University of Technology

Electromechanical Engineering

Navigation and guidance Engineering Branch

First Cycle – Bachelor's Degree (B.Sc.) in Navigation and guidance Engineering Program

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Mission & Vision Statement .1

Vision Statement

Aiming to build an engineering establishment in Navigation and Guidance field to be outstanding one among the top international university.

Mission Statement

1- Prepare our students for successful careers in the Navigation and Guidance profession,

2- Conduct high quality and innovative research, and

3- Serve the community and industry providing educational and research resources.

For future plans, the branch intends to cover all required courses in Navigation and Guidance sectors in Iraq, including transportation, air traffic management, Communication, Navigation (Space, Marine and Land). Through the communications with Ministries of Transportation and Communication (symposiums, industrial advisory board meeting), the branch developed his courses according to the needs of the Ministry which is responsible for Navigation in Iraq.

Program Specification .2

Programme code:	**BSc-NAGE**	**ECTS**	**240**
Duration:	**4 levels, 8 Semesters**	**Method of Attendance:**	**Full Time**

Subject Areas Requirements

The Navigation and Guidance Engineering program produces graduates who are prepared to enter the practice of Navigation and Guidance engineering. For two paths, there are three major components of the program: (1) foundation in the mathematical and physical sciences, (2) engineering topics in both mechanical and electric systems with design applications, and (3) general education in the humanities, English course and ethics.

Mathematics and Physical Sciences

The engineering science fundamentals and engineering design skills are built upon the basic mathematics and physical sciences. The mathematics work begins with a three levels course (six courses) sequence on differential and integral calculus. The first two courses include topics in limits, derivatives, and the integrals of functions of one variable, work on partial derivatives and multiple integrals is presented. Vector analysis and three-dimensional analytical geometry, solution of the first and second order linear differential equations with numerous applications, Laplace transforms, power series solutions, numerical methods, linear systems and numerical analysis with engineering

applications in numerical differentiation and integration. With this foundation in mathematics, our students have necessary tools for applications in analysis and design.

Physics (two courses) in the first level includes materials science, classification of materials, atomic structure and the type of bonding forces, types of materials and their applications and the mechanical material properties.

It is noted that the number of hours for Math and Basic Science is 30 hours and it's satisfies ICAEE requirement.

Engineering Topics

The aim of the program is to graduate students capable to work as mechanical and electrical engineer in Navigation and Guidance field. The engineering topics are divided into four parts; preliminary joint courses, mechanical courses, electrical courses and final joint courses.

Preliminary joint courses:

- Workshop Training; Preparation of engineering cadres trained scientific and practical areas in the electricity, automobiles, machining (lathe, milling, drilling), forging, denting, filings, forging, welding, and casting.
- Computer Courses; Computer Science (Visual BASIC programs), Advanced Programming (C++), Application of Advance Computer (Microprocessors and MATLAB languages).
- Engineering Drawing is to teach students manual drafting and dimensioning of views, explains the principles of orthographic views, multi view projection and sectional view drawing.

Engineering courses are divided into two parts;

Mechanical Courses,

- Engineering Mechanics. This unit of study aims to provide theoretical knowledge and principles of Statics and Dynamics.
- Strength of Material and Vibration. In this course, students will learn; the behavior of solid bodies under loads and deflections, study the simple bending theory for beams and the simple torsion theory for shafts circular and non-circular, deflection of beams, complex stresses, compounds beam and discussion the principles of free & forced vibrations
- Fluid Mechanics. This course provides a working knowledge of Fluid Mechanics and Illustration and discussion the principles of Principle of fluid motional flow classification Bernoulli's equation as well as applications of Bernoulli's equation and anther subject in Fluid Mechanics.
- Aerodynamic deals with the fundamental of air laws after hitting the structures such as aircraft wings, Aircraft fuselage, etc., and how can calculate the forces on the bodies.

- Machine Design, this subject aim to teach the students the steps for necessary calculation to design the engineering bodies and components in addition to design the machine based on engineering codes such as ASME.

- Theory of Aeroelasticity is the study of how inertial, elastic, and aerodynamic forces interact with one another when an elastic body is subjected to fluid flow. Aeroelasticity can be divided into two areas: static aeroelasticity, which examines an elastic body's response to a fluid flow in a static or steady state, and dynamic aeroelasticity, which examines the dynamic (typically vibrational) response of the body. Due to their susceptibility to aeroelastic effects, aircraft design requires aeroelasticity because they need to be lightweight and withstand large aerodynamic loads

Electrical Courses,

- Fundamental of Electric Engineering (illustration and discussion the fundamental f electric engineering and definition, proceeding to the student the DC Electrical Circuits, series, parallel, series-parallel and identify the equations voltages &current for circuits above).

- Electric and Electronic Circuits, in electrical engineering, we are often interested in communicating or transferring energy from one point to another. To do this requires an interconnection of electrical devices. Such interconnection is referred to as an electric circuit.

- Navigation Theory and System, Illustration and discussion the principles of GPS, INS and GNSS, description of the Coordinate, as well as its operation in electrical machines.

- Radar Theory and Microwave Engineering, Giving Knowledge about the basic fundamentals of RADAR theory includes idioms, its operation, challenges, noise structure. Besides that, the syllabus covers the advanced Radar system from Microwave bands point of view involves generation, transmission lines and receiver side for both continuous and pulsed signals.

- Communications, illustration and discussion the principles of analog and digital communication systems in addition to give the knowledge about the optical fiber communication and networks.

- Digital Signal Processing involves incorporating several mathematical and computational algorithms into analog and digital signals to create a signal of more refined quality than the original one.

Final Joint Courses,

- Air traffic Management, this course specification provides the main features of the navigation Air traffic Management for example the monitoring and aircraft or ship movement and keep the connection with it, how to follow the aircraft and keep it to land safely.

- Control and Navigation Theory and Systems, illustration and discussion the Main Theoretical Principles of control systems, understanding of signals in order to control by find the final transfer functions for the system, as well as plot the signal to study the control signal properties.

- Microprocessor and Microcontroller. This subject aim to learn the student to deal with microcontroller devices such as Data acquisition, PLC, etc., as well as the microprocessor chip design and operations.

Others Including General Education

The third major area of the curriculum is the general education component. The University of Technology has a mandated General Education Requirements for all degrees. To satisfy the General Education Requirements the Navigation and Guidance Engineering Program set required courses in the general education component as follows:

- English Language (two levels), this course will improve the ability of the students to understand, speak, read and write English as a second language with some technical texts. It is also intended to teach them, how to use technical English effectively as a language of instruction, Lab. Experiments and Exercises, examples, using Technical Terminologies as close as possible to the lectures they receive during their study.
- Human Rights (second level), Freedom and Democracy, the course covers the concept of human rights and development, definition, classes, properties, and the most important human rights conventions and declarations and international conventions on human rights and human rights in religions and the role of non-governmental organizations in this field and other human rights issues. The substance of freedom and democracy include the concept of freedom and kinds, democracy and the types and components, individual liberty and freedom forced to reconcile the sovereignty, freedom, democracy during the Greeks time, lobbyists, the most important theories on the nature of election, the rights of minorities in democratic governance and other topics that make the student familiar with the issues.
- Ethics in Engineering (fourth level), concentrates on professional Ethics.
- Sport (first level), concentrates on different sport activities.

Major Design Experience

In the last year, students take Senior Capstone Design, which is the final major design course. In this course, students learn how to apply the basic engineering science and design principles to formulate a design problem, and then follow recommended process to complete the design project. Students are required to demonstrate their ability to use the knowledge of mechanical and electrical courses for the whole undergraduate curriculum. Some professional components if not taught in other courses, such as life- long learning to keep knowledge up to date, are covered in this course. For the capstone design experience. The students are typically in teams of three people. At the end of the year, all the design teams present their capstone design projects. All the NAGE faculty members, representatives from industry and NAGE Industrial Advisory Council members are invited at the presentation and they also serve as evaluators for the capstone design projects. The evaluation

includes the project evaluation in three parts (overall technical content, presentation, and response to questions), assessment of the related Graduate Outcomes and comment.

3. Program Objectives

1. Enter the Navigation and Guidance engineering profession as practicing engineers and consultants with prominent companies and organizations in diverse areas that related to Navigation and Guidance Engineering.
2. Pursue graduate education and research at major research universities in Navigation and Guidance Engineering, and related fields
3. Advance in their chosen fields to supervisory and management positions
4. Engage in continued learning through professional development
5. Participate in and contribute to professional societies and community services

4. Student Learning Outcomes

Students from the Navigation and Guidance engineering program will attain (by the time of graduation):

1. An ability to identify, formulate, and solve engineering in energy and renewable energies engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

4. An ability to communicate effectively with a range of audiences

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

6. An ability to recognize the ongoing need to acquire new knowledge, to choose appropriate learning strategies, and to apply this knowledge

7. An ability to function effectively as a member or leader of a team that establishes goals, plans tasks, meets deadlines, and creates a collaborative and inclusive environment

Academic Staff .5

Faculty Name	Highest Degree Earned- Field and Year	Rank	Email
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Credits, Grading and GPA .6

Credits

University of Technology is 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 hrs. student workload, including structure 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 are failed a course. The grading system is defined as follows:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب - قيد المعالجة	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				
Number 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 Cumulative Grade Point Average (CGPA)

1. The CGPA is calculated by the summation of each module score multiplied by its ECTS, all are divided by the program total ECTS.

   CGPA of a 4-year B.Sc. degree:

   CGPA = [(1st ^{m}odule score x ECTS) + (2nd ^{m}odule score x ECTS) + ……] / 240

Curriculum/Modules .7

Semester 1 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
WSHE106	Workshops	90	10	4.00	B	-
ENLA107	English Language I	33	17	2.00	S	-
MATH113	Mathematics I	63	87	6.00	B	-
PHYS114	Physics I	63	62	5.00	B	-
COSC108	Computer Science I	63	12	3.00	S	-
FUEE116	Fundamental of Electrical Engineering (DC)	78	47	5.00	C	-
ENME117	Engineering Mechanics (static)	63	62	5.00	C	-

Semester 2 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
WSHE106	Workshops	90	10	4.00	B	-
HURI121	Human Rights	33	17	2.00	S	-
MATH122	Mathematics II	63	87	6.00	B	-
PHYS123	Physics II	63	37	4.00	B	-
FUEE127	Fundamental of Electrical Engineering (AC)	78	72	6.00	C	-
ENME124	Engineering Mechanics (Dynamic)	63	37	4.00	C	-
ENDR 125	Engineeering Drawing (AUTO CAD)	63	37	4.00	S	-

Contact .8

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University of Technology

Electromechanical Engineering

Navigation and guidance Engineering Branch

First Cycle – Bachelor's Degree (B.Sc.) in Navigation and Guidance Engineering Program

Table of Contents

1. Overview

This manual covers the study materials offered by the Electromechanical Engineering Program / Navigation and Gaudiness Engineering Branch to obtain a Bachelor of Science degree in Navigation and Gaudiness Engineering. The program offers 56 study subjects divided into university requirements (such as sports, human rights, and ethics), and department requirements (such as mathematics, advanced mathematics, physics, engineering analysis, computers, etc.) in addition to the requirements of the branch with regard to electrical and mechanical lessons (such as theories and navigation systems, radar theories and systems, digital electronics, Electrical and Electronic Circuits, Communications, Pneumatics and Hydraulic Systems, Aerodynamics, Structural Stability, Aeroelastic Theory, etc.), with (6000) total student load hours and 240 total European units. The delivery of study materials is based on the Bologna Process.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
WSHE106	Workshops I	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
0	0/6/0/0	90	10
Description			
This section includes a description of the module, 100-150 words			

Module 2

Code	Course/Module Title	ECTS	Semester
ENLA107	English Language I	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0/0/0/0	33	17
Description			
This course improves the student's ability to understand, speak, read, and write English as a second language with some technical texts. It is also intended to teach them, how to use technical English effectively as a language of instruction through lab experiments and exercises, examples, and using technical terminologies as closely as possible to the lectures they receive during their study.			

Module 3

Code	Course/Module Title	ECTS	Semester
MATH113	Mathematics I	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	0	63	87
Description			
This course specification provides the main features of mathematics theory (Part I) for freshmen in electromechanical engineering. Also, learning outcomes gained by this program will help a typical student achieve and demonstrate the learning opportunities that are provided during the course study in accordance with the requirements of navigation and guidance engineering.			

Module 4

Code	Course/Module Title	ECTS	Semester
PHYS114	Physics I	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	0/0/0/0/	63	62
Description			
This course specification provides the concepts, principles, and main features of electronic materials engineering, such as semiconductor properties. Also, students in 1st year study the principles of electronics physics which concluded: the concept of semiconductors as intrinsic and extrinsic			

semiconductors, p-n junction, diode models, types of diodes, Fundamentals Transistor structure, Basic transistor operation, BJT, and JFET transistors.

Module 5

Code	Course/Module Title	ECTS	Semester
COSC108	Computer Science I	3	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	12
Description			
This Course Specification provides the main features of the computer, A basic computer system is defined as a device that accepts input, processes data, stores data, and produces output. A personal computer system includes a computer, peripheral devices, and software. Computers are categorized into five general types, based mainly on their processing speeds, size, and capacity to store data: supercomputers, mainframe computers, minicomputers, microcomputers, and micro-controllers.			

Module 6

Code	Course/Module Title	ECTS	Semester
FUEE116	Fundamental of Electrical Engineering (DC)	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0/2/0/1	78	47
Description			
In this course, freshmen will learn the fundamental concepts of electric circuit analysis, the most important topic for electrical, electronics, and computer engineering. This course is designed to provide students with a solid foundation in electric circuit analysis. Furthermore, the course is designed for undergraduate students. The course will introduce and explain the fundamental concepts of basic electrical engineering, including DC and AC (Single Phase and Three Phase Circuits) Circuit Analysis, Construction and working of transformers, steady-state and phase analysis of AC networks, series and parallel circuits, and how to calculate equivalent resistance. You will also learn about Ohm's and Kirchhoff's laws, and how to use Nodal and Mesh Analysis (KCL and KVL) to solve electrical circuits. By the end of the course, the students will have a deep understanding of the principles of electricity and how they are used to design and build electrical systems.			

Module 7

Code	Course/Module Title	ECTS	Semester
ENME117	Engineering Mechanics (static)	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0/2/0/0	63	62
Description			
In this course, to introduce the basic engineering principles required for analyzing and solving the forces, moment and couple problems for two and three dimensions. By the end of the engineering mechanics module, students will be able to understand and apply the principles of statics in engineering systems, analyze and solve problems related to forces, moments, equilibrium, apply vector mathematics and coordinate systems to engineering mechanics problems, identify and analyze different types of supports in structures and machines and interpret and draw free body diagrams to represent the forces acting on a system.			

Module 8

Code	Course/Module Title	ECTS	Semester
WSHE106	Workshops II	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
0	0/0/6/0	90	10
Description			
This section includes a description of the module, 100-150 words			

Module 9

Code	Course/Module Title	ECTS	Semester
HURI121	Human Rights	2	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0/0/0/0	33	17
Description			
This section includes a description of the module, 100-150 words			

Module 10

Code	Course/Module Title	ECTS	Semester
MATH122	Mathematics II	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	0/0/0/0	63	87
Description			
Advanced topics in mathematics in the areas of Complex Variables, Linear Algebra, Partial Differential Equations and Series Solutions to Differential Equations will be introduced. These mathematical tools are used to model and solve Electrical Engineering related problems in the areas of Circuits, Controls, Electromagnetics, Solid State and Communication Theory. Specifically students will be familiar with convolution, Fourier Series, Fourier Transforms, and Laplace Transforms in analyzing system characteristics and responses. Students will also acquire knowledge of the basic concepts taught in algebra, calculus and differential equations courses. These basic concepts include, but are not limited to, limit theory, differentiation, integration, sequences, series, and various techniques for solving differential equations.			

Module 11

Code	Course/Module Title	ECTS	Semester
PHYS123	Physics II	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	0/0/0/0	63	37
Description			
This course specification provides further knowledge and the main features of electronic materials engineering. Transport phenomena in semiconductors, theory of the p-n junction, bipolar and unipolar devices, general analysis of the metal-semiconductor structures, MOSFETs, and bipolar transistors. Also, the course is designed to teach the physics behind electronic device operations and prepare students for advanced courses in solid-state and quantum electronics. The course is intended to increase knowledge gained in undergraduate-level courses in electronic devices. The main emphasis is on the fundamental physics behind device operation. Topics include background physics and the basic principles of electronic device operation with emphasis on bipolar transistors, and unipolar microwave devices.			

Module 12

Code	Course/Module Title	ECTS	Semester
FUEE124	Fundamental of Electrical Engineering (AC)	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0/2/0/0	78	72
Description			
In this course, freshmen will learn the fundamental concepts of electric circuit analysis, the most important topic for electrical, electronics, and computer engineering. This course is designed to provide students with a solid foundation in electric circuit analysis. Furthermore, the course is designed for undergraduate students. The course will introduce and explain the fundamental concepts of basic electrical engineering, including DC and AC (Single Phase and Three Phase Circuits) Circuit Analysis, Construction and working of transformers, steady-state and phase analysis of AC networks, series and parallel circuits, and how to calculate equivalent resistance. You will also learn about Ohm's and Kirchhoff's laws, and how to use Nodal and Mesh Analysis (KCL and KVL) to solve electrical circuits. By the end of the course, the students will have a deep understanding of the principles of electricity and how they are used to design and build electrical systems.			

Module 13

Code	Course/Module Title	ECTS	Semester
ENME125	Engineering Mechanics (Dynamic)	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
Topics to be covered include equivalent systems of forces, resultants and distributed forces, equilibrium of rigid bodies, centroids, centers of gravity, fluid statics, moments of inertia, and friction. Analysis of frames and machines, forces in beams, internal stresses, and stability will also be considered. The Engineering Statics course provides the basic concepts and skills that form the foundation for structural and mechanical design. The class is a problem-focused engineering science class that helps engineering students develop the ability to understand and analyze static forces on a variety of structures and engineering applications.			

Module 14

Code	Course/Module Title	ECTS	Semester
ENDR 127	Engineering Drawing (AUTO CAD)	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
0	0/4/0/0	63	37
Description			
The AutoCAD Mechanical Essentials training course teaches students about the indispensable core topics required to use the AutoCAD Mechanical software. Through a hands-on, practice-intensive curriculum, students acquire the knowledge needed to accelerate the mechanical design process. With specific tools for creating and manipulating geometry, automatically acquiring bills of materials, generating mechanical components, and performing design calculations, the AutoCAD Mechanical software offers significant productivity gains that the student learns to maximize.			

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