Control Systems**
  Designing algorithms and systems that allow drones to stabilize, navigate, and follow commands automatically.
- **3. Robotics and Autonomous Systems**
  Developing intelligent systems so UAVs can perform tasks without continuous human control.
- **4. Sensors and Navigation**
  Using technologies such as:
  GPS
  Cameras
  LiDAR
  Inertial Measurement Units (IMU)
  These sensors allow UAVs to detect their position, environment, and obstacles.
- **5. Embedded Systems and Electronics**
  Designing onboard computers, microcontrollers, and electronic circuits that control motors, sensors, and communication systems.
- **6. Communication Systems**
  Wireless communication between the UAV and the ground control station for telemetry, commands, and data transmission.
- **7. Artificial Intelligence**
  Using machine learning and computer vision for:
  Object detection
  Autonomous navigation
  Smart decision-making.

7. Program Specification

Program code	BCE	ECTS	240
Duration	4 levels, 8 Semesters	Method of Attendance	Full Time

The Unmanned Aerial Vehicle Techniques Engineering Program Specification outlines the knowledge and skills required for individuals who are interested in pursuing a career in the Installing, calibarating and Maintinance of electrical and electronics instruments. The program focuses on developing technical expertise in the areas of Drone Device sector, new techniques, management, and devices maintenance. **The program typically includes a mix of classroom lectures, practical training, and on-site field experience.** Courses may cover topics such as UAV design, installation, calibration, operation, maintenance, autonomous systems, and drone-based applications in various engineering fields

The program also emphasizes the development of technical skills such as electrical circuit designing , computer-aided design (CAD), microcontroler programing, estimating, graduate projects management. Graduates of the program are expected to have the skills necessary to work as team in field of Unmanned Aerial Vehicle.

Some key components of the Drones instrumentation Techniques Engineering program specification may include:

1. **Program Aims and Objectives:**
   Preparing technical engineers with the ability to research the technical fields of electrical power engineering.
2. **Learning Outcomes:** A list of the specific skills, knowledge, and competencies that students are expected to acquire through the program.
3. **Course Structure:** Details on the specific courses that make up the program, including their content, delivery methods, and any prerequisites or co-requisites.
4. **Assessment Methods:** Information on how student performance will be evaluated, including the types of assessments used (e.g. exams, essays, practical assignments) and the weighting of each assessment.
5. **Resources:** An outline of the facilities, equipment, and other resources required to deliver the program effectively.

Overall, a UAV Engineering Techniques Program Specification serves as a guide for educators and institutions to develop and deliver a

comprehensive curriculum that prepares students for careers in the unmanned aerial systems sector

8. Program Goals

The program goals of Unmanned Aerial Vehicle instrumentation technical engineering typically include:

1. **Strengthening the technical aspect** of its graduates by increasing practical units and inconsistently theoretical units.
2. **Qualifying graduates** in accordance with the requirements of the labor market.
3. **Keeping pace with modernity and global development** in programs and study plans, and focusing on the practical aspect.
4. **Work to enhance performance standards** to ensure the application of international standards in the field of electrical and mechanical engineering techniques.

9. Student Learning Outcomes

- Apply principles of **mathematics, physics, and engineering** to analyze UAV systems.
- Understand the fundamentals of **aerodynamics, flight mechanics, and propulsion systems**.
- Explain how UAV structures, materials, and energy systems affect flight by Design different types of UAVs such as **multirotor, fixed-wing, and hybrid drones**.
- Select appropriate **motors, propellers, batteries, and flight controllers**.
- Develop UAV system architectures and integrate hardware components.
- Design and implement **flight control systems** for stability and navigation.
- Develop algorithms for **autonomous flight and path planning**.
- Use onboard sensors for **position estimation and obstacle detection**.
- Program UAV systems using languages such as **C/C++, Python, or MATLAB**.
- Work with **microcontrollers and flight controllers**.

- Integrate sensors, communication modules, and onboard computing systems.

Overall, the student learning outcomes of a Unmanned Aerial Vehicle technical engineering proposed program is play an important role in preparing graduates for careers in different fields by providing them with the necessary knowledge, skills, and competencies to succeed.

10. Academic Staff

Names	Degree	Postion	General specialize	Prersize specialize	Academic email
Amer Farhan Sheet	Ph D	Assitant Professor	Electronic and Communication Engineering	Electronic and Communication Engineering	dr.amerfarhan@ntu.edu.iq
Ali Nathim Hamoodi	PhD	Professor	Electrical Engineering	Renewable Energy	ali_n_hamoodi74@ntu.edu.iq
Abdullah Kutaiba Shanshal	Ph.D.	Assistant Professor	Electrical and Electronic Engineering	Design of Electrical Machines	a.shanshal@ntu.edu.iq
Omar talal Mahmood	Ph.D	Assistant Professor	Electrical engineering	Control engineering	omar.talal@ntu.edu.iq
Ziad Khalaf faraj	Ph.D	Assistant Professor	Computer Network and Communication Engineering	Wireless computer and communication	drziyad.farej@ntu.edu.iq
Firas Aziz Ali	Master	Assistant Professor	Mechanical Engineering	Thermal Power	firasaziz@ntu.edu.iq
Safwan Assaf Hamoodi.	Master	Assistant Professor	Electrical and electronic engineering	Electrical Power Techniques Engineering.	safwan79azb@ntu.edu.iq
Bashar Mohammed Salih	Master	Assistant Professor	Electrical Engineering	Electrical Power and Machines	basharms_tecm@ntu.edu.iq

11. Credits, Grading and GPA

Credits in the Unmanned Aerial Vehicle Techniques Engineering Department are following the Bologna Process with the European Credit Transfer System (ECTS) credit system. The total degree program number of ECTS is 240, 30 ECTS per semester. (1 ECTS) is equivalent to (25 hour) student workloads, including structured and unstructured workload.

Grading: Before the evaluation, the results are divided into two subgroups: pass and fail. Therefore, the results are independent of the students who failed a course. The grading system is defined as follows:

GRADING SCHEME			
Group	**Grade**	**Marks %**	**Definition**
Success Group (50 - 100)	Excellent	90 - 100	Outstanding Performance
	Very Good	80 - 89	Above average with some errors
	Good	70 - 79	Sound work with notable errors
	Satisfactory	60 - 69	Fair but with major shortcomings
	Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required
NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.			

Calculation of the Grade Point Average (GPA)

The GPA is calculated by the summation of each module score multiplied by its ECTS, all are divided by the program total ECTS. (as illustrated Equation)

GPA of 4-year B.Sc. degrees:

GPA = [(1st module score x ECTS) + (2nd module score x ECTS) + ……] / 240

12. Curriculum/Modules

Level 1 – First semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
UAV100	DC Electrical circuits	4	2		8		
UAV101	Engineering Mechanics-statics	4	2		6		
UAV102	Engineerind Drawing		4		6		
UAV103	Mathematics-1	4			6		
NTU100	Human Rights and Democracy	2			2		
NTU101	English Langauge (Beginner)	2	0		2		
T:Theoritical, P:Practical, C:Credit		18	8	20	30		

Level 1 – Second Semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
UAV104	Theory of Drones	3			6		
UAV105	Engineering workshoap		3		6		
UAV106	AC ELECTRICAL CIRCUITS	4	3		8		
UAV107	Physics	3	2		5		
NTU103	Arabic Langauge	2			2		
NTU102	COMPUTER-1	2	2		3		
T:Theoritical, P:Practical, C:Credit		13	11	20	30		

Level 2 – First semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
UAV200	Fundamentals of Communications	3	2		5		
UAV201	Fundamentals of Electronic	3	2		5		
UAV202	Introduction to drone technology	2	-		5		
UAV203	control basics	2	2		5		
UAV204	Mathematics-2	2	-		5		
UAV205	modeling and simulation	2	2		3		
NTU200	Crimes of the Ba'ath Regime in Iraq	2	-		2		
T:Theoritical, P:Practical, C:Credit		16	8		30		

Level 2 – Second semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
NTU201	Computer-2	3	2		6		
UAV208	Thermodynamics	2	2		4		
UAV209	Smart Sensor Systems for UAV Applications	2	2		6		
UAV210	Fundamentals of Electrical Machines for drones	3	2		5		
UAV211	Engineering materials for UAVs	2	-		5		
NTU202	English Language	2	-		2		
NTU203	Arabic Language	2			2		
T:Theoritical, P:Practical, C:Credit		16	8		30		

Level 3 – First semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
UAV300	Digital Electronic Circuits	2	2		5		
UAV301	Communication Systems	2	2		5		
UAV302	Dssign of UAV by CAD/CAM	3	2		5		
UAV303	Aerodynamics-1	4	2		5		
UAV304	Microprocessor	2	2		5		
UAV305	Numerical Analysis	2			5		
T:Theoritical, P:Practical, C:Credit		15	10		30		

Level 3 – Second semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
UAV306	Fundamentals of Unmanned Aircraft Systems	2	2		5		
UAV307	Digital Signal Processing	2	2		5		
UAV308	Artificail Intelligence Systems	2	2		5		
UAV309	UAV Electronics and special machines	3	2		6		
UAV310	Aircraft vibrations	2	2		5		
UAV311	Drone Systems Laboratory	3	2		4		
T:Theoritical, P:Practical, C:Credit		14	12		30		

Level 4 – First semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
UAV400	Digital Communications	4	2		5		
UAV401	aerodynamics 2	4	2		5		
UAV402	Remote radio control	4	2		5		
UAV403	Image processing and aerial camera systems	3	2		5		
UAV404	Smart sensors and actuaters	3	2		5		
UAV405	Project	-	1		5		
T:Theoritical, P:Practical, C:Credit		18	11		30		

Level 4 – Second semester							
CODE	TITLE	T	P	C	ECTS	Bologna Content	UAV Engineering Techniques
UAV406	Communication protocols and WIFI standard	2	2		4		
UAV407	Aircraft Structures	2	2		5		
UAV408	Avionic Systems	2	2		5		
UAV409	Aircraft stability	3	2		5		
UAV410	Advanced aerial systems and applications	2	1		6		
UAV411	Project		1		5		
T:Theoritical, P:Practical, C:Credit		12	11		30		