Northern Technical University

First Cycle – Bachelor's Degree (B.Sc.) – Power Mechanics

Northern Technical University

Engineering Technical College/ Mosul

Department of Power Mechanics Engineering Techniques

Refrigeration and Air Conditioning

بكلوريوس – هندسة تقنيات ميكانيك القوى –

فرع التبريد والتكييف

Modules Catalogue Form

University Name: .Northern Technical University.....

Faculty/Institute: .Technical Engineering College Mosul.....

Scientific Department: Power Mechanics Engineering Technology

Academic or Professional Program Name: Bachelor of Power Mechanics Engineering Technology

Final Certificate Name: Bachelor of Power Mechanics Engineering Technology

Academic System: Bologna Process.....

Description Preparation Date: 2/9/2025

File Completion Date: 2/9/2025

Signature:

Head of Department Name: Dr. Ammar Hassan Suhail

Date: 2/9/2025

Signature:

Scientific Associate Name: Prof. Dr. Mohammed Sabah Jarjees

Date: 25/9/2025

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance

Department: Assist. Lect. Warqaa Hashim Mahmood

Date:

Signature:

Approval of the Dean



Table of Contents

1. **Overview**
2. **Undergraduate Modules 2025-2026**
3. **Contact**

1. Overview

This catalogue is about the courses (modules) given by the program of Power Mechanics Techniques Engineering to gain the Bachelor of Technical Engineering degree. The program delivers (45) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

نظره عامه

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج هندسة تقنيات ميكانيك القوى للحصول على درجة البكالوريوس في الهندسة التقنية. يقدم البرنامج (45) مادة دراسية بإجمالي (6000) ساعة حمل للطالب و(240) اجمالي الوحدات الاوربية (ECTS) ويعتمد تقديم المقررات على عملية بولونيا.

2. Undergraduate Courses 2025-2026

2.1 First Year

Module 1

Code	Course/Module Title	ECTS	Semester
NTU101	English Language	2	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	**0**	33	17
Description			
The module adopts a communicative and student-centered approach, focusing on active participation in real-life language scenarios. Interactive seminars, pair work, and group discussions are used to integrate listening, speaking, reading, and writing skills. Role-plays, dialogues, and audio materials simulate authentic contexts such as travel, work, and daily conversations. Formative assessments including quizzes, assignments, and a seminar presentation provide ongoing feedback to reinforce grammar, vocabulary, and pronunciation. This strategy encourages students to practice English confidently both inside and outside the classroom, promoting continuous improvement.			

Module 2

Code	Course/Module Title	ECTS	Semester
PM 100	Mechanics Engineering / Static	8	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
3	2	78	122
Description			
Statics, is a fundamental branch of Engineering Mechanics that deals with the analysis and prediction of the behavior of objects at rest or in equilibrium. It provides the foundation for understanding the principles of forces, moments, and their effects on structures and systems. This branch is primarily concerned with the study of particles and rigid bodies under the action of forces and moments. One of the main objectives of this module is to enable engineers to calculate and predict the behavior of structures and systems under different loading conditions. This includes understanding the concepts of force vectors, moments, and couples, as well as the methods for resolving and combining these forces to determine their resultant effects. Through theoretical study, problem-solving, and practical applications, the students develop critical skills in analyzing and solving engineering problems. They learn to apply mathematical principles, physics, and engineering concepts to determine the forces and moments in structures and systems, and to ensure their stability and safety.			

Module 3

Code	Course/Module Title	ECTS	Semester
PM 101	Mathematics Principles	6	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
4	2	93	58

Description

The proficiencies of Understanding, Fluency, Problem Solving and Reasoning are fundamental to learning mathematics and working mathematically and are applied across all three strands Number and Algebra, Measurement and Geometry, and Statistics and Probability.
Understanding refers to students building a robust knowledge of adaptable and transferable mathematical concepts and structures. Students make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the 'why' and the 'how' of mathematics. Students build understanding when they:

- connect related ideas
- represent concepts in different ways
- identify commonalities and differences between aspects of content
- describe their thinking mathematically
- interpret mathematical information

Module 4

Code	Course/Module Title	ECTS	Semester
PM 102	Electrical technology	6	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	2	63	87

Description

Electrical technology encompasses the study of electrical systems, circuits, devices, and their applications. It focuses on understanding the principles and theories behind electricity, electrical power generation, transmission, and distribution. This field involves the design, installation, maintenance, and troubleshooting of electrical systems in various industries, such as power generation, manufacturing, telecommunications, and transportation. Electrical technology professionals work with electrical equipment, control systems, and renewable energy technologies. They are skilled in analyzing electrical circuits, performing measurements, and ensuring safety and compliance with electrical codes and standards. A strong foundation in electrical technology enables individuals to contribute to the development and advancement of electrical systems, energy efficiency, and the integration of new technologies in the field.

Module 5

Code	Course/Module Title	ECTS	Semester
PM 103	**Workshops**	**6**	**1**
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
0	**6**	**93**	**57**
Description			
The workshop in an engineering college provides students with a valuable opportunity to acquire knowledge and practical skills in specific engineering fields. The workshop aims to enhance the application of theoretical concepts learned in classrooms and provides an interactive learning environment. It includes instructional sessions, hands-on exercises, problem-solving, and practical application projects. Students collaborate in teams to achieve specific goals and develop effective projects. The workshop promotes communication and collaboration among students, encourages critical thinking, and problem-solving in an engineering simulation environment. The workshop is a valuable chance for students to develop their technical and practical skills and enhance their engineering capabilities for the future.			

Module 6

Code	Course/Module Title	ECTS	Semester
NTU 100	Democracy and Human Rights	2	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	0	33	17
Description			
تُعنى هذه المادة بدراسة المفاهيم الأساسية لحقوق الإنسان والديمقراطية، من حيث التعريف والنشأة والتطور التاريخي، مع التركيز على المبادئ والقيم التي تقوم عليها الأنظمة الديمقراطية، وعلاقتها بحماية الحقوق والحريات العامة. كما تتناول المادة الإطار القانوني الدولي والوطني لحقوق الإنسان، وآليات حمايتها وتطبيقها في الواقع.			

Module 7

Code	Course/Module Title	ECTS	Semester
PM 103	Thermodynamics principle	8	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	4	93	107

Description

In this thermodynamics module, students will explore the foundational concepts that form the basis of this field of study. They will examine energy interactions in thermal systems and measure relevant properties. Key concepts covered include force, energy, work, thermal equilibrium, and temperature. The workshop aims to develop a clear understanding of thermodynamics and its application in engineering. Students will also learn about the practical implications of thermodynamics, such as the laws of heat transfer and their applications in engine cycles. Additionally, they will explore the functioning of refrigerators and heat pumps based on the reversed Carnot cycle, which requires external work to transfer heat from a lower temperature body to a higher temperature body.

Module 8

Code	Course/Module Title	ECTS	Semester
NTU 102	Computer	3	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	2	63	12

Description

Computer Principles is an introductory course that provides a comprehensive understanding of the fundamental concepts and principles of computer science. The course covers topics such as computer architecture, data representation, algorithms, programming languages, operating systems, and computer networks. Students will learn about the basic components of a computer system, how data is stored and processed, and the principles behind efficient and reliable computer operations. The course also explores the role of computers in society, ethical considerations in computing, and emerging trends in the field. Through this course, students will develop a solid foundation in computer principles and gain the necessary skills to pursue further studies or careers in computer science

Module 9

Code	Course/Module Title	ECTS	Semester
NTU 103	Arabic Language	2	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	0	33	17
Description			
تهدف هذه المادة إلى تنمية قدرات الطلبة في فهم اللغة العربية واستعمالها استعمالًا صحيحًا من خلال دراسة النصوص القرآنية والأدبية، والتعرّف على القواعد النحوية والبلاغية الأساسية، والتدريب على تحليل النصوص واستيعاب معانيها. كما تسعى إلى تعزيز مهارات الطلبة في التعبير اللغوي السليم، وتنمية ذائقتهم الأدبية، وتمكينهم من توظيف اللغة في السياقات الأكاديمية بصورة دقيقة ومنظمة، مع معالجة الأخطاء اللغوية الشائعة وتطوير القدرة على الفهم والتحليل.			

Module 10

Code	Course/Module Title	ECTS	Semester
PM 104	Mechanical Engineering /Dynamic	8	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
3	2	78	122
Description			
Dynamics is a branch of Engineering Mechanics that focuses on the study of objects in motion and the forces that cause that motion. It builds upon the principles of statics and expands them to analyze the behavior of objects subjected to acceleration, velocity, and displacement. This field is concerned with understanding and predicting the motion of particles and rigid bodies, as well as the forces and energy associated with their motion. The primary goal of Engineering Mechanics/Dynamics is to provide engineers with a comprehensive understanding of how objects move and interact under the influence of forces and moments. By studying dynamics, engineers can design and analyze systems such as machines, vehicles, and structures to ensure their optimal performance, efficiency, and safety. In this subject, students explore various topics, including the kinematics and kinetics of particles and rigid bodies. Kinematics deals with the description of motion, focusing on concepts such as displacement, velocity, and acceleration. Kinetics, on the other hand, focuses on the forces and torques acting on objects, leading to their motion.			

Module 11

Code	Course/Module Title	ECTS	Semester
PM 106	Engineering Drawing	7	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
0	4	63	112
Description			
Engineering drawing is a universal language used exclusively by engineers, technicians, and all those working in engineering fields to convey and translate scientific and technical ideas. It is also used in communication between design professionals and product developers, regardless of the language they speak. Due to the urgent need for a means of assisting those interested in computer-aided engineering drawing, AutoCAD was chosen. It is considered one of the most advanced programs for the drafting process and one of the most popular CAD systems in the world due to its ease of use and speed of implementation.			

Module 12

Code	Course/Module Title	ECTS	Semester
PM 107	Occupational Safety	2	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	0	32	18
Description			
Occupational safety is a field of study focused on achieving a safe and healthy working environment for employees across all industries and sectors. Scientists and researchers in this field aim to analyze and assess potential workplace hazards and develop and implement strategies and systems for preventing and controlling these risks. Areas of study in occupational safety include hazard identification, risk assessment, designing and implementing safety and prevention procedures, training and education, accident and emergency management, and safety legislation and standards. Scientists and professionals in this field aim to promote a culture of safety and raise awareness of the importance of occupational safety among employees and the business community as a whole. Occupational safety is a fundamental component of effective risk management and contributes to improved overall performance, quality, and employee well-being in the workplace.			

2.2 Second Year

Module 13

Code	Course/Module Title	ECTS	Semester
PM 200	Refrigeration & Air Conditioning Principles	8	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
4	2	123	77

Description

This course introduces students to the fundamental principles and applications of refrigeration and air-conditioning systems. It covers the basic concepts of thermodynamics and heat transfer as applied to cooling processes, including the study of refrigeration cycles such as the vapor compression cycle. The course also explores the main components of refrigeration systems, including compressors, condensers, evaporators, and expansion devices, and explains their functions and operation.
In addition, the course addresses psychrometric processes and air-conditioning principles used to control temperature, humidity, and air quality in indoor environments. Students will learn how to estimate cooling loads, evaluate system performance, and understand energy efficiency considerations. Practical aspects such as system operation, maintenance, and common troubleshooting techniques are also introduced to prepare students for real-world applications in residential, commercial, and industrial settings

Module 14

Code	Course/Module Title	ECTS	Semester
PM 200	Mathematics	6	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
4	2	93	57

Description

The proficiencies of Understanding, Fluency, Problem Solving, and Reasoning are fundamental to learning mathematics and working mathematically and are applied across all three strands Number and Algebra, Measurement and Geometry, and Statistics and Probability.
Understanding refers to students building a robust knowledge of adaptable and transferable mathematical concepts and structures. Students make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the ‘why’ and the ‘how’ of mathematics. Students build understanding when they:

- connect related ideas
- represent concepts in different ways
- identify commonalities and differences between aspects of content
- describe their thinking mathematically
- interpret mathematical information

Module 15

Code	Course/Module Title	ECTS	Semester
PM 201	Fluid Mechanics	8	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
4	4	123	77

Description

Fluid Mechanics, the branch of science that deals with the study of fluids (liquids and gasses) in a state of rest or motion, is an important subject of Civil, Mechanical and Chemical Engineering. Its various branches are fluid statics, fluid kinematics and fluid dynamics.
A substance that flows is called a fluid. All liquid and gaseous substances are considered to be fluids. Water, oil, and others are very important in our day-to-day life as they are used for various applications. For instance, water is used for generation of electricity in hydroelectric power plants and thermal power plants, water is also used as the coolant in nuclear power plants, oil is used for the lubrication of automobiles etc.
Fluid Mechanics is the branch of science that studies the behavior of fluids when they are in state of motion or rest. Whether the fluid is at rest or motion, it is subjected to different forces and different climatic conditions and it behaves in these conditions as per its physical properties. Fluid mechanics deals with three aspects of the fluid: static, kinematics, and dynamics aspects.

Module 16

Code	Course/Module Title	ECTS	Semester
PM 202	Mechanical Drawing	4	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
0	4	63	37

Description

The course on Mechanical Drafting provides comprehensive training on various aspects of drafting and design in mechanical engineering. It covers topics such as the use of AutoCAD system for mechanical drafting, screw threads, bolts, nuts, keys, pin and cotter joints, riveting joints, welding symbols, gear drawings, assembly drawings, detail drawings, and coupling, bearing, and pipe joints. The course includes practical examples and exercises that allow students to gain hands-on experience in drawing each component. By completing this course, students can enhance their knowledge and skills in mechanical engineering drafting, enabling them to create accurate and detailed drawings for various mechanical components and systems.

Module 17

Code	Course/Module Title	ECTS	Semester
NTU 200	Crimes of the Baath Party in Iraq	2	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	0	33	17

Description

This module examines the crimes committed by the Ba'ath regime in Iraq, focusing on their political, social, and humanitarian consequences. It provides students with a comprehensive understanding of the regime's historical background, policies, and human rights violations. Through the analysis of testimonies, documents, and scholarly sources, students will explore the nature, scope, and impact of these crimes on individuals and communities. The module emphasizes critical evaluation of sources, legal and ethical perspectives, and the long-term consequences of authoritarian rule. By comparing the Ba'ath regime with other authoritarian systems, students will develop awareness of justice, accountability, and transitional justice mechanisms. Teaching methods include lectures, case studies, discussions, debates, and reflective writing to foster critical thinking and informed analysis.

Module 18

Code	Course/Module Title	ECTS	Semester
NTU 201	English Language	2	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	0	32	18

Description

The English Language module covers essential content including grammar (tenses, modals, conditionals, reported speech, passive voice), vocabulary (collocations, phrasal verbs, everyday topics like work, travel, technology, and health), listening (dialogues and interviews), speaking (discussions, role-plays, and presentations), reading (skimming, scanning, and identifying main ideas), writing (paragraphs, emails, and letters), and cultural awareness. Its main advantages are that students develop strong core language skills for real-life and academic contexts, gain confidence in spoken communication with improved pronunciation and fluency, expand practical vocabulary, and enhance their understanding of English-speaking cultures—all of which prepare them for effective interaction in diverse personal and professional settings.

Module 19

Code	Course/Module Title	ECTS	Semester
PM 203	Strength of Materials	6	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	2	63	87
Description			
Strength of Materials is a core engineering course that studies how solid bodies behave under various types of loads and forces. It introduces fundamental concepts of stress, strain, and deformation, enabling students to understand how materials respond to tension, compression, shear, torsion, and bending. The course examines stress–strain relationships, Hooke's law, and material properties such as elasticity and yield strength. It also covers practical topics including thermal stresses, thin-walled pressure vessels, compound sections, and structural elements like beams. Students learn to construct and interpret shear force and bending moment diagrams, analyze bending stresses, and evaluate deflection and torsional effects. Emphasis is placed on both theoretical understanding and problem-solving skills for real engineering applications. By the end of the course, students can assess the strength, stability, and safety of mechanical and structural components, forming an essential foundation for design courses and professional engineering practice.			

Module 20

Code	Course/Module Title	ECTS	Semester
PM 204	Engineering Materials	6	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	2	63	87
Description			
The Engineering Materials module covers the internal structure of materials (atomic arrangements, crystal structures like FCC, BCC, and CPH, atomic bonds, and crystalline defects), phase diagrams and transformations, mechanical properties (stress-strain, elasticity, plasticity, hardness, toughness, creep, fatigue), metals and alloys (ferrous and non-ferrous, strengthening mechanisms, corrosion), iron-making and steel-making, iron-iron carbide diagram, types of steels, ceramics, polymers, composites, nanomaterials, biomaterials, and material selection criteria. Practical lab work includes impact testing, fatigue testing, microscopic examination, heat treatments, surface hardening, and microstructure analysis of stainless steel and cast iron. The main advantages are that students gain a comprehensive understanding of material properties and behavior, learn to select appropriate materials for engineering applications, understand processing and manufacturing techniques, develop failure analysis skills, gain hands-on testing experience, and consider sustainability and environmental impact—essential for careers in mechanical, civil, aerospace, and manufacturing engineering.			

Module 21

Code	Course/Module Title	ECTS	Semester
PM 205	Thermodynamics	7	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
4	4	123	52
Description			
Thermodynamics is a branch of physics that deals with the study of energy and its transformations in various systems. It focuses on understanding the behavior of heat, work, and energy flow. Thermodynamics encompasses fundamental principles such as the laws of thermodynamics, which describe the relationships between energy, heat, and work. It explores concepts like temperature, pressure, entropy, and equilibrium. Thermodynamic principles find applications in various fields, including engineering, chemistry, and environmental science. By analyzing thermodynamic processes and systems, scientists and engineers can optimize energy utilization, design efficient engines and power plants, and understand the behavior of substances under different conditions			

Module 22

Code	Course/Module Title	ECTS	Semester
PM 206	Electrical Machines	6	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	2	63	87
Description			
The Electrical Machines module introduces students to the fundamental principles and applications of electrical circuits, machines, and power systems. It provides a solid foundation in electrical calculations for both AC and DC circuits, covering essential concepts such as voltage, current, resistance, and power. Students will apply this knowledge to the analysis of electrical circuits and the operation of machines, including motors and generators. The module also addresses the fundamentals of power systems, including generation, transmission, and distribution. Through active participation, problem-solving activities, and hands-on laboratory work, students will develop both theoretical understanding and practical skills, enabling them to analyze, maintain, and apply electrical machines effectively within the broader field of electrical and electronic engineering.			

Module 23

Code	Course/Module Title	ECTS	Semester
NTU 202	Computer	3	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	2	63	12
Description			
The computer module provides students with a comprehensive understanding of how information is transmitted and received across various media. It introduces fundamental concepts such as signals, modulation, bandwidth, and noise, while also covering analog and digital communication systems. Students will develop analytical and problem-solving skills for designing and evaluating communication circuits and systems, and prepare for advanced topics including wireless communication, data networks, and information theory. Practical learning is emphasized through laboratory work and simulations that reflect real-world communication technologies. In addition, students will strengthen their verbal, non-verbal, and digital communication skills, adapt to diverse professional contexts, and learn to resolve communication barriers. The module equips students with essential theoretical and practical knowledge for careers in telecommunications, networking, and electronics.			

Module 24

Code	Course/Module Title	ECTS	Semester
NTU 203	Arabic Language	2	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	0	32	18
Description			
تستهدف مادة اللغة العربية للمرحلة الثانية تنمية مهارات الطلبة اللغوية على مستوى متقدم، من خلال دراسة القواعد النحوية والإملائية المعقدة، وتطوير القدرة على الكتابة الأكاديمية والإدارية بشكل سليم ودقيق. وتركز المادة على تحليل النصوص الأدبية والإدارية، واستخدام البلاغة والأساليب اللغوية المتقدمة، مع معالجة الأخطاء اللغوية الشائعة وتصحيحها في مختلف السياقات الكتابية. كما تهدف إلى تعزيز التفكير النقدي والتحليلي لدى الطلاب، وتمكينهم من التعبير عن أفكارهم بشكل واضح ومنظم، وإتقان صياغة المقالات، التقارير، والوثائق الرسمية، بما يدعم الأداء الأكاديمي والمهني في المجالات المختلفة.			

2.3 Third Year

Module 25

Code	Course/Module Title	ECTS	Semester
PM 300	Machine design	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
This course introduces students to the principles and methods of mechanical design with a focus on components commonly used in energy and refrigeration systems. It covers the analysis of stresses, material behavior, and design criteria necessary for ensuring safety, reliability, and efficiency in mechanical elements. Students learn to design machine components such as shafts, fasteners, springs, bearings, and power transmission elements under various loading conditions. The course integrates theoretical understanding with practical skills through laboratory work, engineering drawings, computer-aided modeling, and simulation tools. Emphasis is placed on applying engineering judgment, selecting appropriate materials, and developing solutions to real mechanical problems encountered in compressors, fans, pumps, and other cooling and power devices. Through design projects and hands-on exercises, students gain the competencies required to analyze, model, and evaluate machine components in modern engineering applications.			

Module 26

Code	Course/Module Title	ECTS	Semester
PM 301	**Engineering Analysis**	**4**	**5**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
3	**0**	**48**	**52**
Description			
The Engineering Analysis module covers linear and non-linear equations, systems of linear equations, solution methods (Gaussian and Gauss-Jordan elimination), applications such as polynomial fitting, network analysis, Kirchhoff's laws, and heat flow, Fourier series (periodic functions, even and odd functions, Euler's formulae for Fourier coefficients), Laplace transforms (properties and inverse transforms), and solving first- and second-order differential equations using Laplace transforms. The module is delivered through theory and tutorials. The main advantages are that students develop the ability to translate physical systems into mathematical models, solve complex algebraic and differential equations using various analytical methods, evaluate how parameter changes affect system performance, compare model predictions with theoretical results, and perform cost-benefit analysis for design optimization—essential skills for advanced engineering problem-solving, design verification, failure investigation, and performance improvement across all engineering disciplines.			

Module 27

Code	Course/Module Title	ECTS	Semester
PM302	Heat Transfer	8	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
4	4	123	77
Description			
This module introduces the fundamental principles, mechanisms, and applications of Heat Transfer. The course typically combines theoretical study and practical training to provide students with a comprehensive understanding of heat transfer processes, including conduction, convection, and radiation, and to qualify them to analyze and design thermal systems efficiently and professionally.			

Module 28

Code	Course/Module Title	ECTS	Semester
RAC 300	Thermal Systems Design	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
3	0	48	87
Description			
This module provides a comprehensive introduction to the design, simulation, and optimization of thermal systems, which are essential across diverse engineering applications including energy generation, manufacturing, aerospace, HVAC, and electronic cooling. Students will learn the structured engineering design process from problem formulation and conceptual design to modeling and simulation, with particular emphasis on two core component types: heat exchangers (covering parallel-flow, counter-flow, cross-flow, and multipass configurations using LMTD and effectiveness-NTU methods) and flat-plate solar collectors (analyzing energy balance, efficiency, heat removal factors, and overall loss coefficients). The module then advances to system-level simulation using Information Flow Diagrams (IFDs) to manage component interconnections and reduce computational complexity. Finally, students are introduced to mathematical optimization techniques—including calculus methods, Lagrange multipliers for constrained problems, and geometric programming—to move beyond acceptable designs toward optimal solutions that minimize cost or maximize performance within real-world constraints. Throughout the module, theoretical derivations are reinforced through worked examples, tutorial problems, and case studies drawn from standard textbooks.			

Module 29

Code	Course/Module Title	ECTS	Semester
RAC 301	Drawing of Refrigeration & Air Conditioning Systems	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
0	4	63	37
Description			
The Drawing of Refrigeration & Air Conditioning Systems module covers the concept and interface of AutoCAD software, including commands, constants, measurements, and drawing techniques applied specifically to HVAC systems. Indicative content includes drawing of cooling system components, refrigeration and air conditioning systems, auxiliary devices (cooling towers), piping system components and layouts, modern air conditioning systems (VRV and VRF), air handling units, air ducting design, and detailed drawings of the evaporator, condenser, expansion valve, and full assembly for refrigeration systems. The module is delivered entirely through laboratory work with hands-on practice. The main advantages are that students gain practical skills in using AutoCAD for mechanical and HVAC drawings, learn to design air distribution and piping systems, understand how to implement detailed component and assembly drawings for cooling systems, and develop industry-relevant drafting capabilities essential for careers in refrigeration, air conditioning, HVAC design, and building services engineering.			

Module 30

Code	Course/Module Title	ECTS	Semester
NTU301	English Language	2	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
2	0	32	18
Description			
The English Language module covers essential content including grammar (tenses, modals, conditionals, reported speech, passive voice), vocabulary (collocations, phrasal verbs, everyday topics like work, travel, technology, and health), listening (dialogues and interviews), speaking (discussions, role-plays, and presentations), reading (skimming, scanning, and identifying main ideas), writing (paragraphs, emails, and letters), and cultural awareness. Its main advantages are that students develop strong core language skills for real-life and academic contexts, gain confidence in spoken communication with improved pronunciation and fluency, expand practical vocabulary, and enhance their understanding of English-speaking cultures—all of which prepare them for effective interaction in diverse personal and professional settings.			

Module 31

Code	Course/Module Title	ECTS	Semester
RAC 302	Refrigeration & Air Conditioning	8	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
4	4	123	77
Description			
Refrigeration and Air Conditioning is a branch of Mechanical Engineering that focuses on the study of heat transfer, thermodynamic cycles, and the systems designed to control temperature and humidity in various environments. It builds upon the principles of thermodynamics and fluid mechanics and expands them to analyze the behavior of systems subjected to heat gain, heat loss, and thermal loads. This field is concerned with understanding and predicting the performance of refrigeration cycles and air conditioning systems, as well as the energy and environmental factors associated with their operation. The primary goal of Refrigeration and Air Conditioning is to provide engineers with a comprehensive understanding of how thermal energy is transferred and controlled within closed and open systems. By studying refrigeration and air conditioning, engineers can design and analyze systems such as cold storage facilities, comfort cooling units, and industrial process cooling systems to ensure their optimal performance, efficiency, and safety.			

Module 32

Code	Course/Module Title	ECTS	Semester
RAC 303	Maintenance of Refrigeration & Air Conditioning Systems	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
0	4	63	87
Description			
This module introduces the fundamental principles, technologies, and applications of Maintenance of Refrigeration & Air Conditioning systems. This course usually requires a combination of theoretical study and practical training to ensure a comprehensive and complete understanding of the subject and qualify students to work in the field of refrigeration and air conditioning maintenance efficiently and professionally.			

Module 34

Code	Course/Module Title	ECTS	Semester
PM 303	Engineering Computer Applications	**4**	**6**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
0	**3**	**48**	**52**
Description			
The Computer Applications in this level provides students with a comprehensive fundamental knowledge for modeling the mechanical different parts in 2D & 3D. And make them understanding the definition, significance, calculation, analysis, create, design and inert of [Fasteners {Nuts, Screws, Washer}; {Shaft generators: Cylinder, Wrench, thread, gear, chamfer and fillet}; {Shaft Component: Roller Bearing, (Key: Parallel and Woodruff Key), Seals}; {Drill Bushing: Assembly Drawing}; {Springs: Compression, Extension and Torsion}; {moment of inertia}; {Deflection Line}]. As well as identifying and description the icons components of a typical insertion of different mechanical parts into different mechanical structures. Also enhancing and developing the student's capability for following the right steps in mechanical design and analysis the different mechanical parts into different mechanical structures with simulating the strength of material important parameters for accurate design performing.			

Module 34

Code	Course/Module Title	ECTS	Semester
PM 304	**Numerical Analysis**	**4**	**6**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
3	**0**	**48**	**52**
Description			
The Numerical Analysis (PM304) module covers iterative methods for solving linear equations (Jacobi, Gauss-Seidel), nonlinear equations (root-finding: graphical approach, bisection, false-position, Newton-Raphson, secant, fixed-point iteration), systems of nonlinear equations, numerical differentiation (finite difference formulas for first and second order derivatives: forward, backward, central), numerical solution of differential equations (Runge-Kutta method), and numerical integration (Newton-Cotes formulas: trapezoidal rule, Simpson's 1/3 and 3/8 rules, Boole's rule, composite integration, Riemann sums, and Gaussian quadrature). The module includes theory, lectures, and tutorials, with an emphasis on MATLAB implementation. The main advantages are that students understand theoretical and practical aspects of numerical methods, learn to solve engineering problems that lack analytical solutions, distinguish between true, approximate, and acceptable errors, use error analysis to terminate iterative computations, apply finite differences to derivatives, and gain confidence in using numerical tools for design verification, performance improvement, and cost-benefit analysis—essential for advanced engineering and scientific computing.			

Module 35

Code	Course/Module Title	ECTS	Semester
PM 305	Theory of Machines and Vibrations	8	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	4	123	77
Description			
The main purpose of this course: 1- Acquiring the skill and ability to interact with devices and machines and use them, calculate vibrations and ways to reduce and treat them, and demonstrate the student's ability to use knowledge to prepare scientific and applied research. 2. The ability to use electronic programs to solve problems in mechanical systems. 3. The ability to think critically to develop engineering solutions to problems related to mechanical parts. 4. The ability to keep pace with scientific and technological advancements. 5. Teaching leadership skills and the value and quality of commitment, love of work, and dedication			

2.4 Fourth Year / Renewable Energy

Module 36

Code	Course/Module Title	ECTS	Semester
PM 400	Thermal Power Plants	8	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	4	123	77

Description

A course on Thermal Power Plants. Includes the following sections:
1. Introducing students to thermodynamics by studying thermal systems in terms of energy interactions with its immediate surroundings. and measure differences in the appropriate properties of both the system and its surroundings and applications in engineering fields
2. To understand the fuel and combustion, show the combustion is perfect or in perfect
3. To study the steam turbine. By using the single or double blade and calculation the efficiency of blades
4. To explain steam condenser, explain the types of condensers
5. To study the types of pumps by state the law that use in pumps and the advantage and disadvantage of pumps
6. To study the water treatment, explain the method of water treatment (thermal, chemical, mechanical)
7. How to use the steam tables to find the properties (enthalpy, entropy, ect.)
8. How to use the combustion charts.

Module 37

Code	Course/Module Title	ECTS	Semester
RAC 400	Refrigeration Systems	**8**	**7**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
4	**4**	**123**	**77**

Description

The Refrigeration Systems (RAC400) module covers condensers, evaporators, expansion devices (capillary tubes, thermostatic expansion valves), cooling towers, thermoelectric refrigeration, absorption systems (LiBr-water and aqua-ammonia), adsorption systems, steam jet refrigeration, air refrigeration, and cryogenic gas liquefaction (Joule-Thomson effect, Claude and cascade systems). Practical lab work includes studying system components, measuring temperatures and pressures, calculating energy efficiency, testing different refrigerants, applying freezing techniques, and designing refrigeration systems. The main advantages are that students understand the basics of refrigeration and freezing, analyze and design efficient refrigeration systems for food preservation and air conditioning, evaluate energy efficiency and environmental impact, apply thermodynamics principles, and develop safety awareness in handling refrigeration systems—essential for careers in HVAC, food industry, and industrial cooling.

Module 38

Code	Course/Module Title	ECTS	Semester
PM 401	**Engineering Measurement Systems**	6	**7**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
2	**2**	63	87

Course Description

Engineering Measurement Systems is a fundamental module designed to provide senior engineering students with the critical skills required to quantify physical phenomena with scientific rigor. In an era dominated by data-driven decision-making and high-precision manufacturing, understanding the "science of measurement" (Metrology) is essential. This course bridges the gap between theoretical physics and practical engineering by focusing on the systematic analysis of measurement chains, from the initial sensing element to the final data output.

The curriculum is structured to provide a deep dive into Statistical Error Analysis and Uncertainty Quantification, enabling students to distinguish between systematic biases and random fluctuations. By mastering advanced tools such as Linear and Non-linear Regression in Microsoft Excel, students learn to transform raw experimental data into reliable mathematical models. The course further explores the Dynamic Response of sensors, teaching students how to account for time lags and damping in high-speed industrial processes.

A significant portion of the module is dedicated to Advanced Instrumentation, covering the full spectrum of industrial sensors for temperature, pressure, displacement, and fluid flow. Students explore the physics behind Thermoelectric effects, Resistance thermometry, and Radiation pyrometry, while simultaneously gaining hands-on experience through a state-of-the-art Virtual Laboratory framework. This integration of simulation-based learning with classical theory ensures that graduates can design, calibrate, and troubleshoot complex measurement systems in sectors ranging from aerospace and automotive to energy and robotics.

Module 39

Code	Course/Module Title	ECTS	Semester
PM 402	Methodology of Scientific Research	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
2	2	32	68

Description

The Methodology of Scientific Research (PM402) module covers research foundations (scientific principles, engineering problem-solving, mathematical modeling), literature review techniques, research methodology (experimental, numerical, and analytical methods), experimental design (measurement techniques, uncertainty analysis), numerical and CFD methods (finite methods, simulation, turbulence modeling), data handling (collection, analysis, statistics), engineering applications (heat transfer, fluid mechanics, thermodynamics), results and discussion, research writing (abstract, introduction, methodology, results), academic skills (IEEE referencing, plagiarism avoidance, research ethics), professional skills (presentation, communication, project planning, time management), numerical analysis and simulation validation (convergence, mesh independence, validation), advanced engineering analysis (dimensionless, sensitivity, and optimization techniques), experimental and measurement systems (sensors, error analysis, data accuracy), and modern engineering topics (renewable energy, energy efficiency, machine learning in engineering). The main advantages are that students develop a deep understanding of scientific research principles in engineering, enhance analytical thinking and problem-solving skills, learn to formulate engineering problems and build mathematical models, gain skills in data collection and analysis, and prepare effectively for graduation projects and academic research writing—essential for postgraduate studies and professional engineering research careers.

Module 40

Code	Course/Module Title	ECTS	Semester
PM 403	**Industrial Engineering Management**	**4**	**7**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	**0**	**33**	**67**
Description			
Engineering Management is an important course that combines engineering knowledge with management skills. It teaches students how to plan, organize, execute, and control engineering projects efficiently while managing resources such as time, cost, and workforce. The course covers key topics like project management, cost analysis, decision-making, risk management, and teamwork, along with developing leadership and communication skills in engineering environments.			

Module 41

Code	Course/Module Title	ECTS	Semester
RAC 401	Renewable Energy	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
2	2	63	87
The **Renewable Energy** module covers traditional energy sources, solar energy (types of solar collectors, extraterrestrial radiation variation, calculations), wind energy (natural characteristics, wind turbine components, design and sizing), geothermal energy (commercial power plant types), hydroelectricity, biomass energy (biofuels, biogas), and lifecycle assessment of biofuels. The module includes theory, lectures, labs, practical work, and seminars. The main advantages are that students learn the fundamentals of renewable energy technologies, become familiar with modern techniques and energy resources, understand the advantages and disadvantages of each energy source, analyze performance and efficiency of different systems, assess feasibility of renewable energy projects in various contexts, evaluate environmental impacts including carbon reduction and sustainability, and gain skills to design and operate modern power plants—essential for careers in sustainable energy engineering, power generation, and environmental management.			

Module 42

Code	Course/Module Title	ECTS	Semester
RAC 402	Design of Air Conditioning Systems	8	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
4	4	123	77

Description

The Design of Air Conditioning Systems module covers types of air conditioning systems (all-air, single duct, variable volume, dual duct, multiple zone, air-water, induction, all-water systems), air handling units, fan coil units, advanced air duct design (static and dynamic pressure losses, fan total pressure estimation, fan types and laws), air distribution (air diffusers, ventilation apertures), air filtration (HEPA and modern filters), psychometric processes (humidification, dehumidification, sensible heating and cooling, central cooling with dehumidification, central heating with humidification), water air conditioning systems (pipe diameter design, pump capacity and head calculation), evaporative cooling, noise control (sources, silencers), and a mini project. Practical lab work includes measuring air velocity, estimating pressure losses in flexible and smooth ducts and elbows, psychometric chart application, fan performance testing, and fan coil unit analysis. The main advantages are that students learn to select the best A/C system for each application, use psychometric charts to draw processes and determine relative humidity and comfort levels, design advanced air duct systems and water systems, select appropriate fans, filters, and diffusers, and gain technical skills for careers in HVAC design, building services, and refrigeration engineering.

Module 43

Code	Course/Module Title	ECTS	Semester
PM 404	Automatic Control Systems	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
2	**2**	63	87

Course Description / وصف المادة الدراسية

Automatic Control Systems is a cornerstone of modern engineering technology, focusing on the systematic regulation and management of dynamic processes to achieve desired performance objectives with precision and autonomy. This module builds upon advanced mathematical foundations to analyze how feedback mechanisms can stabilize systems, minimize steady-state errors, and enhance transient responses. It provides a comprehensive transition from conventional manual operations to sophisticated, autonomous industrial environments, which are essential in the era of Industry 4.0. The primary goal of this course is to equip senior engineering students with a rigorous analytical framework for modeling physical systems. By mastering Laplace transforms and Transfer Functions, students learn to predict system behavior under various conditions. The curriculum delves deeply into graphical representation techniques, including Block Diagram Algebra and Signal Flow Graphs (SFG), enabling engineers to simplify complex, multi-variable industrial architectures and determine overall system gains using Mason's Gain Formula.

Beyond theoretical modeling, this module emphasizes high-level practical field competence. Students explore the intricate logic of Classic Electromagnetic Control, mastering the operation of Relays, Contactors, Timers, and Thermal Overload protection. This is seamlessly integrated with modern Programmable Logic Controllers (PLC) technology. Through the use of industry-standard simulation software such as Cade SIMU and hands-on laboratory implementation on physical training boards, students bridge the gap between abstract control laws and real-world hardware execution.

Module 44

Code	Course/Module Title	ECTS	Semester
PM 405	Computer Aided Design	**4**	**8**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
0	**3**	**48**	**52**
Description			
The Computer Aided Design module covers AutoCAD interface, 2D drafting commands, coordinate systems, layers, 3D modeling primitives, Boolean operations, solid editing (Extrude, Revolve, Sweep, Loft), UCS, viewports, dimensioning, annotation, and plotting. Practical lab work progresses from basic drawing setup to advanced 3D modeling and a mini project. The main advantages are that students gain proficiency in using AutoCAD for 2D and 3D engineering drawings, learn to apply standard drafting conventions, develop skills in creating accurate models ready for printing and professional presentation, and prepare for engineering design careers in manufacturing, construction, and product development.			

Module 45

Code	Course/Module Title	ECTS	Semester
PM 406	**Project**	**6**	**8**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
0	**4**	**62**	**88**
Description			
This capstone course enables students to apply power mechanics engineering principles to design, analyze, and manufacture a complete thermal or mechanical system. Working in teams, students integrate knowledge from thermodynamics, fluid mechanics, and machine design to solve real-world engineering problems. The project emphasizes systematic design methodology, safety standards, performance evaluation, and technical report writing. Upon completion, students demonstrate professional competencies including project management, oral defense, and documentation of engineering solutions.			

Contact

Program Manager:

Dr. Ammar Hassan Suhail | Ph.D. in Thermal Technical Engineering | Lecturer.

Email: ammarsuhail@ntu.edu.iq

Mobile no.: 07736973363

Program Coordinator:

Ahmed Hani Ghanim | M.Sc. in Mechanical Engineering | Assist. Lecturer.

Email: ahmed.hanigh@ntu.edu.iq

Mobile no.: 07703896133