Ministry of Higher Education and Scientific Research
Scientific Supervision and Scientific Evaluation Apparatus
Directorate of Quality Assurance and Academic Accreditation
Accreditation Department

Academic Program and Course Description Guide

2024

Introduction:

The educational program is a well-planned set of courses that include procedures and experiences arranged in the form of an academic syllabus. Its main goal is to improve and build graduates' skills so they are ready for the job market. The program is reviewed and evaluated every year through internal or external audit procedures and programs like the External Examiner Program.

The academic program description is a short summary of the main features of the program and its courses. It shows what skills students are working to develop based on the program's goals. This description is very important because it is the main part of getting the program accredited, and it is written by the teaching staff together under the supervision of scientific committees in the scientific departments.

This guide, in its second version, includes a description of the academic program after updating the subjects and paragraphs of the previous guide in light of the updates and developments of the educational system in Iraq, which included the description of the academic program in its traditional form (annual, quarterly), as well as the adoption of the academic program description circulated according to the letter of the Department of Studies T 3/2906 on 3/5/2023 regarding the programs that adopt the Bologna Process as the basis for their work.

In this regard, we can only emphasize the importance of writing an academic programs and course description to ensure the proper functioning of the educational process.

Concepts and terminology:

Academic Program Description: The academic program description provides a brief summary of its vision, mission and objectives, including an accurate description of the targeted learning outcomes according to specific learning strategies.

Course Description: Provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the students to achieve, proving whether they have made the most of the available learning opportunities. It is derived from the program description.

Program Vision: An ambitious picture for the future of the academic program to be sophisticated, inspiring, stimulating, realistic and applicable.

Program Mission: Briefly outlines the objectives and activities necessary to achieve them and defines the program's development paths and directions.

Program Objectives: They are statements that describe what the academic program intends to achieve within a specific period of time and are measurable and observable.

Curriculum Structure: All courses / subjects included in the academic program according to the approved learning system (quarterly, annual, Bologna Process) whether it is a requirement (ministry, university, college and scientific department) with the number of credit hours.

Learning Outcomes: A compatible set of knowledge, skills and values acquired by students after the successful completion of the academic program and must determine the learning outcomes of each course in a way that achieves the objectives of the program.

Teaching and learning strategies: They are the strategies used by the faculty members to develop students' teaching and learning, and they are plans that are followed to reach the learning goals. They describe all classroom and extra-curricular activities to achieve the learning outcomes of the program.

Academic Program Description Form

University Name: Northern Technical University
Faculty/Institute: Technical Engineering College – Kirkuk
Scientific Department: Electronics and Control Engineering Techniques
Academic or Professional Program Name: Electronics and Control Engineering Techniques
Final Certificate Name: Electronics and Control Engineering Techniques
Academic System: Courses
Description Preparation Date: 1/9/2024
File Completion Date: 1/9/2024

Signature:
Head of Department Name:
Dr. Hussein Nadhem Fadhel
Date: 1/9/2024

Signature:
Scientific Associate Name:
Dr. Muntadher A. Shareef
Date: 1/9/2024

The file is checked by:
Department of Quality Assurance and University Performance
Director of the Quality Assurance and University Performance Department:
Dr. Rana Hilmi Abduljabbar
Date: 1/11/2024
Signature:

Approval of the Dean

1. **Program Vision**
The department seeks scientific excellence in its field, through innovation, development and community service by providing effective and innovative solutions.

2. **Program Mission**
To provide high-quality academic programs that align with scientific and technological development at the local, regional, and global levels, and to actively participate in developing engineering technologies and continuous improvement in the educational and research system of the college through ongoing cooperation with entities working in various engineering and technical specializations.

3. **Program Objectives**
1. To provide students with fundamental scientific and engineering concepts to enable them to integrate into engineering work fields and keep pace with developments in the field of electronics and control engineering. 2. To establish scientific partnerships with similar departments and research centers inside and outside Iraq to achieve benefits for students and faculty members from contemporary developments in engineering and technology fields. 3. To work towards national accreditation according to standards set by the Ministry of Higher Education and international standards through ABET. 5. Digital transformation of administrative and scientific operations within the department and enhancing communication with administrative units in the college. 6. To provide graduates with the necessary skills and knowledge to engage in the local and global job market.

4. **Program Accreditation**
Does the program have program accreditation? And from which agency? No (Applied)

5. **Other external influences**
Is there a sponsor for the program?

6. Program Structure				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements	**13**	**22**	**%14.56**	
College Requirements	**16**	**31**	**%20.53**	
Department Requirements	**33**	**98**	**%64.91**	
Summer Training	**2**	**-**	**-**	
Other				

* This can include notes whether the course is basic or optional.

7. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
			theoretical	**practical**
Level 1	NTU100	Human rights	1	
	NTU106	Democracy	1	
	NTU102	Computer principles 1	1	2
	NTU103	Computer principles 2	1	2
	NTU104	language Arabic	2	
	NTU105	Sport	1	1
	NTU107	French language	2	
	NTU101	English language 1	2	
	TECK101	Math 1	2	
	TECK103	Engineering drawing	1	2
	TECK104	Mechanical workshop		3
	TECK102	Math 2	2	
	TECK105	Engineering mechanics (Static)	3	
	ECE100	Electrical circuits 1	3	2
	ECE102	Electrical circuits 2	3	2
	ECE103	Electronics 2	2	2
	ECE104	Electronics 1	2	2
	ECE105	Electrical and Electronics workshop		3
Level 2	NTU201	professional ethics	2	
	NTU200	English language 2	2	
	TECK201	Math 3	3	
	TECK202	Math 4	3	

	TECK203	Physics	2	
	TECK204	Summer training 1		
	ECE200	Electromagnetic fields 1	3	
	ECE201	Electronic circuits 1	2	2
	ECE202	Digital electronics 1	2	2
	ECE203	Measurement systems 1	2	2
	ECE204	Electromagnetic fields 2	3	
	ECE205	Electronic circuits 2	2	2
	ECE206	Digital electronics 2	2	2
	ECE207	Measurement systems 2	2	2
	ECE208	Special Topic in Electrical circuit		
	ECE209	programming language	1	2
Level 3	NTU300	English language 3	2	
	TECK300	Engineering analysis	3	
	TECK301	Numerical Analysis	2	2
	TECK302	Summer training 2		
	ECE300	Control theory 1	2	2
	ECE301	Computer architecture	2	2
	ECE302	Power electronics 1	2	2
	ECE303	Communications principles	2	2
	ECE304	Control theory 2	2	2
	ECE305	Microcontrollers	2	2
	ECE306	Power electronics 2	2	2
	ECE307	Digital communications	**2**	**2**
	ECE308	SCADA systems	**2**	**2**
Level 4	NTU410	Scientific Research Methodology	2	
	NTU400	English language 4	2	
	TECK401	Project 1		3
	TECK403	Project 2		3
	TECK400	Eng. project management	3	
	TECK402	Engineering Economics	2	
	ECE400	Computer networks	2	2
	ECE401	Digital control 1	2	2
	ECE402	Control of power systems 1	2	2
	ECE403	Digital signal processing	2	2
	ECE404	Digital control 2	2	2
	ECE405	Control of power systems 2	2	2
	ECE406	Modeling and simulation	2	2
	ECE407	Robotics and Automations	2	2
	ECE408	Internet of things	**2**	

8. Expected learning outcomes of the program
Knowledge
A1- Understands the fundamental principles of mathematics, physics, and electrical circuits and their applications in electronic engineering. **A2-** Analyzes electronic circuits, control theories, and digital control systems in various engineering applications. **A3-** Explains the principles of communications, digital signal processing, computer architecture, and microcontroller systems. **A4-** Describes automation techniques, robotics, and Internet of Things (IoT) technologies and their applications in modern industry.
Skills
B1- Designs and analyzes electronic circuits and control systems using specialized tools and software applications. B2- Applies measurement and control techniques and programs microcontrollers to implement automation tasks. B3- Uses simulation and modeling tools to develop and improve electronic and engineering systems. B4- Solves technical problems systematically and works effectively within multidisciplinary teams.
Ethics
C1- Demonstrates commitment to ethical and professional standards in engineering practice and shows responsibility in designing safe systems. **C2-** Embraces the principle of lifelong learning and continuous professional development in the field of technology. **C3-** Respects the environment and seeks to develop sustainable and eco-friendly solutions in engineering projects. **C4-** Interacts positively with the community and contributes to technological development and local advancement.

9. Teaching and Learning Strategies

For Theoretical Courses (Mathematics, Physics, Theories):

- **Interactive lectures** using presentations and visual aids
- **Problem-based learning** to apply theoretical concepts
- **Group discussions** to deepen understanding of complex concepts
- **Self-directed learning** through guided readings and research

For Practical Courses (Laboratories and Workshops):

- **Hands-on learning** in specialized laboratories
- **Teamwork** in conducting experiments and mini-projects
- **Discovery-based learning** through experimentation and simulation
- **Practical training** on equipment and instrument usage

For Applied Courses (Graduation Projects and Training):

- **Project-based learning** to develop real engineering solutions
- **Collaborative learning** with industry and external institutions
- **Critical and creative thinking** in analyzing and solving technical problems
- **Blended learning** using digital technologies and simulation

For Specialized Courses (Electronics and Control):

- **Computer simulation** for system design and analysis
- **Case studies** from real industrial applications
- **Visual learning** through technical diagrams and drawings
- **Training on specialized software** (MATLAB, Simulink, etc.)

10. Evaluation methods

For Theoretical Courses:

- **Final examinations** to measure understanding of theoretical concepts
- **Monthly exams/quizzes** for continuous assessment
- **Assignments and problem solving** to apply concepts
- **Class participation and attendance** to evaluate interaction

For Practical Courses (Laboratories and Workshops):

- **Laboratory reports** to document experiments and results
- **Practical performance in laboratory** to assess applied skills
- **Practical examinations** to measure practical competency
- **Attendance and discipline** to evaluate commitment

For Applied Courses (Graduation Projects):

- **Final project** to evaluate application capability
- **Periodic reports** to monitor progress
- **Presentation and discussion** to assess communication skills
- **Supervisor evaluation** for continuous monitoring

For Specialized Courses:

- **Applied projects** to evaluate practical application
- **Theoretical examinations** to measure theoretical knowledge
- **Designs and simulation** to assess software usage
- **Research and reports** to develop research skills

11.Faculty					
Faculty Members					
Academic Rank	**Specialization**		**Special Requirements/Skills (if applicable)**	**Number of the teaching staff**	
	General	**Special**		**Staff**	**Lecturer**
Prof.	Electronic and Communications Engineering	Communications Engineering		✓	
Prof.	physics	solid state physics		✓	
asst. Prof.	Electrical engineering	Electrical power and machines		✓	
Lect.	Electronics and Control Engineering	Communication Engineering and Information theory		✓	
Lect.	Software Engineering	Neural Network Security		✓	
Lect.	Computer Engineering	Electronic Technology Engineering		✓	
Lect.	Computer Science	Computer Science - Communications		✓	
Lect.	Physics	Material Physics		✓	

Lect.	Mechatronics and Robotics	Mechatronics and Robotics			✓	
asst. Lect.	Electronic and control engineering	Electronic and communication engineering			✓	
asst. Lect.	Electronic and control engineering	Electrical and Computer Engineering			✓	
asst. Lect.	Electronic and control engineering	Electronic Engineering			✓	
asst. Lect.	Electrical engineering	Electrical and electronics engineering			✓	
Lect.	Electronic Engineering	Electronic Engineering			✓	
asst. Lect.	Electronics Engineering	Electronics Engineering			✓	
asst. Lect.	Electronic and control technical engineering	Electronic and control technical engineering			✓	
asst. Lect.	Electrical Engineering	Communication Engineering			✓	
asst. Lect.	Electrical Engineering	Electronic and Communications Engineering			✓	
Lect.	Electronic and control engineering	Mechatronics and Robotics			✓	
asst. Lect.	Electronic and control engineering	Control Engineering			✓	
asst. Lect.	Electronic and control	Communication			✓	

	engineering	Engineering				
Lect.	Physics	Astronomy Physics			✓	
Lect.	Electronic and Control Engineering	Mechatronics Engineering			✓	
asst. Lect.	Electrical engineering	Power electronics			✓	
asst. Lect.	Electrical and Electronics Engineering	Control			✓	
asst. Lect.	Mechatronics Engineering	Mechatronics Engineering			✓	
asst. Lect.	Public law	Administrative Law			✓	
asst. Lect.	Electronic and Control engineering	Electronic and Communications Engineering			✓	

Professional Development

Mentoring new faculty members

- Training courses in modern developments in electronics and control
- Training on specialized software and simulation
- Workshops on teaching strategies in technical specializations
- Courses in writing and publishing scientific research

Professional development of faculty members

- Continuous updating in emerging technologies and Industry 4.0
- Developing scientific research skills and international publication
- Collaboration with industrial and academic institutions
- Developing administrative and leadership skills in the academic environment

12.Acceptance Criterion
(Setting regulations related to enrollment in the college or institute, whether central admission or others)

13.The most important sources of information about the program

Required Textbooks:

- Internationally recognized electrical and electronic circuits references
- Control theory and digital control systems books
- Computer architecture and microcontroller references
- Communications and digital signal processing books

Main References:

- International standards and publications (IEEE, IEC, ISO)
- Peer-reviewed scientific journals in electronics and control
- Reference books in automation and robotics
- Emerging technologies and Internet of Things references

Electronic References:

- Specialized academic databases
- E-learning platforms for technical specializations
- Leading technical companies and institutions websites
- Specialized simulation and design software

14.Program Development Plan

Required Textbooks:

- Internationally recognized electrical and electronic circuits references
- Control theory and digital control systems books
- Computer architecture and microcontroller references
- Communications and digital signal processing books

Main References:

- International standards and publications (IEEE, IEC, ISO)
- Peer-reviewed scientific journals in electronics and control
- Reference books in automation and robotics
- Emerging technologies and Internet of Things references

Electronic References:

- Specialized academic databases
- E-learning platforms for technical specializations
- Leading technical companies and institutions websites
- Specialized simulation and design software

Program Skills Outline															
				Required program Learning outcomes											
Year/ Level	**Course Code**	**Course Name**	**Basic or optional**	**Knowledge**				**Skills**				**Ethics**			
				A1	**A2**	**A3**	**A4**	**B1**	**B2**	**B3**	**B4**	**C1**	**C2**	**C3**	**C4**
Level 1	NTU100	Human rights	Basic									✓			✓
	NTU106	Democracy	Basic									✓			✓
	NTU102	Computer principles 1	Basic	✓		✓		✓		✓			✓		
	NTU103	Computer principles 2	Basic	✓		✓		✓		✓			✓		
	NTU104	language Arabic	Basic								✓		✓		✓
	NTU105	Sport	Basic						✓		✓		✓	✓	
	NTU107	French language	Basic								✓		✓		
	NTU101	English language 1	Basic								✓		✓		
	TECK101	Math 1	Basic	✓						✓			✓		
	TECK103	Engineering drawing	Basic	✓				✓			✓				

	TECK104	Mechanical workshop	Basic					✓	✓		✓	✓			
	TECK102	Math 2	Basic	✓						✓			✓		
	TECK105	Engineering mechanics (Static)	Basic	✓						✓					
	ECE100	Electrical circuits 1	Basic	✓	✓			✓		✓			✓		
	ECE102	Electrical circuits 2	Basic	✓	✓			✓		✓			✓		
	ECE103	Electronics 2	Basic	✓	✓			✓		✓			✓		
	ECE104	Electronics 1	Basic	✓	✓			✓		✓			✓		
	ECE105	Electrical and Electronics workshop	Basic					✓	✓		✓	✓		✓	
Level 2	NTU201	professional ethics	Basic									✓	✓	✓	✓
	NTU200	English language 2	Basic								✓		✓		
	TECK201	Math 3	Basic	✓						✓			✓		
	TECK202	Math 4	Basic	✓						✓			✓		
	TECK203	Physics	Basic	✓						✓			✓		
	TECK204	Summer training 1	Basic					✓	✓		✓	✓	✓		✓
	ECE200	Electromagnetic fields 1	Basic	✓	✓			✓		✓			✓		

	ECE201	Electronic circuits 1	Basic	✓	✓			✓		✓			✓		
	ECE202	Digital electronics 1	Basic	✓	✓	✓		✓		✓			✓		
	ECE203	Measurement systems 1	Basic	✓	✓			✓	✓	✓			✓		
	ECE204	Electromagnetic fields 2	Basic	✓	✓			✓		✓			✓		
	ECE205	Electronic circuits 2	Basic	✓	✓			✓		✓			✓		
	ECE206	Digital electronics 2	Basic	✓	✓	✓		✓		✓			✓		
	ECE207	Measurement systems 2	Basic	✓	✓			✓	✓	✓			✓		
	ECE208	Special Topic in Electrical circuit	optional	✓	✓	✓	✓	✓	✓	✓	✓		✓		
	ECE209	programming language	Basic			✓		✓	✓	✓	✓		✓		
Level 3	NTU300	English language 3	Basic								✓		✓		
	TECK300	Engineering analysis	Basic	✓						✓			✓		
	TECK301	Numerical Analysis	Basic	✓						✓			✓		
	TECK302	Summer training 2	Basic					✓	✓		✓	✓	✓		✓

	ECE300	Control theory 1	Basic		✓			✓	✓	✓			✓		
	ECE301	Computer architecture	Basic			✓		✓	✓	✓			✓		
	ECE302	Power electronics 1	Basic	✓	✓			✓	✓	✓			✓	✓	
	ECE303	Communications principles	Basic			✓		✓		✓			✓		
	ECE304	Control theory 2	Basic		✓			✓	✓	✓			✓		
	ECE305	Microcontrollers	Basic		✓	✓		✓	✓	✓			✓		
	ECE306	Power electronics 2	Basic	✓	✓			✓	✓	✓			✓	✓	
	ECE307	Digital communications	optional			✓		✓		✓			✓		
	ECE308	SCADA systems	optional		✓		✓	✓	✓	✓	✓		✓		
Level 4	NTU410	Scientific Research Methodology	Basic							✓	✓	✓	✓		✓
	NTU400	English language 4	Basic								✓		✓		
	TECK401	Project 1	Basic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	TECK403	Project 2	Basic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

	TECK400	Eng. project management	Basic								✓	✓	✓		✓
	TECK402	Engineering Economics	Basic								✓	✓	✓	✓	✓
	ECE400	Computer networks	Basic			✓	✓	✓		✓			✓		
	ECE401	Digital control 1	Basic		✓	✓		✓	✓	✓			✓		
	ECE402	Control of power systems 1	Basic		✓			✓	✓	✓			✓	✓	
	ECE403	Digital signal processing	Basic			✓		✓		✓			✓		
	ECE404	Digital control 2	Basic		✓	✓		✓	✓	✓			✓		
	ECE405	Control of power systems 2	Basic		✓			✓	✓	✓			✓	✓	
	ECE406	Modeling and simulation	Basic		✓	✓		✓	✓	✓	✓		✓		
	ECE407	Robotics and Automations	Basic		✓		✓	✓	✓	✓	✓		✓	✓	
	ECE408	Internet of things	Optional			✓	✓	✓	✓	✓	✓		✓	✓	✓

Course Description Form

1. Course Name:					
2. Course Code:					
3. Semester / Year:					
4. Description Preparation Date:					
5. Available Attendance Forms:					
6. Number of Credit Hours (Total) / Number of Units (Total)					
7. Course administrator's name (mention all, if more than one name) Name: Email:					
8. Course Objectives					
Course Objectives			• ..... • ..... •		
9. Teaching and Learning Strategies					
Strategy					
10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
11. Course Evaluation					
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc					

12.Learning and Teaching Resources	
Required textbooks (curricular books, any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

1. Course Name:	
Human Rights	
2. Course Code:	
NTU100	
3. Semester / Year:	
First Semester / First Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (theoretical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
2 Hours - 2 Units	
7. Course administrator's name (mention all, if more than one name)	
Name: Email:	
8. Course Objectives	
Course Objectives	• Introduce students to human rights and familiarize them with their importance, scope, elements, and the extent of need for them • Shed light on the historical development of human rights in different eras, linking them to contemporary modern applications • Provide students with understanding and awareness of the fundamental principles of human rights and their universal application • Develop critical thinking skills to analyze human rights violations and protection mechanisms
9. Teaching and Learning Strategies	
Strategy	**Teaching Methods:** • **Lectures:** Direct lectures, use of audio-visual aids, and modern technology • **Interactive Classroom Learning:** Classroom participation, expression of ideas, dialogue, and discussion • **Case Study Analysis:** Examination of real-world human rights situations and violations • **Document Analysis:** Study of international human rights treaties and declarations **Assessment Methods:** • Continuous assessment through discussions and oral presentations • Written examinations and case study analyses • Research assignments on human rights topics

10. Course Structure

Week	Hours	Required Learning	Unit or subject	Learnin	Evaluation

		Outcomes	name	g method	method
1	**2T**	**Knowledge:** Understand fundamental human rights concepts, definitions, and basic principles **Skills:** Identify and categorize different types of human rights **Values:** Appreciate the universal nature and importance of human dignity	**Chapter One: Conceptual Framework of Human Rights**	**Theoretica lectures, discussion case studie**	Tests and Reports
2	**2T**	**Knowledge:** Learn about root causes and patterns of human rights violations **Skills:** Analyze specific cases of human rights violations and their underlying factors **Values:** Develop awareness of injustice and commitment to preventing violations	**Chapter Two: Causes of Human Rights Violations**	**Theoretica lectures, discussion case studie and dialog**	Tests and Reports
3	**2T**	**Knowledge:** Explore historical development of human rights in ancient civilizations **Skills:** Examine historical documents and compare ancient and modern rights concepts **Values:** Appreciate the evolutionary nature of human rights across cultures and time	**Chapter Three: Human Rights in Historical Context**	**Theoretica lectures, discussion case studie and dialog**	Tests and Reports
4	**2T**	**Knowledge:** Understand international human rights law and key treaties **Skills:** Analyze and interpret international human rights documents and declarations **Values:** Value international cooperation and legal frameworks for protecting rights	**Chapter Four: International Human Rights Law**	**Theoretica lectures, discussion case studie and dialog**	Tests and Reports
5	**2T**	**Knowledge:** Learn about national constitutions and domestic human rights protections	**Chapter Five: National Human Rights Frameworks**	**Theoretica lectures, discussion case studie**	Tests and Reports

		Skills: Compare international standards with national legal frameworks **Values:** Appreciate the role of national institutions in rights protection		**and dialog**	
6	**2T**	**Knowledge:** Understand various mechanisms and institutions for human rights protection **Skills:** Evaluate the effectiveness of different protection mechanisms **Values:** Recognize the importance of institutional safeguards and rule of law	**Chapter Six: Human Rights Protection Mechanisms**	**Theoretica lectures, discussion case studie and dialog**	Tests and Reports
	2P	**Knowledge:** Assessment of foundational human rights knowledge **Skills:** Demonstrate mastery of analytical abilities in human rights contexts **Values:** Show development of human rights value commitments	**Mid-term Examination**	**Examinati**	
7	**2T**	**Knowledge:** Understand the role of international organizations in human rights **Skills:** Evaluate the effectiveness of international bodies like the UN in rights protection **Values:** Value multilateral cooperation and global governance for rights protection	**Chapter Seven: International Organizations and Human Rights**	**Theoretica lectures, discussion case studie and dialog**	Tests and Reports
8	**2T**	**Knowledge:** Understand genocide as the gravest human rights violation **Skills:** Analyze historical cases of genocide and prevention mechanisms **Values:** Develop commitment to preventing mass atrocities and protecting vulnerable populations	**Chapter Eight: Genocide and Mass Atrocities**	**Lectures a group discussion**	Tests and Reports

9	**2T**	**Knowledge:** Learn about civil liberties and classification of fundamental freedoms **Skills:** Categorize and analyze different types of civil and political rights **Values:** Appreciate the breadth of human freedoms and their interconnectedness	**Chapter Nine: Civil and Political Rights**	**Lectures a group discussion**	Tests and Reports
10	**2T**	**Knowledge:** Understand economic, social, and cultural rights **Skills:** Analyze the relationship between different generations of rights **Values:** Recognize the indivisibility and interdependence of all human rights	**Chapter Ten: Economic, Social, and Cultural Rights**	**Lectures, discussion case studi**	Tests and Reports
11	**2T**	**Knowledge:** Learn about specific vulnerable groups and their rights **Skills:** Assess protection mechanisms for marginalized populations **Values:** Develop special concern for protecting vulnerable and marginalized groups	**Chapter Eleven: Rights of Vulnerable Groups**	**Lectures, discussion case studi and dialog**	Tests and Reports
12	**2T**	**Knowledge:** Understand contemporary human rights challenges and emerging issues **Skills:** Apply human rights principles to modern challenges like technology and climate change **Values:** Commit to addressing contemporary human rights challenges	**Chapter Twelve: Contemporary Human Rights Challenges**	**Lectures, discussion and case studies**	Tests and Reports
13	**2T**	**Knowledge:** Learn about human rights education and advocacy strategies **Skills:** Develop skills for human rights promotion and education **Values:** Foster	**Chapter Thirteen: Human Rights Education and Advocacy**	**Interactiv workshop and group activities**	

		responsibility for human rights education and advocacy			
14	**2T**	**Knowledge:** Synthesize comprehensive understanding of human rights framework **Skills:** Demonstrate ability to apply human rights knowledge to real-world situations **Values:** Commit to lifelong engagement with human rights principles and practice	**Final Review and Future Perspectives**	**Comprehe ive review and studer presentati s**	
15	**2T**	**Knowledge:** Understand fundamental human rights concepts, definitions, and basic principles **Skills:** Identify and categorize different types of human rights **Values:** Appreciate the universal nature and importance of human dignity	**Chapter One: Conceptual Framework of Human Rights**	**Theoretica lectures, discussion case studie**	

11. Course Evaluation	
The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Human Rights: Concepts and Contemporary Issu
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

1. Course Name:	
Democracy	
2. Course Code:	
NTU106	
3. Semester / Year:	
Second Semester / First Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (theoretical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
2 Hours - 2 Units	
7. Course administrator's name (mention all, if more than one name)	
Name: Email:	
8. Course Objectives	
Course Objectives	• Introduce students to democratic principles and familiarize them with the foundations, elements, and various forms of democratic governance • Examine the historical evolution of democratic systems and their development across different cultures and societies • Provide comprehensive understanding of democratic institutions, processes, and mechanisms of governance • Develop analytical skills to evaluate democratic systems and their effectiveness in promoting good governance and citizen participation
9. Teaching and Learning Strategies	
Strategy	**Teaching Methods:** • **Lectures:** Comprehensive lectures on democratic theory and practice with multimedia presentations • **Interactive Learning:** Student participation in democratic simulations and model governments • **Comparative Analysis:** Examination of different democratic systems and their institutions • **Case Studies:** Analysis of democratic transitions and consolidation processes **Assessment Methods:** • Continuous assessment through class participation and democratic simulations • Comparative analysis assignments of democratic systems • Written examinations on democratic theory and institutions

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1	**2T**	**Knowledge:** Understand fundamental concepts and definitions of democracy **Skills:** Identify and distinguish between different types of democratic systems **Values:** Appreciate the importance of democratic principles and citizen participation	**Chapter One: Foundations of Democracy**	**Theoretica lectures, discussion and interactive sessions**	Tests and Reports
2	**2T**	**Knowledge:** Learn about the historical evolution of democratic thought and practice **Skills:** Analyze the development of democratic ideas from ancient to modern times **Values:** Understand the progressive nature of democratic development	**Chapter Two: Historical Development of Democracy**	**Theoretica lectures, discussion case studi**	Tests and Reports
3	**2T**	**Knowledge:** Understand democratic principles such as popular sovereignty and majority rule **Skills:** Evaluate the balance between majority rule and minority rights **Values:** Appreciate the importance of protecting minority rights in democratic systems	**Chapter Three: Democratic Principles and Values**	**Theoretica lectures, discussion and dialog**	Tests and Reports
4	**2T**	**Knowledge:** Learn about the principle of separation of powers and checks and balances **Skills:** Analyze how separation of powers protects democracy and prevents authoritarianism **Values:** Appreciate democratic governance structures and institutional safeguards	**Chapter Four: Separation of Powers and Checks and Balances**	**Theoretica lectures, discussion case studi**	Tests and Reports
5	**2T**	**Knowledge:** Understand different electoral systems	**Chapter Five: Electoral**	**Theoretica lectures,**	Tests and Reports

		and their impact on representation **Skills:** Compare electoral systems and analyze their effects on political outcomes **Values:** Value fair representation and democratic legitimacy through elections	**Systems and Representation**	**discussion and simulation**	
6	**2T**	**Knowledge:** Learn about political parties, party systems, and their role in democracy **Skills:** Assess the functions of political parties in democratic governance **Values:** Understand the importance of political pluralism and competitive politics	**Chapter Six: Political Parties and Party Systems**	**Theoretica lectures, discussion case studie**	Tests and Reports
	2P	**Knowledge:** Assessment of foundational democratic knowledge and concepts **Skills:** Demonstrate mastery of analytical abilities in democratic theory **Values:** Show development of democratic value commitments	**Mid-term Examination**	**Examinati**	
7	**2T**	**Knowledge:** Understand the role of civil society and citizen participation in democracy **Skills:** Evaluate mechanisms for citizen engagement and civic participation **Values:** Cultivate commitment to active citizenship and civic engagement	**Chapter Seven: Civil Society and Citizen Participation**	**Theoretica lectures, discussion and interactive workshops**	Tests and Reports
8	**2T**	**Knowledge:** Learn about democratic accountability and transparency mechanisms **Skills:** Analyze oversight	**Chapter Eight: Democratic Accountability and Transparency**	**Theoretica lectures, discussion case studie**	Tests and Reports

		institutions and accountability measures **Values:** Value transparency, accountability, and good governance principles			
9	**2T**	**Knowledge:** Study various democratic systems practiced globally (parliamentary, presidential, mixed) **Skills:** Compare and contrast different democratic models and their effectiveness **Values:** Understand the diversity of democratic expressions and institutional arrangements	**Chapter Nine: Types of Democratic Systems**	**Theoretica lectures, discussion comparati analysis**	Tests and Reports
10	**2T**	**Knowledge:** Examine democratic systems in different regional and cultural contexts **Skills:** Analyze how culture and history shape democratic development **Values:** Appreciate cultural diversity in democratic practice while maintaining core principles	**Chapter Ten: Democracy in Different Cultural Contexts**	**Theoretica lectures, discussion case studie**	Tests and Reports
11	**2T**	**Knowledge:** Understand processes of democratic transition and consolidation **Skills:** Analyze factors that contribute to successful democratization **Values:** Develop commitment to supporting democratic transitions and consolidation	**Chapter Eleven: Democratic Transition and Consolidation**	**Lectures, case studie and group discussion**	Tests and Reports
12	**2T**	**Knowledge:** Learn about contemporary challenges facing democratic systems **Skills:** Assess threats to democracy such as populism, polarization, and authoritarianism **Values:** Understand the	**Chapter Twelve: Contemporary Challenges to Democracy**	**Lectures, discussion and curre events analysis**	Tests and Reports

		fragility of democracy and the need for its protection			
13	2T	**Knowledge:** Understand the role of media, technology, and information in democratic governance **Skills:** Evaluate the impact of digital technology on democratic processes **Values:** Appreciate the importance of free media and information literacy in democracy	**Chapter Thirteen: Media, Technology, and Democracy**	**Lectures, discussion and digita democracy workshops**	
14	2T	**Knowledge:** Synthesize comprehensive understanding of democratic governance and future prospects **Skills:** Develop proposals for strengthening democratic institutions and processes **Values:** Commit to lifelong engagement with democratic principles and civic responsibility	**Final Review: Future of Democracy**	**Comprehe ive review student presentati s, and democrati simulation**	
15	2T	**Knowledge:** Understand fundamental concepts and definitions of democracy **Skills:** Identify and distinguish between different types of democratic systems **Values:** Appreciate the importance of democratic principles and citizen participation	**Chapter One: Foundations of Democracy**	**Theoretica lectures, discussion and interactive sessions**	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Democratic Theory and Practice: Contemporary Perspectives (2023 Edition)
Main references (sources)	

Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

1. Course Name:

Computer Principles 1		
2. Course Code:		
NTU102		
3. Semester / Year:		
First semester / first stage		
4. Description Preparation Date:		
01-09-2024		
5. Available Attendance Forms:		
(Theoretical and practical lectures)		
6. Number of Credit Hours (Total) / Number of Units (Total)		
1 theoretical + 2 practical / Total hours / 45 Number of units / 2		
7. Course administrator's name (mention all, if more than one name)		
Name: Nyan Farooq Ezzulddin Email: nyan8287@ntu.edu.iq		
8. Course Objectives		
Course Objectives		1. Familiarize yourself with common computer applications and their basic programs. 2. Enhance students' productivity by using computer tools to perform various tasks. 3. Acquire data analysis and visualization skills using computer programs. 4. Develop problem-solving skills using digital tools. 5. Promote digital citizenship and understand the fundamentals of ethical technology use. 6. Prepare students to adapt to new and ever-changing technologies.
9. Teaching and Learning Strategies		
Strategy	Teaching Methods: • Theoretical lectures: To introduce basic concepts, explain computer architecture, and cover the theoretical aspects of computer science principles. • Practical lab work: To enable students to use computer software. • Homework: To practice the concepts and principles taught in class. • Peer collaboration: The instructor encourages students to collaborate with each other. Students can work together on projects, share knowledge, and exchange ideas. Assessment Methods: • Assessments: Short quizzes and tests are administered to measure students' mastery of computer science terminology. Students can track their progress and success.	
10. Course Structure		

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**1T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understand the basic concepts of computers and the basic concepts of information and communication technology (ICT) and its applications, and classify computer types (personal, desktop, high-speed, embedded). **Skills**: Distinguish between computer types, compare their characteristics, and determine the most appropriate one for each use. **Values**: Understand the importance of computers as an effective tool in supporting various aspects of life.	Introduction to computer characteristics	T	Tests and Reports
	2P	**Knowledge**: Understanding the basic concepts of computers and the basic concepts of information and communications technology (ICT) and its applications, and classifying computer types (personal, desktop, high-speed, embedded). **Skills**: Distinguishing between computer types, comparing their characteristics, and determining the most appropriate one for each use. **Values**: Understanding the importance of computers	Introduction to Computer	P	

		as an effective tool in supporting various aspects of life.			
2-3	**1T**	**Knowledge**: The student will be able to identify the hardware and software components of a computer. **Skills**: Distinguish between input and output units and storage units. **Values**: Awareness of the importance of each component in a computer system. Commitment to maintaining the integrity of hardware components and not tampering with them.	Computer components (hardware and software)	T	Tests and Reports
	2P	**Knowledge**: The student will be able to identify the hardware and software components of a computer. **Skills**: Distinguish between input and output units such as (mouse, keyboard, and printers). **Values**: Awareness of the importance of each component in a computer system. Commitment to maintaining the integrity of hardware components and not tampering with them.	Computer components (hardware and software)	P	
4-6	**1T**	**Knowledge**: Distinguish between graphical user interface elements such as icons, the taskbar, menus, windows, and folders, and learn the basics of common operating systems such as Windows, Linux, and macOS. **Skills**: The operating system is used to navigate between windows and programs efficiently. **Values**: Demonstrates a commitment to organized	Operating Systems and Graphical User Interface (GUI)	T	Tests and Reports

		computer use by clearly organizing files and folders.			
	2P	**Knowledge**: Distinguish between graphical user interface elements such as icons, the taskbar, menus, windows, and folders, and learn the basics of common operating systems such as Windows, Linux, and macOS. **Skills**: The operating system (windows)is used to navigate between windows and programs efficiently. **Values**: Demonstrates a commitment to organized computer use by clearly organizing files and folders.	Operating Systems and Graphical User Interface (GUI)	P	
7	1T	**Knowledge**: The student learns about the basic components of a computer (central processing unit, memory, input and output units). The difference between software and hardware (Hardware vs. Software) The concept of word processing and the tools used to process it. **Skills**: Operating a computer, using the most common operating system (Windows), using the mouse and keyboard efficiently in a desktop environment, and managing folders and files **Values**: Commitment to accuracy and organization when working on documents and professionalism in document formatting	Midterm exam	T	midterm exam
	2P	**Knowledge**: The student learns about the basic components of a computer	Practical applications + review	P	

		(central processing unit, memory, input and output units). The difference between software and hardware (Hardware vs. Software) The concept of word processing and the tools used to process it. **Skills**: Operating a computer, using the most common operating system (Windows), using the mouse and keyboard efficiently in a desktop environment, and managing folders and files **Values**: Commitment to accuracy and organization when working on documents and professionalism in document formatting			
8-10	**1T**	**Knowledge**: The student becomes familiar with the components of a word processing program interface such as Microsoft Word. **Skills**: Use word processing software to open and create documents, insert and edit tables within the document, and save the document. **Values**: Accuracy and attention in writing and processing texts.	Word processing	T	Tests and Reports
	2P	**Knowledge**: The student becomes familiar with the components of a word processing program interface such as Microsoft Word. **Skills**: Use word processing software to open and create documents, insert and edit tables within the document, and save the	Word processing	P	

		document. **Values**: Accuracy and attention in writing and processing texts.			
11-13	**1T**	**Knowledge**: Learn about the components of the Microsoft Excel spreadsheet interface. **Skills**: The student will learn how to open Excel files, create new tables, and use mathematical functions to analyze data. **Values**: Methodology and organization in arranging data within tables	Spreadsheets	T	Tests and Reports
	2P	**Knowledge**: Learn about the components of the Microsoft Excel spreadsheet interface. **Skills**: The student will learn how to open Excel files, create new tables, and use mathematical functions to analyze data. **Values**: Methodology and organization in arranging data within tables	Spreadsheets Excel	P	
14	**1T**	**Knowledge**: Understand the concept of emerging technology trends. **Skills**: Distinguish between different types of technical trends based on their use and impact. **Values**: Appreciating the importance of continuous learning in an age of accelerating technology.	Emerging trends and future applications	T	
	2P	**Knowledge**: Understand the concept of emerging technology trends and learn about modern technologies such as AI. **Skills**: Distinguish between different types of technical trends based on their use and impact. **Values**: Appreciating the importance of continuous learning in an age of	Future trends and applications such as AI	P	

		accelerating technology.			
15	**1T**	**Knowledge**: Learn the basic components of a computer, differentiate between hardware and software, learn about the operating system, word processing software, entering data into tables, applying functions to them, and learn about presentation programs. **Skills**: Able to operate the computer, navigate the operating system, and manage files and folders. **Values**: Responsible for the safe and responsible use of computers and the internet. Accuracy and organization in formatting files, documents, and data entry.	Preparatory week	T	Comprehensive review
	2P	**Knowledge**: Learn the basic components of a computer, differentiate between hardware and software, learn about the operating system, word processing software, entering data into tables, applying functions to them, and learn about presentation programs. **Skills**: Able to operate the computer, navigate the operating system, and manage files and folders. **Values**: Responsible for the safe and responsible use of computers and the internet. Accuracy and organization in formatting files, documents, and data entry.	Modern technologies such as artificial intelligence + comprehensive review	P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	"Computer Science Principles: The Foundation Concepts of Computer Science" BY: Mr. Kevin P Hare
Electronic References, Websites	https://edu.gcfglobal.org/en/computers/

1. Course Name:
Computer Principles 2
2. Course Code:
NTU103
3. Semester / Year:
Second semester / first stage
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
(Theoretical and practical lectures)
6. Number of Credit Hours (Total) / Number of Units (Total)
1theoretical + 2 practical / Total Hours \ 45 \ Number of Credit \2
7. Course administrator's name (mention all, if more than one name)
Name: Nyan Farooq Ezzulddin Email: nyan8287@ntu.edu.iq
8. Course Objectives

Course Objectives	1. Familiarize yourself with common computer applications and their basic programs. 2. Enhance students' productivity by using computer tools to perform various tasks. 3. Acquire data analysis and visualization skills using computer programs. 4. Develop problem-solving skills using digital tools. 5. Promote digital citizenship and understand the fundamentals of ethical technology use. 6. Prepare students to adapt to new and ever-changing technologies.

9. Teaching and Learning Strategies	
Strategy	Teaching Methods: Theoretical lectures: To introduce basic concepts, explain computer architecture, and cover the theoretical aspects of computer science principles. • Practical lab work: To enable students to use computer software. • Homework: To practice the concepts and principles taught in class. • Peer collaboration: The instructor encourages students to collaborate with each other. Students can work together on projects, share knowledge, and exchange ideas. Assessment Methods: • Short quizzes and tests are administered to measure students' mastery of computer science terminology.

	Students can track their progress and success on their own.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**1T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: The student learns the concept of a computer network and the importance of networks in exchanging information. The difference between local area networks (LANs) and wide area networks (WANs) in terms of scope and use. The concept of the Internet and how it functions as an interconnected global network. **Skills**: Find information using search engines in effective ways and distinguish between types of networks. **Values**: Digital awareness and the importance of responsible and safe use of the Internet.	Introduction to the Internet and Web Browsers	T	Tests and Reports
	2P	**Knowledge**: The student learns the concept of a computer network and the importance of networks in exchanging information. The difference between local area networks (LANs) and wide area networks (WANs) in	Internet applications and search engines	P	

		terms of scope and use. The concept of the Internet and how it operates as an interconnected global network. It also explores the most prominent applications of the Internet, such as email, social media, and cloud storage. **Skills**: Find information using search engines like (google) in effective ways and distinguish between types of networks. **Values**: Digital awareness and the importance of responsible and safe use of the Internet.			
2-3	**1T**	**Knowledge:** The concept of email and its importance as a digital communication tool. Email interface components (inbox, sent messages, drafts, trash). **Skills**: Create and activate a new email account using freely available tools. **Values**: Respect when composing messages and choosing appropriate language in electronic communication.	Communications and Email	T	Tests and Reports
	2P	**Knowledge:** The concept of email and its importance as a digital communication tool. Components of the email interface (inbox, sent messages, drafts, trash). **Skills:** Create and activate a new email account (Gmail) using freely available tools. Send emails with attachments and format	Create an email account (Gmail)	P	

		the message content correctly. **Values:** Respect when composing messages and choosing appropriate language when communicating electronically.			
4-6	**1T**	**Knowledge:** The concept of presentations and the importance of their use in education and work. **Skills:** Ability to use the presentation software interface, create a new presentation, design slides, and how to format and store them. **Values:** Innovation and creativity in designing presentations and presenting ideas visually.	Presentation programs	T	Tests and Reports
	2P	**Knowledge:** The concept of presentations and the importance of their use in education and work. **Skills:** Ability to use the Microsoft PowerPoint presentation software interface, create a new presentation, design slides, and how to format and store them. **Values:** Innovation and creativity in designing presentations and presenting ideas visually.	Presentation programs	P	
7	**1T**	**Knowledge:** The student learns the concept of the internet, types of browsers, digital communication methods, components of email, and the principles of presentation software. **Skills:** The student acquires the ability to navigate the internet, use a browser, create emails,	Midterm exam	T	midterm exam

		and design a presentation. **Values**: Ethical and responsible use of the internet and technology. Developing a creative spirit in presentations.			
	2P	**Knowledge:** The student learns the concept of the internet, types of browsers, digital communication methods, components of email, and the principles of presentation software. **Skills:** The student acquires the ability to navigate the internet, use the Google browser, create emails, and design a presentation. **Values:** Ethical and responsible use of the internet and technology. Developing a creative spirit in presentations.	Practical applications + review	P	
8-10	**1T**	**Knowledge:** Define a database as an organized collection of data that can be easily accessed and managed. **Skills:** Familiarity with simple interfaces for database systems such as Microsoft Access. **Values:** Respect data privacy and protect it from unauthorized use.	Database management	T	Tests and Reports
	2P	**Knowledge:** The student will be able to differentiate between basic database concepts such as tables, records, and fields. **Skills:** Familiarize themselves with simple interfaces for database systems such as Microsoft Access and create a simple example of a spreadsheet using	Database management	P	

		Access. **Values:** Respect data privacy and protect it from unauthorized use.			
11-12	**1T**	**Knowledge:** The student will be able to define a computer network, its importance, and the types and components of networks. **Skills:** Identify the hardware and software components of a network and determine the type of network. **Values:** The importance of networks in connecting communities and exchanging knowledge.	computer networks	T	Tests and Reports
	2P	**Knowledge:** The student will be able to define a computer network, its importance, and the types and components of networks. **Skills:** Identify the hardware and software components of a network and determine the type of network. Test connectivity between devices using simple tools such as the ping command. **Values:** The importance of networks in connecting communities and sharing knowledge.	computer networks	P	
13-14	**1T**	**Knowledge:** The student will identify common computer problems, such as slow performance, screen freezes, internet disconnections, and sound and printer problems. **Skills:** Identify faults based on symptoms. **Values:** The importance of regular maintenance	Computer problems and repairs	T	Tests and Reports

		and proper computer use.			
	2P	**Knowledge:** The student will learn about the most common computer problems, such as slow performance, screen freezes, internet disconnections, and sound and printer problems. **Skills**: Identify faults through symptoms using commands such as ping. **Values**: The importance of regular maintenance and proper computer use.	Computer problems and repairs	P	
15	1T	**Knowledge:** Steps to diagnose and repair common computer malfunctions. Operating system tools used for network management or troubleshooting. **Skills**: Implement simple steps to resolve computer problems, such as rebooting, hardware testing, and software management. **Values**: Patience and logical thinking when dealing with malfunctions and problems.	Preparatory week	T	Comprehensive review
	2P	**Knowledge:** Steps to diagnose and repair common computer malfunctions. Operating system tools used for network management or troubleshooting. **Skills**: Implement simple steps to resolve computer problems, such as rebooting, hardware testing, and software management. **Values**: Patience and logical thinking when	Computer Troubleshooting	P	

		dealing with malfunctions and problems.			

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Computer Science Principles: The Foundationa Concepts of Computer Science" BY: Mr. Kevin P Hare
Electronic References, Websites	https://edu.gcfglobal.org/en/computers/

1. Course Name:
Math 1
2. Course Code:
TECK101
3. Semester / Year:
First Semester / Second Academic Year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (Theoretical and Practical Lectures)
6. Number of Credit Hours (Total) / Number of Units (Total)
Theory2 / Total: 2
7. Course administrator's name (mention all, if more than one name)
Name: Name: Asst. Lecturer Marwa Khaleel Hassan Email: Email: marwa.khaleel@ntu.edu.iq
8. Course Objectives

Course Objectives	• The mathematics course aims to provide students with essential knowledge and skills, enabling them to develop equation-solving abilities and use mathematical tools to analyze problems in the fields of science, engineering, and economics.

9. Teaching and Learning Strategies	
Strategy	• **Theoretical lectures**: To achieve cognitive learning objectives. • **Discussions and dialogues**: To enhance understanding and develop analytical thinking. • **Utilizing general engineering principles**: To illustrate the application of mathematics in system design and analysis.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1-2	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Identify the concept and properties of determinants, compute determinants of degree *n*, and understand Cramer's rule for solving linear equations.	Determinants and Their Properties – Determinants of Degree *n* – Solving Linear Equations Using Cramer's Rule – Applications of Determinants.	T	Tests and Reports

		Skills: Apply Cramer's rule to solve systems of linear equations and use determinants in solving mathematical and engineering problems. **Values**: Promote accuracy and discipline in mathematical problem-solving steps, and develop logical thinking in dealing with equation.			
3-4	**2T**	**Knowledge:** Understand the basic concepts of trigonometric functions and their relationships, how to graph them, and know their applications in engineering fields, triangles, and solving various problems. **Skills:** Accurately plot trigonometric function curves, apply trigonometric identities to solve equations and problems, and calculate geometric quantities using trigonometric functions. **Values:** Appreciate the importance of trigonometric functions in describing periodic phenomena and geometric concepts, develop accuracy in calculations and graphing, and enhance the ability to solve applied problems.	Trigonometric Functions – Trigonometric Identities and Graphing of Functions – Geometric and Trigonometric Applications – Various Applications of Trigonometric Functions.	T	Tests and Reports
5-6	**2T**	**Knowledge:** Understand the concept of vectors in two- and three-dimensional space,	Vectors – Vector Operations in Two- and Three-Dimensional	T	Tests and Reports

		perform vector operations (addition, subtraction, dot product, and cross product), comprehend unit vectors and vector magnitude, and their applications in finding areas, projections, and mechanics. **Skills:** Accurately perform vector calculations, determine unit vectors and magnitudes, compute dot and cross products, calculate areas using vectors, and solve applied mechanical problems involving vectors. **Values:** Appreciate the importance of vectors as a mathematical tool to describe physical quantities, develop spatial thinking and the ability to visualize dimensions, and enhance precision and logical reasoning in solving engineering and mechanical problems.	Space – Orthogonal Unit Vectors – Vector Magnitude – Dot Product, Cross Product, and Projections – Calculating Area Using Vectors – Mechanical Applications of Vectors.		
7-8	**2T**	**Knowledge:** Understand the concept of functions and limits, grasp methods for calculating limits of algebraic and trigonometric functions, know how to handle limits at infinity, and recognize applications of limits. **Skills:** Accurately compute limits of various functions, apply limit rules to solve problems, analyze function behavior as it approaches specific values or infinity, and solve applied problems based on	Function and Limit – Limits – Limits of Algebraic and Trigonometric Functions and the Limit of a Function as it Approaches Infinity – Applications of Limits.	T	Tests and Reports

		the concept of limits. **Values:** Appreciate the fundamental role of limits in calculus, develop analytical thinking to understand function behavior, and enhance accuracy and logical reasoning in solving mathematical problems.			
9	**2T**	**Knowledge:** Comprehend and recall the mathematical concepts studied during the first half of the semester, and correctly apply the related rules and theorems. **Skills:** Solve complex problems under time pressure, identify appropriate methods to tackle different types of problems, and apply acquired concepts in new contexts. **Values:** Appreciate the importance of regular review and thorough preparation, develop self-discipline in studying, and boost confidence in academic performance.	Midterm Exam	T	Final Exam
10-11 12	**2T**	**Knowledge:** Understand the theory of derivatives, the concepts of composite, implicit, and inverse functions, how to differentiate algebraic and trigonometric functions, grasp the chain rule, and comprehend applications of derivatives in mechanics and inverse	Derivative Theory – Composite Functions – Derivatives of Algebraic, Trigonometric, and Implicit Functions – Standard Functions – Chain Rule –	T	Tests and Reports

		trigonometric functions. **Skills:** Skillfully apply various differentiation rules (composite, implicit, inverse functions), use the chain rule to solve complex differentiation problems, and solve physical and mechanical problems using derivatives. **Values:** Appreciate the power of calculus in describing changes and natural phenomena, develop accuracy in computational and analytical processes, and strengthen the connection between mathematical concepts and their practical applications in engineering and physics.	Mechanical Applications of Derivatives – Inverse Functions – Derivatives of Inverse Trigonometric Functions – Various Applications.		
13-14	**2T**	**Knowledge:** Understand the derivatives of logarithmic, exponential, and hyperbolic functions, the identities and graphs of hyperbolic functions and their inverses, and their applications in physics and mechanics. **Skills:** Skillfully differentiate logarithmic, exponential, hyperbolic functions and their inverses, graph hyperbolic functions and interpret their relationships, and apply these concepts to solve physical and mechanical problems. **Values:** Appreciate the diversity and power of differential tools, develop	Derivatives of Logarithmic and Exponential Functions – Hyperbolic Functions – Derivatives of Hyperbolic and Inverse Hyperbolic Functions – Identities, Graphs, and Inverses of Hyperbolic Functions – Applications in Physics and Mechanics.	T	Tests and Reports

		precision in handling advanced functions, and strengthen the connection between mathematics and its scientific and engineering applications.			
15	**2T**	**Knowledge:** Comprehend the basic concepts and review previously studied essential mathematical topics, and become familiar with the course syllabus and its objectives. **Skills:** Recall and apply foundational mathematical skills, identify personal strengths and weaknesses in core subjects, and develop effective study habits for the new course. **Values:** Appreciate the importance of mathematical fundamentals, cultivate self-discipline in study preparation, and build confidence to succeed in the course.	Preparatory Week	T	Comprehensi ve Review

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	"CALCULUS", by George. B. Thomas. "Engineering Mathematics", by John Bird.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

1. Course Name:	
Engineering drawing	
2. Course Code:	
TECK103	
3. Semester / Year:	
First semester / First stage	
4. Description Preparation Date:	
2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
125 total hours / 2 credit units (1 theoretical + 2 practical) hour	
7. Course administrator's name (mention all, if more than one name)	
Name: Nabeel Muhamed Akram Samad Email: **nabeelakram@ntu.edu.iq**	
8. Course Objectives	
Course Objectives	1- Develop vocabulary and terminology: Expand students' technical vocabulary and scientific and practical terminology specific to their field of study or profession, enabling them to communicate technical concepts and ideas accurately. 2- Improving work skills in engineering drawing: enhancing students' ability to draw electronic maps, for the purpose of applying them in electronic device factories. 3 - Developing technical skills: enhancing students' work skills in factories, enabling them to understand the mechanism of work and participating in activities to raise the scientific level. 4- Develop effective communication: Enhance students' ability to communicate effectively in professional technical environments, with an emphasis on clarity, coherence, and appropriate use of engineering drawing in industrial business contexts. 5- Enhancing students' competencies in engineering drawing: Developing students' skills and enhancing their competency in order to gain them skills in the field of manufacturing and engineering.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills

	• Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	**Knowledge**: Understands basic engineering drawing concepts, including command types and their properties. **Skills**: Develops the ability to program geometric shapes and apply them to a calculator. **Values**: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing.	Introduction to AutoCAD • Explore the AutoCAD interface and tools • Set up your workspace and modules • Understand basic drawing and editing commands	Theoretical + Practical	Tests and exercises
2	3	**Knowledge**: Understands basic engineering drawing concepts, including command types and their properties. **Skills**: Develops the ability to program geometric shapes and apply them to a calculator. **Values**: Enhances accuracy and discipline in analyzing	Engineering Construction Techniques • Introduction to Cartesian Coordinates • Two-dimensional shapes and their representation in coordinates	Theoretical + Practical	Tests and exercises

		measurements and engineering calculations for drawing.			
3	3	**Knowledge**: Understands basic engineering drawing concepts, including command types and their properties. **Skills**: Develops the ability to program geometric shapes and apply them to a calculator. **Values**: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Drawing Command • Point Representation • Lines in a Decatrical Style • Angular Lines Types of Lines	Theoretical + Practical	Tests and exercises
4		**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Drawing Command • Methods for drawing a circle • Tangent, perpendicular, and parallel relationships Drawing Command • Methods for drawing arcs	Theoretical + Practical	Tests and exercises

5		**Knowledge**: Understands basic engineering drawing concepts, including command types and their properties. **Skills**: Develops the ability to program geometric shapes and apply them to a calculator. **Values**: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Drawing command • Arc drawing methods	Theoretical + Practical	Tests and exercises
6	3	**Knowledge**: Understands basic engineering drawing concepts, including command types and their properties. **Skills**: Develops the ability to program geometric shapes and apply them to a calculator. **Values**: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Drawing Commands • Rectangular and Polygon Drawing Methods • Dimensions and Measurement Explanation	Theoretical + Practical	Tests and exercises
7	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Midterm exam	Theoretical + Practical	midterm exam
8	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties.	A Drawing Commands • Methods for	Theoretical + Practical	Tests and exercises

		Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	drawing rectangles and polygons • Dimensions and explanation of measurements		
9	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Modify command • Resize command • Move command • Copy command	Theoretical + Practical	Tests and exercises
10	**3**	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Modification Pass • Crop Command • Shade Command • Erase Command	Theoretical + Practical	Tests and exercises
11	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes	Modify Commands • Displace Command • Reflect Command • Explode Command • Boundary Command	Theoretical + Practical	Tests and exercises

		and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing			
12	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Modify Commands • Displace Command • Reflect Command • Explode Command • Boundary Command	Theoretical + Practical	Tests and exercises
13	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Modify Commands • Matrix Command • Stretch Command • Rotate Command • Scale Command	Theoretical + Practical	Tests and exercises
14	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy	Modification Commands • Matrix Command • Stretch Command • Rotate Command • Scale Command	Theoretical + Practical	Tests and exercises

		and discipline in analyzing measurements and engineering calculations for drawing			
15	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Comprehensive review	Theoretical + Practical	Comprehensive review
16	3	**Know**ledge: Understands basic engineering drawing concepts, including command types and their properties. Skills: Develops the ability to program geometric shapes and apply them to a calculator. Values: Enhances accuracy and discipline in analyzing measurements and engineering calculations for drawing	Final exam	Theoretical + Practical	Final exam

11.Course Evaluation

The grades:	
Coursework	20
Practical	20
Midterm Exam	10
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	الرسم الصناعي بالحاسوب باستخدام برنامج (**Auto CAD**
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

1. Course Name:	
Workshops (electronics + electrical)	
2. Course Code:	
ECE105	
3. Semester / Year:	
Second semester / First Stage	
4. Description Preparation Date:	
2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
3 practical/hour 150 Number of units 1/	
7. Course administrator's name (mention all, if more than one name)	
Name: Nabeel Muhamed Akram Samad Email: **nabeelakram@ntu.edu.iq**	
8. Course Objectives	
Course Objectives	1. Vocabulary and Terminology Development: Expanding students' technical vocabulary and the scientific and practical terms specific to their field of study or profession, enabling them to accurately communicate technical concepts and ideas. 2. Improving Workshop Skills: Enhancing students' practical skills for practical application in real-life situations. 3. Developing Technical Skills: Enhancing students' laboratory skills, enabling them to understand the work process and participate in activities to raise academic standards. 4. Developing Effective Communication: Enhancing students' ability to communicate effectively in professional technical environments, with a focus on clarity, coherence, and the appropriate use of work tools in various business contexts. 5. Enhancing Students' Competencies in Electronics and Electrical Workshops: Developing students' skills and enhancing their competence for success in daily life.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and

	designing engineering problems • Application of programming principles and rules: for programmable control systems design

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Training Workshop Concepts • Occupational Safety • Components and Contents of Training Workshops • Determining Measuring Devices	Theoretical + Practical	Tests and exercises
2	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and	Semiconductors • Introduction to semiconductor alloys. • Types of semiconductor elements. • Factors affecting semiconductor alloys.	Theoretical + Practical	Tests and exercises

		apply optimization techniques to improve these performance.			
3	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Resistance • Definition of resistance. • Reading resistance by color. • Types of resistors. • Uses and applications of resistors	Theoretical + Practical	Tests and exercises
4		1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and	Capacitor • Definition of a capacitor. • Types of capacitors. • Factors affecting capacitors. • Reading capacitors. • Their uses in electronic circuits.	Theoretical + Practical	Tests and exercises

		Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
5		1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Diode • Definition, components, and characteristics of a diode. • Types of diodes. • Diode testing. • Uses of diodes	Theoretical + Practical	Tests and exercises
6	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students	Transistor • Definition of an ester transistor and its components. • Types of transistors. • Examination of an ester transistor. • Uses of an ester transistor	Theoretical + Practical	Tests and exercises

		should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
7	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Rayleigh Family • Definition of Rayleigh • Parts and Types of Rails • How a Relay Works • Uses of Rayleigh	Theoretical + Practical	Tests and exercises
8	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these	Welding • Introduction to welding and its types. • Welding elements and requirements. • Element processing and welding requirements. • Welding steps • Welding removal	Theoretical + Practical	Tests and exercises

		performance.			
9	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Design a simple circuit • Understand how an electronic circuit works. • Trace the signal according to the circuit diagram to understand the function of each component. • Solder the electronic components according to the circuit diagram.	Theoretical + Practical	Tests and exercises
10	**3**	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Workshop Safety Procedures • Principles of Electrophysiology • Methods of Electrical Injury • Types of Electrical Injuries • Prevention of Electrical Hazards	Theoretical + Practical	Tests and exercises
11	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of	Electricity • Introduction to National Electricity • Methods of	Theoretical + Practical	Tests and exercises

		workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	generating electricity through power plants • Occupational safety for high-voltage electricity		
12	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Electrical Supply • Types of Power Transmission Lines • Electricity Distribution from the Grid to Residential Areas • Types of Foundation Cables for Homes • Types of Outdoor Transformers in the Area • Home Electricity Connection and Connection Type: Single-Phase or Three-Phase	Theoretical + Practical	Tests and exercises
13	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects:	Applications for some electrical circuits and household wiring • A single-switch electrical circuit using a lamp • Installing a ladder switch using a lamp	Theoretical + Practical	Tests and exercises

		Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	• Installing a circuit breaker and protection devices • Circuiting the doorbell		
14	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Measuring Devices • Multimeter • How to Connect a Multimeter	Theoretical + Practical	Tests and exercises
15	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and	Generators and Motors • Types of Generators and Motors • Components of a Single-Phase Motor	Theoretical + Practical	Comprehensive review

		implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
16	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve performance.	Final exam	Theoretical + Practical	Final exam

11.Course Evaluation

The grades:	
Coursework	20
Practical	20
Report and design	10
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	• Practical electronics workshop equipment • Electrical installation design and inspection Electrical circuit principles
Main references (sources)	• "الأجهزة الإلكترونية ونظرية الدوائر" بقلم بويلستاد وناشيلسكي
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	https://www.et3lemdelivery.com/2018/11/Electry-Basics-Workshop-pdf.html

1. Course Name:
Math 2
2. Course Code:
TECK102
3. Semester / Year:
First Semester / Second Academic Year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (Theoretical and Practical Lectures)
6. Number of Credit Hours (Total) / Number of Units (Total)
Theory2 / Total: 2
7. Course administrator's name (mention all, if more than one name)
Name: Name: Asst. Lecturer Marwa Khaleel Hassan Email: Email: marwa.khaleel@ntu.edu.iq

8. Course Objectives	
Course Objectives	• The mathematics course aims to provide students with essential knowledge and skills, enabling them to develop equation-solving abilities and use mathematical tools to analyze problems in the fields of science, engineering, and economics.

9. Teaching and Learning Strategies	
Strategy	• **Theoretical lectures**: To achieve cognitive learning objectives. • **Discussions and dialogues**: To enhance understanding and develop analytical thinking. • **Utilizing general engineering principles**: To illustrate the application of mathematics in system design and analysis.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1-	**2T**	If the student successfully completes this course, he will be able to: **Knowledge:** Understand the theory of integration, distinguish between definite and indefinite integrals, know how to integrate trigonometric, inverse,	Integration – Integration Theory – Definite and Indefinite Integrals – Integration of Trigonometric and Inverse Functions –	T	Tests and Reports

		exponential, logarithmic, and hyperbolic functions, and how to use L'Hôpital's rule in integration. **Skills:** Apply various integration techniques to accurately compute definite and indefinite integrals, integrate diverse types of functions, and use L'Hôpital's rule to solve complex integrals. **Values:** Appreciate the importance of integration as a tool for calculating areas and volumes, develop accuracy in computational and analytical processes, and enhance the ability to solve complex mathematical problems methodically.	Integration of Exponential and Logarithmic Functions – Integration of Hyperbolic and Inverse Hyperbolic Functions – Integration Using L'Hôpital's Rule.		
3	**2T**	**Knowledge:** Understand the concept of integration by parts as one of the fundamental integration methods, including when and how to apply it to solve specific types of integrals. **Skills:** Skillfully apply the integration by parts formula to solve integrals involving the product of two functions, and correctly choose the functions uuu and dvdvdv to simplify the process. **Values:** Appreciate the importance of flexibility in selecting appropriate methods for solving integral problems, cultivate patience and accuracy in lengthy calculations, and enhance the ability to analyze complex function structures.	Integration Techniques – Integration by Parts.	T	Tests and Reports

4	**2T**	**Knowledge:** Understand the method of integration by partial fractions and grasp the mechanical applications of vectors. **Skills:** Apply the partial fractions method to solve integration problems and use vectors to solve mechanical problems. **Values:** Appreciate the effectiveness of advanced integration methods, develop accuracy in solving mechanical problems, and strengthen the connection between algebra and physical applications.	Integration by Partial Fractions – Mechanical Applications of Vectors.	T	Tests and Reports
5	**2T**	**Knowledge:** Understand the principle of integration by trigonometric substitution, identify cases that require its use, and know the appropriate trigonometric substitutions for different types of integrals. **Skills:** Effectively apply the trigonometric substitution method to solve integrals containing specific radical expressions, transforming them into simpler forms that can be solved. **Values:** Appreciate flexibility in solving integration problems, develop algebraic and trigonometric transformation skills, and enhance confidence in handling advanced integration techniques.	Integration by Trigonometric Substitution.	T	Tests and Reports

6	**2T**	**Knowledge:** Understand the method of completing the square in integration and know how to use appropriate substitutions (assumptions) to solve complex integrals. **Skills:** Successfully apply the completing the square technique to transform integrals and select the correct substitutions to effectively solve various integrals. **Values:** Appreciate flexibility and creativity in integration methods, develop accuracy in algebraic manipulations, and enhance analytical thinking skills for solving mathematical problems.	Integration by Completing the Square and by Substitution	T	Tests and Reports
7	**2T**	**Knowledge:** Comprehensively understand and apply the mathematical concepts studied throughout the entire semester, demonstrating deep mastery of the syllabus. **Skills:** Efficiently solve a wide range of complex and detailed problems under time pressure, integrate and apply acquired knowledge and skills to tackle new challenges. **Values:** Appreciate the importance of perseverance and thorough review, develop self-discipline in learning and preparation, and boost confidence in academic abilities within the subject.	Midterm Exam	T	Final Exam

8	**2T**	**Knowledge:** Understand how to use integration to solve physical problems (such as work and energy) and engineering problems (such as areas, volumes, and centers of mass). **Skills:** Apply integration to accurately calculate physical and engineering quantities, and translate real-world problems into solvable integral models. **Values:** Appreciate the role of integration as a powerful tool for solving applied problems, develop analytical thinking skills, and strengthen the connection between mathematical concepts and the real world.	Physical and Engineering Applications of Integration	T	Tests and Reports
9	**2T**	**Knowledge:** Understand the concept of area calculation using integration, and how to find the area bounded between a curve and the x-axis, or between two different curves. **Skills:** Accurately apply definite integrals to calculate areas, correctly determine the limits of integration, and graph curves to identify the required area region. **Values:** Appreciate the importance of integration as a tool for solving geometric and applied problems, develop precision in mathematical calculations, and enhance visual and analytical thinking for complex regions.	Area Under a Curve and Between Curves	T	Tests and Reports

10 11	**2T**	**Knowledge:** Understand the concepts of volumes of revolution and methods to calculate them, as well as how to determine the arc length of a curve using integration. **Skills:** Calculate volumes of solids generated by rotating plane regions, and determine arc lengths of various curves using integration techniques. **Values:** Appreciate the role of integration in computing complex geometric quantities, develop accuracy in applying mathematical formulas, and enhance the ability to visualize three-dimensional shapes.	Volumes of Revolution – Arc Length of a Curve	T	Tests and Reports
12	**2T**	**Knowledge:** Understand the concept of simple differential equations, their types, and basic methods of solving them. **Skills:** Solve simple differential equations using appropriate methods, and determine the general and particular solutions for given problems. **Values:** Appreciate the importance of differential equations in modeling natural phenomena, develop logical thinking in analyzing changes, and enhance accuracy in finding solutions.	Simple Differential Equations	T	Tests and Reports
13 14	**2T**	**Knowledge:** Understand the principles of area estimation using the Trapezoidal and Simpson's rules, and grasp	Approximate Area Using the Trapezoidal and Simpson's Rules	T	Tests and Reports

		the concept of numerical integration methods and their applications. **Skills:** Accurately apply the Trapezoidal and Simpson's rules to approximate integrals, use numerical methods to practically solve integration problems, and analyze and interpret the results of approximate integrations. **Values:** Appreciate the importance of numerical methods in solving mathematical problems that cannot be addressed analytically, develop precision in approximate calculations, and enhance the ability to apply mathematics in practical contexts.	– Numerical Integration Methods – Applications.		
15	**2T**	**Knowledge:** Comprehend the basic concepts and review the necessary mathematical prerequisites for the course, and become familiar with the study plan and its objectives. **Skills:** Recall and apply foundational mathematical skills, assess current knowledge levels, and develop effective study strategies. **Values:** Appreciate the importance of a solid knowledge foundation, cultivate commitment to thorough preparation, and enhance self-confidence to successfully start the course.	Preparatory Week	T	Comprehensive Review

11.Course Evaluation	
The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	"CALCULUS", by George. B. Thomas. "Engineering Mathematics", by John Bird.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

1. Course Name:
Mechanical engineering
2. Course Code:
ECE101
3. Semester / Year:
First semester / First year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (theoretical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
3 hours each week / 3
7. Course administrator's name (mention all, if more than one name)
Name: Yahya Ghufran Khidhir Email: yahhya.khidhir24@ntu.edu.iq
8. Course Objectives

Course Objectives	• **Introduce Fundamental Concepts of Mechanics:** Equip students with a strong foundation in the basic principles of statics, dynamics, and the mechanics of materials, essential for understanding the behavior of physical systems in engineering contexts. • **Develop Problem-Solving Skills:** Enable students to apply mechanical principles, such as equilibrium, force analysis, and motion, to model and solve real-world engineering problems logically and effectively. • **Bridge Theory with Engineering Applications:** Foster the ability to connect theoretical mechanics with practical applications in mechanical systems, preparing students for advanced courses and multidisciplinary problem-solving in future engineering practice.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems Assessment Methods: • Daily written and oral tests, applied tests, seminars,

	semester and final exams, assignments, attendance and commitment, feedback (testing the student on the previous subject), self-evaluation (questions are set for the student by the teacher and the student. • Theoretical examinations: periodic and semester exams to verify (A1-A5) • Practical examinations: periodic and semester exams to verify (B1-B5) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**3T**	If the student successfully completes this course, he will be able to: **Knowledge:** Understands the scope, importance, and applications of engineering mechanics in various engineering disciplines. **Skills:** Identifies and categorizes mechanical problems into statics or dynamics; interprets engineering terminology and symbols. **Values:** Develops curiosity and appreciation for the foundational role of mechanics in engineering design and innovation.	Introduction to Engineering Mechanics	T	Tests and Reports
2	**3T**	**Knowledge**: Understands the principles of force systems and conditions for static equilibrium. **Skills**: Solves equilibrium problems	Forces and Equilibrium	T	Tests and Reports

		using free-body diagrams and vector analysis. **Values**: Encourages logical reasoning and precision in solving real-world equilibrium problems.			
3	**3T**	**Knowledge:** Recognizes the characteristics of two-dimensional force systems and their components. **Skills:** Resolves coplanar force systems graphically and analytically. **Values:** Promotes systematic analysis and attention to detail in force resolution.	Coplanar Force Systems	T	Tests and Reports
4	**3T**	**Knowledge:** Understands the concept and physical meaning of distributed loads in mechanical systems. **Skills:** Calculates resultants of distributed loads on beams and surfaces. **Values:** Emphasizes accuracy and thoroughness in dealing with continuous systems.	Distributed Forces	T	Tests and Reports
5	**3T**	**Knowledge:** Understands the classification and behavior of structures under load. **Skills:** Applies methods of joints and sections to analyze trusses and frames. **Values:** Encourages teamwork and responsibility in	Analysis of Structures	T	Tests and Reports

		structural analysis tasks.			
6	**3T**	**Knowledge:** Understands the laws of dry friction and its role in mechanical equilibrium. **Skills:** Analyzes equilibrium problems involving frictional forces on inclined planes and wedges. **Values:** Promotes realism in engineering design by considering frictional effects.	Friction	T	Tests and Reports
7	**3T**	**Knowledge:** Ability to recall and explain core concepts and laws of mechanics **Skills:** Proficiency in solving static equilibrium problems and analyzing simple structures **Values:** Demonstration of analytical discipline, accuracy, and clear logical reasoning	Mid-term Exam	T	Tests and Reports
8	**3T**	**Knowledge**: Understands the concept of moments, couples, and their applications. **Skills**: Calculates moments about a point or axis and simplifies force-couple systems. **Values**: Cultivates critical thinking in evaluating mechanical systems' torque and	Moments and Couples	T	Tests and Reports

		balance.			
9	**3T**	**Knowledge:** Understands equilibrium conditions for two- and three-dimensional rigid bodies. **Skills**: Constructs accurate free-body diagrams and solves static problems for rigid bodies. **Values**: Instills responsibility and rigor in developing reliable mechanical designs.	Equilibrium of Rigid Bodies	T	Tests and Reports
10	**3T**	**Knowledge:** Understands loading types (point, distributed, and moment) and shear/moment relationships. **Skills:** Constructs shear force and bending moment diagrams for statically determinate beams. **Values:** Promotes diligence and care in interpreting structural responses to loading.	Distributed Forces in Beams	T	Tests and Reports
11	**3T**	**Knowledge:** Understands fluid pressure distribution on submerged surfaces and the concept of center of pressure. **Skills:** Calculates hydrostatic forces and centers of pressure on	Center of Pressure and Hydrostatics	T	Tests and Reports

		plane surfaces. **Values:** Encourages ethical responsibility in designing fluid-containing systems.			
12	**3T**	**Knowledge:** Understands the definition and significance of area and mass moments of inertia. **Skills:** Computes moments of inertia for composite shapes and uses parallel axis theorem. **Values:** Promotes accuracy and conceptual clarity in dynamic and structural analysis.	Moments of Inertia	T	Tests and Reports
13	**3T**	**Knowledge:** Understands the principle of virtual work and its application in structural systems. **Skills:** Applies virtual work to solve statically indeterminate trusses and verify static results. **Values:** Encourages analytical efficiency and appreciation for alternative solution methods.	Virtual Work and Trusses	T	
14	**3T**	**Knowledge:** Understands internal loadings such as shear, bending moment, and axial force. **Skills:** Determines	Internal Forces in Beams and Frames	T	

		internal forces in structural members through sectioning methods. **Values:** Reinforces the importance of structural integrity and safety in engineering practice.			
15	**3T**	**Knowledge:** Understands the conditions and vector principles governing 3D equilibrium. **Skills:** Analyzes spatial force systems and solves 3D equilibrium problems. **Values:** Promotes spatial reasoning and attention to comprehensive analysis in complex systems.	Three-Dimensional Equilibrium	T	

11.Course Evaluation

The grades:	
Quizzes	10
Projects	10
Online assignments	10
Reports	10
Midterm Exam	10
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	statics and DYNAMICS ENGINEERING MECHANICS Fourteenth EDITION Authors: R. C. HIBBELER
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Mechanics of Materials Authors: R.C. Hibbeler

Electronic References, Websites	Mechanics of Materials Authors: R.C. Hibbeler URL: https://www.youtube.com/playlist?list=PLPLlcV 9fXj-jVczLmF44fkjoh6hY-1Q1

1. Course Name:	
Principles of Electrical Circuits1	
2. Course Code:	
ECE100	
3. Semester / Year:	
First Semester / First Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
90 / 4 credit units	
7. Course administrator's name (mention all, if more than one name)	
Name: Roaya S. Abdalrahman Email: rouya.abdalrahman@ntu.edu.iq	
8. Course Objectives	
Course Objectives	• Understand the fundamental concepts of electrical circuits, including voltage, current, resistance, and power. • Apply Ohm's Law and Kirchhoff's Laws to analyze simple DC and AC circuits. • Develop the ability to solve series, parallel, and series-parallel circuit configurations. • Analyze and interpret circuit behavior using basic theorems such as Thevenin's and Norton's theorems. • Gain practical skills in measuring electrical quantities using standard laboratory instruments.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications

	• Classroom result presentations: for discussion and student participation.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3T	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understand the importance and applications of electrical circuits **Skills**: Identify course structure and learning expectations **Values**: Develop scientific curiosity and commitment to learning	Introduction to electrical circuits	T	Tests and Reports
	3P	**Knowledge**: Understand the types and functions of measuring instruments (voltmeter, ammeter, ohmmeter, multimeter) **Skills**: Properly use and connect measuring devices in electrical circuits **Values**:Accuracy, safety awareness, and responsibility in the lab	Identifying Measuring Devices	P	
2	3T	**Knowledge**: Understand SI units and unit conversions in electrical engineering **Skills**: Perform unit conversions accurately **Values**: Attention to detail and precision	Systems of Units	T	Tests and Reports
	3P	**Knowledge**: Learn how to read resistor values using color codes **Skills**: Identify resistance values practically from physical resistors **Values**: Attention to detail and visual analysis	Standard Resistor Color Code Measurement	P	
3	3T	**Knowledge**: Understand	Charge and	T	Tests and

		the concepts of electric charge and current **Skills**: Calculate electric charge and current in simple situations **Values**: Foster scientific inquiry and analytical thinking	Current		Reports
	3**P**	**Knowledge**: Understand the relationship between voltage, current, and resistance **Skills**:Build a simple circuit and measure current and voltage to verify Ohm's Law **Values**: Logical problem-solving and adherence to procedures	Ohm's Law – Practical Verification	P	
4	3**T**	**Knowledge**: Understand the definition of voltage and its relation to energy and charge **Skills**: Calculate voltage difference between two points **Values**: Build logical thinking and concept linking	Voltage	T	Tests and Reports
	3**P**	**Knowledge**: Learn how series connection affects total resistance **Skills**: Construct and test a series circuit; measure current and voltage **Values**: Cooperation and responsibility during circuit construction	Resistors in Series	P	
5	3**T**	**Knowledge**: Understand the relationship between power, voltage, and current **Skills**: Calculate energy consumption or generation in circuits **Values**: Appreciate energy efficiency and responsible usage	Power and Energy	T	Tests and Reports
	3**P**	**Knowledge**:Understand how parallel connection affects total resistance	Resistors in Parallel	P	

		Skills: Build and analyze a parallel circuit using real components **Values**: Comparing results and critical thinking			
6	3T	**Knowledge**: Learn the relationship between voltage, current, and resistance **Skills**: Apply Ohm's Law to solve simple circuit problems **Values**:Develop logical and sequential problem-solving skills	Ohm's Law	T	Tests and Reports
	3P	**Knowledge**: Learn why and when to use Δ-to-Y transformation in circuits **Skills**: Apply transformation equations in a practical setup **Values**:Patience, precision in measurements	Delta to Star (Δ-Y) Transformation	P	
7	3T	**Knowledge**: Identify the components and structure of electric circuits **Skills**: Distinguish between nodes, branches, and loops **Values**:Enhance circuit organization and analysis abilities	Nodes, Branches, and Loops	T	Tests and Reports
	3P	**Knowledge**:Understand the reverse transformation and its applications **Skills**: Perform Y-to-Δ conversion and test results **Values**:Improve analytical thinking and confidence in solving	Star to Delta (Y-Δ) Transformation	P	
8	3T	**Knowledge**: Understand the principle of current conservation at nodes **Skills**: Apply KCL to analyze simple circuits **Values**:Encourage collaboration in solving circuit problems	Kirchhoff's Current Law (KCL)	T	Tests and Reports
	3P	**Knowledge**: Understand Kirchhoff's Current and Voltage Laws	Kirchhoff's Laws – Practical Application	P	

		Skills: Apply KCL and KVL in multi-branch circuits **Values**:Reinforce theory with hands-on practice and teamwork			
9	3**T**	**Knowledge**: Understand the principle of voltage conservation in loops **Skills**: Apply KVL to analyze voltage in closed loops **Values**:Foster accuracy and analytical concentration	Kirchhoff's Voltage Law (KVL)	T	Tests and Reports
	3**P**	**Knowledge**: Learn how to simplify a circuit to a single voltage source and resistance **Skills**: Find Thevenin equivalent practically and verify results **Values**:Promote abstraction and equivalent modeling	Thevenin's Theorem	P	
10	3**T**	**Knowledge**: Integrate KCL and KVL in more complex circuit analysis **Skills**: Solve multi-path and mixed-source circuits **Values**:Promote perseverance and persistence in problem solving	Applications of Kirchhoff's Laws	T	Tests and Reports
	3**P**	**Knowledge**: Understand Norton's equivalent circuit and its relation to Thevenin's **Skills**: Find Norton equivalent circuit practically **Values**:Deepen understanding of circuit simplification	Norton's Theorem	P	
11	3**T**	**Knowledge**: Reinforce understanding of previous concepts **Skills**: Solve review problems and exercises **Values**:Build confidence in self-assessment and	General Review and Exercises	T	Tests and Reports

		understanding			
	3P	**Knowledge**: Analyze circuits with multiple sources **Skills**: Isolate sources and measure resulting currents or voltages **Values**:Step-by-step problem-solving and precision	Superposition Theorem	P	
12	3T	**Knowledge**: Evaluate accumulated knowledge and understanding **Skills**: Manage time and accuracy during test analysis **Values**:Respect academic integrity and fair assessment	Midterm Exam / Review	T	Tests and Reports
	3P	**Knowledge**: Understand how to analyze circuits based on node voltages **Skills**: Write and solve node voltage equations using measurements **Values**:Enhance accuracy and structured thinking	Nodal Analysis	P	
13	3T	**Knowledge**: Analyze series, parallel, and combination circuits **Skills**: Apply circuit laws to solve mixed circuits **Values**:Enhance critical thinking and interpretation	Series, Parallel, and Mixed Circuits	T	
	3P	**Knowledge**: Consolidate all previously learned practical concepts **Skills**: Perform integrated experiments combining multiple **Values**:Develop critical evaluation and troubleshooting skills	General Review of Previous Labs	P	
14	3T	**Knowledge**: Integrate and connect all course topics coherently **Skills**: Solve sample final exam problems **Values**:Prepare mentally and organizationally for the exam	Final Review	T	

	3P	**Knowledge**: Demonstrate mastery of all lab concepts **Skills**: Build and analyze a comprehensive circuit using learned methods **Values**:Independence, discipline, and performance under pressure	Final Practical Exam / Project	P	
15	3T	**Knowledge**: Demonstrate mastery of course learning outcomes **Skills**: Apply all acquired skills in a comprehensive test **Values**:Show responsibility and integrity in evaluation	Final Exam	T	
	3P	**Knowledge**: Summarize key practical outcomes; discuss results **Skills**: Reflect on learning, common errors, and strengths **Values**: Accept constructive feedback and value self-assessment	Lab Conclusion & Evaluation	P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Fundamentals of Electric Circuits by Charle .K. Alexander | Matthew N. O. Sadiku (5th • Introductory Circuit Analysis (10th ed.) by .Robert L. Boylestad • Principles of Electric Circuits Conventional Current Version by Thomas L. Floyd (Ninth .(Edition
Main references (sources)	• Introduction to Circuit Analysis and Design .Tildon H. Glisson, Jr
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	· Website: https://www.multisim.com

	· Description: Professional-grade circuit simulation tool by National Instruments. A free online version is available for basic use.

1. Course Name:	
Alternating Current Circuit	
2. Course Code:	
102 ECE	
3. Semester / Year:	
Second Semester / First Year	
4. Description Preparation Date:	
20/06/2025	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
290	
7. Course administrator's name (mention all, if more than one name)	
Name: Haitham Hashim Abbas Email: haithamhashim7@ntu.edu.iq	
8. Course Objectives	
Course Objectives	1. Understanding AC Fundamentals: Gain a solid understanding of the basic concepts and principles of AC electricity, including voltage, current, power, frequency, phase, and waveforms. 2. Analyzing AC Circuits: Learn techniques to analyze AC circuits using mathematical tools such as phasors, complex numbers, impedance, admittance, and reactance. 3. Circuit Components: Study various components used in AC circuits, such as resistors, capacitors, and inductors, and learn how these components behave in AC circuits. 4. Circuit Analysis Techniques: Develop skills in applying different methods and techniques to analyze AC circuits, including Kirchhoff's laws, mesh analysis, nodal analysis, and Thevenin's and Norton's theorems. 5. Impedance and Phasor Diagrams: Understand the concept of impedance and its relationship with resistance, capacitance, and inductance. Learn how to represent AC quantities using phasor diagrams and analyze circuit behavior. 6. AC Power Analysis: Study the concepts of active power (real power), reactive power, and apparent power in AC circuits. Learn how to calculate power factor, power factor correction, and perform power calculations. 7. AC Circuit Analysis Techniques: Gain proficiency in solving AC circuit problems involving series and parallel circuits, RC circuits, RL circuits, RLC circuits, resonant circuits, and filters. 8. AC Network Theorems: Understand and apply various network theorems specific to AC circuits, such as maximum power transfer theorem, superposition theorem, and compensation theorem.

9. Teaching and Learning Strategies	
Strategy	• Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems. • Seminars: Teaching students to give lectures

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**5T**	1. SINUSOIDAL ac VOLTAGE CHARACTERISTICS AND DEFINITIONS. 2. GENERAL FORMAT FOR THE SINUSOIDAL VOLTAGE OR CURRENT. 3. PHASE RELATIONS. 4. AVERAGE and RMS VALUE.	Sinusoidal Alternating Waveforms	T	Quiz, HW, Exam, Reports
	3P	1. To operate and use measuring devices in the Laboratory. 2. Study the characteristics of the sine wave and how to generate it.	AC and sine wave meters	P	
2,3	**10T**	1.RESPONSE OF BASIC R, L, AND C ELEMENTS TO A SINUSOIDAL VOLTAGE OR CURRENT 2. FREQUENCY RESPONSE OF THE BASIC ELEMENTS. 3. AVERAGE POWERAND POWER FACTOR. 4. COMPLEX NUMBERS.	The Basic Elements in the phasor domain	T	Quiz, HW, Exam, Reports
	6P	Understand how a capacitor and inductor react to alternating current	Capacitive reactance and inductive	P	

		and how reactance changes with frequency.	reactance		
4,5,6	**15T**	**1.** IMPEDANCE AND THE PHASOR DIAGRAM. 2. SERIES CONFIGURATION. 3. ADMITTANCE AND SUSCEPTANCE. 4. PARALLEL ac NETWORKS. 5. EQUIVALENT CIRCUITS.	Series and Parallel ac Circuits	T	Quiz, HW, Exam, Reports
	9P	1. Calculating the inductive reactance of the coil and the capacitive reactance of the capacitor. 2. Calculating the phase angle between the voltage and current in the circuit.	Series and Parallel ac Circuits	P	
7	**2T**		Mid-EXAM	T	MID-EXAM
	1P		Mid-EXAM	P	
10 ,9 , 8	**15T**	1. SOURCE CONVERSIONS. 2. MESH ANALYSIS. 3. NODAL ANALYSIS. 4. BRIDGE NETWORKS (ac) 5. Conversion Δ-Y, Y- Δ.	Methods of Analysis (ac)	T	Quiz, HW, Exam, Reports
	9P	To study the transient R-C and R-L circuits	Transients in R-C and R-L Series circuits	P	
11, 12,13	**15T**	1.SUPERPOSITION THEOREM. 2. THEVENIN’S THEOREM. 3. NORTON’S THEOREM. 4. MAXIMUM POWER TRANSFER THEOREM.	Network Theorems (ac)	T	Quiz, HW, Exam, Reports
	9P	Applying the theories of analysis in practice and measuring the results practically using measuring devices	Network Theorems (ac)	P	
14, 15	**10T**	1.RESISTIVE CIRCUIT. 2. APPARENT POWER 3. INDUCTIVE CIRCUIT AND REACTIVE POWER 4. CAPACITIVE	Resonant and power circuits (AC)	T	Quiz, HW, Exam, Reports

		CIRCUIT 5. THE POWER TRIANGLE 6. POWER-FACTOR CORRECTION			
	6P	1. WATTMETERS AND POWER-FACTOR METERS. 2. Study of resonance in series RLC circuits.	Resonant and power circuits (AC)	P	

11.Course Evaluation

The grades:
Formative assessment: 40% (10 assignments, 10 Quiz, 10 lab reports, and 10 projects)
Midterm 10%
Final Exam (50%)

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introductory circuit analysis / Robert L. Boylestad.—11th ed.
Main references (sources)	1. Introductory circuit analysis / Robert L. Boylestad.—11th ed. 2. "Engineering Circuit Analysis" by William H. Hayt Jr. and Jack E. Kemmerly. 3. Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N.O. Sadiku
Recommended books and references (scientific journals, reports...)	Introductory circuit analysis / Robert L. Boylestad.—11th ed
Electronic References, Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering.

1. Course Name:
Electronics
2. Course Code:
ECE 103
3. Semester / Year:
Second Semester / First Year
4. Description Preparation Date:
2024
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
4 Theoretical + 3 Practical (290 hours total) / 8 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Ali Adnan Wahbi Email: ali.adnan@ntu.edu.iq
8. Course Objectives

Course Objectives	• Recognize the electrical properties of semiconductor materials such as silicon and germanium. • Identify fundamental electronic components such as the diode and Zener diode. • Explain the operation of bipolar-junction (BJT) as switches and amplifiers. • Acquire analytical skills for electrical and electronic circuit analysis. • Design basic electronic circuits using semiconductor devices. • Employ circuit-simulation software to analyze circuits prior to hardware implementation. • Conduct laboratory experiments that bridge theoretical concepts with practical applications. • Lay the foundation for advanced courses in analogue and digital electronics. • Relate theoretical concepts to real-world applications such as charging circuits and voltage regulators.

9. Teaching and Learning Strategies

Strategy	• Interactive lectures that simplify complex concepts and employ illustrative graphics to enhance conceptual understanding. • Laboratory correlation: a hands-on experiment follows each theoretical topic, utilizing instruments such as oscilloscopes and power supplies to analyze signals and device characteristics. • Active learning: small-group discussions and problem-solving

	sessions that foster critical thinking. • Circuit simulation: use of Multisim (or equivalent) to design and simulate circuits, and to compare simulated results with theoretical predictions and laboratory measurements. • Formative quizzes: short assessments that provide continuous feedback on student progress. • Project-based learning: student teams design and realize mini-projects featuring diodes, transistors, or mixed-device circuits. • Blended learning: supplemental video lectures and online resources (e.g., MIT OpenCourseWare) complement classroom delivery. • Use of authentic examples: disassembly and analysis of commercial electronic devices to contextualize course concepts. • Continuous feedback: constructive comments on designs, reports, and laboratory notebooks to guide improvement.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4T	**If the student successfully completes this course, he will be able to:** **Knowledge:** Distinguish between intrinsic and extrinsic semiconductors and explain the doping process. **Skills:** Interpret variations in electrical properties due to doping. **Values:** Develop scientific rigout, curiosity, and appreciation of theoretical modelling.	Semiconductors and Diode Models (intrinsic vs. extrinsic, doping mechanism)	T	Tests , Assessments Reports
	3P	**Knowledge**: Identify laboratory instruments (ammeter, voltmeter, oscilloscope). **Skills**: Operate instruments safely; obtain accurate measurements. **Values**: Promote safety awareness and precision in experimental work.	Introduction to Diode, introduction to Laboratory instruments	P	
2	4T	**Knowledge**: Describe ideal, practical and	Semiconductors and Diode	T	Tests , Assessments

		complete diode models. **Skills**: Select the appropriate model for circuit analysis. **Values**: Foster methodological accuracy in model selection.	Models (Ideal, Practical, and Complete diode models)		Reports
	3P	**Knowledge**: Observe diode characteristics under forward and reverse bias. **Skills**: Plot experimental curves and analyze data. **Values**: Encourage precision and critical comparison between theory and practice.	Diode characteristics (PN junction)	P	
3	**4T**	**Knowledge**: Explain basic rectifier circuits (half-wave, full-wave center-tap). **Skills**: Differentiate rectifier types and select appropriate configuration. **Values**: Cultivate systematic analysis linking inputs to outputs	Diode Applications (Half-wave rectifier, Full-wave Center-tapped rectifier)	T	Tests , Assessments Reports
	3P	**Knowledge**: Describe hardware implementation of a half-wave rectifier. **Skills**: Assemble circuit and measure rectified output. **Values**: Reinforce safe practice and measurement accuracy.	Half-wave rectifier	P	
4	**4T**	**Knowledge**: Discuss bridge full-wave rectifiers and filter design. **Skills**: Compare rectifier performance with and without filtering.	Diode Applications (Half-wave Bridge rectifier, Rectifiers Filter)	T	Tests , Assessments Reports

		Values: Promote responsibility in selecting power-supply solutions.			
	3P	**Knowledge**: Show practical operation of bridge rectifier. **Skills**: Build and test bridge rectifier circuit. **Values**: Encourage meticulous lab execution.	Full-wave Bridge rectifier	P	
5	4T	**Knowledge**: Understands how the diode is utilized for voltage regulation and signal shaping. **Skills**: Explains practical diode applications for refining and modifying electrical signals. **Values**: Reinforces systematic thinking for circuit analysis and for relating inputs to outputs. Cultivates responsibility in selecting technical solutions that secure power-supply stability. Encourages integration of theory and practice in designing reliable circuits for real-world environments.	Diode Applications (Voltage regulator, Diode Clipper, Clampers)		Tests , Assessments Reports
	3P	**Knowledge**: Recognizes the importance of filters in rectifier circuits. **Skills**: Builds a half-wave and full-wave rectifiers with a filter and evaluates their efficiency. **Values**: Upholds laboratory safety and vigilance during experimentation. Develops measurement accuracy and troubleshooting skill.	Full-wave bridge rectifier with filter		

		Strengthens the link between theoretical understanding and practical application.			
6	**4T**	**Knowledge**: Explains the principles of clamper circuits and voltage multipliers. **Skills**: Identifies practical uses of these circuits across various applications. **Values**: Promotes systematic reasoning in circuit analysis. Encourages responsible choice of technical solutions for stable power delivery. Bridges theoretical concepts with practical circuit design.	Diode Applications (Clampers, Voltage multipliers)	T	Tests , Assessments Reports
	3P	**Knowledge**: Gains hands-on familiarity with clipping circuits. **Skills**: Assembles and tests these circuits and analyses their performance. **Values**: Maintains strict safety and attentiveness in the lab. Enhances experimental precision and investigative rigout. Integrates theoretical predictions with empirical data.	Diode Clipper	P	
7	**4T**	**Knowledge**: Displays comprehensive mastery of all theoretical concepts and functions of electronic components covered in the first half of the course. Shows ability to solve problems and compare different theoretical	Midterm Exam	T	Mid-Term Examination

		models. Explains circuit-analysis steps fluently and justifies component or connection choices. **Skills**: Employs technical symbols and terms accurately in written responses. Structures ideas logically and clearly while presenting solutions. Applies electrical-analysis principles with academic rigout. **Values**: Reinforces academic integrity and self-reliance during assessment. Commits to deep conceptual understanding rather than rote memorization. Appreciates proactive revision and personal organization for optimal performance.		T	Tests , Assessments
	3P	**Knowledge**: Gains hands-on familiarity with clamping circuit, and voltage doubler. **Skills**: Assembles and tests these circuits and analyses their performance. **Values**: Promotes adherence to safety procedures and care in the laboratory. Develops practical skill, measurement accuracy, and troubleshooting. Strengthens the integration of theoretical concepts with experimental work.	Diode Clamper and Voltage Doubler	P	
8	**4T**	**Knowledge**: Understands the Zener breakdown	Zener Diode (Zener	T	Tests , Assessments

		mechanism and voltage-regulation characteristics. **Skills**: Analyses the role of the Zener diode in voltage stabilization and related applications. **Values**: Raises awareness of protection and regulation in electronic systems. Encourages precise understanding of circuit behavior under varying voltage and load conditions. Cultivates sound component selection for dependable performance.	Characteristics, Zener Breakdown, Voltage regulation characteristics)		Reports
	3P	**Knowledge**: Demonstrates Zener characteristics through laboratory experiments. **Skills**: Measures Zener performance and analyses laboratory data. **Values**: Maintains safety and diligence in experimental work. Enhances measurement precision and troubleshooting capability. Links theoretical expectations with practical findings.	Zener Diode Characteristics	P	
9	**4T**	**Knowledge**: Recognizes how changes in load and input voltage affect a Zener regulator circuit. **Skills**: Selects the appropriate circuit configuration for specific operating conditions. **Values**: Promotes protective-design	Zener Diode (Zener regulation with variable input source, regulation with variable load)	T	Tests , Assessments Reports

		awareness in electronic systems. Fosters accuracy in understanding circuit performance under variable conditions. Strengthens competence in choosing reliable components.			
	3P	**Knowledge**: Understands the practical use of a Zener diode for voltage regulation. **Skills**: Constructs a Zener regulator and evaluates its stability. **Values**: Upholds safety and attentiveness in the lab. Improves experimental precision and troubleshooting skill. Bridges theoretical analysis with practical measurement.	Zener Voltage regulation	P	
10	**4T**	**Knowledge**: Explains how a Zener diode is used in variable-load circuits and for wave shaping. **Skills**: Chooses appropriate circuits for regulation and waveform modification. **Values**: Enhances awareness of protection and regulation in electronic systems. Promotes exact understanding of circuit behavior under changing conditions. Develops sound component selection for reliable design.	Zener Diode (Zener voltage regulation with variable load, Zener limiter)	T	Tests , Assessments Reports
	3P	**Knowledge**: Observes the effect of load variation on a Zener circuit.	Zener regulation with variable load	P	

		Skills: Performs experiments and analyses circuit behavior under different conditions. **Values**: Maintains strict safety and measurement diligence. Develops troubleshooting skill and empirical analysis. Confirms theoretical predictions through experimentation.			
11	**4T**	**Knowledge**: Understands transistor structure, classifications, and current-amplification mechanisms. **Skills**: Accurately explains and analyses circuits employing BJTs. **Values**: Encourages critical interpretation of transistor characteristics. Promotes disciplined application of theory in circuit design and analysis. Fosters innovation in using transistors for amplification and control.	Bipolar junction transistor (characteristics, types, current gain calculation)		Tests , Assessments Reports
	3P	**Knowledge**: Identifies transistor characteristics through laboratory measurement. **Skills**: Conducts experiments to measure and analyze transistor performance. **Values**: Enforces laboratory safety and precision. Enhances empirical skills aligned with theory. Strengthens understanding	Transistor characteristics (Determine collector and emitter)		

		through practical validation.			
12-133	8T	**Knowledge**: Understands various transistor-biasing techniques and their operational impact. **Skills**: Determines the appropriate biasing method for a given application. **Values**: Develops critical analysis of transistor operation. Reinforces rigorous application of theoretical principles. Encourages creative and effective use of BJTs.	Bipolar junction transistor (Biasing methods)	T	Tests , Assessments Reports
	6P	**Knowledge**: Demonstrates the effect of biasing methods on transistor performance. **Skills**: Builds bias circuits and measures their behavior. **Values**: Maintains strict safety and accuracy. Enhances troubleshooting competence. Connects theoretical bias concepts with laboratory results.	Different BJT biasing circuits	P	
14	4T	**Knowledge**: Learns to plot and analyze transistor characteristic curves and calculate the Q-point. **Skills**: Interprets curves to assess performance and selects the optimal Q-point for efficient operation. **Values**: Strengthens critical evaluation of transistor behavior. Promotes disciplined	Bipolar junction transistor (collector curves, Dc-load line, Q-point)	T	Tests , Assessments Reports

		theoretical application. Encourages innovative circuit optimization.			
	3P	**Knowledge**: Recognizes the transistor working areas, active, cut-off and saturation. **Skills**: ability to use the transistor as a switch in electrical circuits. **Values**: Emphasizes safety and precise measurement. Develops practical understanding of configuration impact. Integrates theory with empirical evaluation.	BJT Transistor as an electrical switch	P	
15	**4T**	**Knowledge**: Recalls key concepts of semiconductors, diode models, rectifiers, Zener diodes, BJTs, and biasing methods. Distinguishes component applications based on functional context. **Skills**: Analyses circuits combining multiple devices. Applies analytical models to interpret circuit responses. **Values**: Enhances self-evaluation and responsibility for final preparation. Encourages integration of concepts for advanced learning.	Preparatory Week (Comprehensive Review)	T	In-class Exercises and Assignments
	3P	**Knowledge**: Integrates theoretical and practical elements for a holistic understanding of circuit behavior. **Skills**: Revisits earlier	Preparatory Week (Comprehensive Review)	P	

		experiments, interprets discrepancies between theory and practice. **Values**: Cultivates critical reflection and continuous improvement. Strengthens readiness for higher-level courses.			

11.Course Evaluation

The grades:

Assignments (in-class & take-home)	10
Seminar	5
Quizzes (Testes)	15
Practical (Laboratory Work)	10
Midterm Exam	10
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	• Electronic Devices (by: Thomas L. Floyd • Electronic Devices and Circuit Theory (b Robert L. Boylestad, Louis Nashelsky)
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	MIT OpenCourseWare - Introduction To Electronics, Signals, And Measurement URL: https://ocw.mit.edu/courses/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/pages/lecture-notes

1. Course Name:
Workshops (electronics + electrical)
2. Course Code:
ECE105
3. Semester / Year:
Second semester / First Stage
4. Description Preparation Date:
2024
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
3 practical/hour 150 Number of units 1/
7. Course administrator's name (mention all, if more than one name)
Name: Nabeel Muhamed Akram Samad Email: **nabeelakram@ntu.edu.iq**
8. Course Objectives

Course Objectives	1. Vocabulary and Terminology Development: Expanding students' technical vocabulary and the scientific and practical terms specific to their field of study or profession, enabling them to accurately communicate technical concepts and ideas. 2. Improving Workshop Skills: Enhancing students' practical skills for practical application in real-life situations. 3. Developing Technical Skills: Enhancing students' laboratory skills, enabling them to understand the work process and participate in activities to raise academic standards. 4. Developing Effective Communication: Enhancing students' ability to communicate effectively in professional technical environments, with a focus on clarity, coherence, and the appropriate use of work tools in various business contexts. 5. Enhancing Students' Competencies in Electronics and Electrical Workshops: Developing students' skills and enhancing their competence for success in daily life.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve

	• Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Training Workshop Concepts • Occupational Safety • Components and Contents of Training Workshops • Determining Measuring Devices	Theoretical + Practical	Tests and exercises

2	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Semiconductors • Introduction to semiconductor alloys. • Types of semiconductor elements. • Factors affecting semiconductor alloys.	Theoretical + Practical	Tests and exercises
3	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world	Resistance • Definition of resistance. • Reading resistance by color. • Types of resistors. • Uses and applications of resistors	Theoretical + Practical	Tests and exercises

		projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
4	**3**	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Capacitor • Definition of a capacitor. • Types of capacitors. • Factors affecting capacitors. • Reading capacitors. • Their uses in electronic circuits.	Theoretical + Practical	Tests and exercises

5	**3**	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Diode • Definition, components, and characteristics of a diode. • Types of diodes. • Diode testing. • Uses of diodes	Theoretical + Practical	Tests and exercises
6	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects,	Transistor • Definition of an ester transistor and its components. • Types of transistors. • Examination of an ester transistor. • Uses of an ester transistor	Theoretical + Practical	Tests and exercises

		demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
7	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Rayleigh Family • Definition of Rayleigh • Parts and Types of Rails • How a Relay Works • Uses of Rayleigh	Theoretical + Practical	Tests and exercises

8	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Welding • Introduction to welding and its types. • Welding elements and requirements. • Element processing and welding requirements. • Welding steps • Welding removal	Theoretical + Practical	Tests and exercises
9	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world	Design a simple circuit • Understand how an electronic circuit works. • Trace the signal according to the circuit diagram to understand the function of each component. • Solder the electronic components according to the circuit diagram.	Theoretical + Practical	Tests and exercises

		projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
10	**3**	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Workshop Safety Procedures • Principles of Electrophysiology • Methods of Electrical Injury • Types of Electrical Injuries • Prevention of Electrical Hazards	Theoretical + Practical	Tests and exercises

11	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Electricity • Introduction to National Electricity • Methods of generating electricity through power plants • Occupational safety for high-voltage electricity	Theoretical + Practical	Tests and exercises
12	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world	Electrical Supply • Types of Power Transmission Lines • Electricity Distribution from the Grid to Residential Areas • Types of Foundation Cables for Homes • Types of Outdoor Transformers in the Area • Home Electricity Connection and Connection Type: Single-Phase or Three-Phase	Theoretical + Practical	Tests and exercises

		projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
13	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Applications for some electrical circuits and household wiring • A single-switch electrical circuit using a lamp • Installing a ladder switch using a lamp • Installing a circuit breaker and protection devices • Circuiting the doorbell	Theoretical + Practical	Tests and exercises

14	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.	Measuring Devices • Multimeter • How to Connect a Multimeter	Theoretical + Practical	Tests and exercises
15	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world	Generators and Motors • Types of Generators and Motors • Components of a Single-Phase Motor	Theoretical + Practical	Comprehensive review

		projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these performance.			
16	3	1. Knowledge of Qualifying Workshops: Students will gain a solid understanding of workshops, including their applications and student roles. 2. Application of Qualifying Workshops to Projects: Students will be able to apply scientific knowledge to real-world projects, demonstrating their ability to design and implement specific requirements. 3. Workshop Analysis and Optimization: Students should be able to identify and calibrate equipment to improve performance and apply optimization techniques to improve these	Final exam	Theoretical + Practical	Final exam

		performance.			

11.Course Evaluation

The grades:	
Coursework	20
Practical	20
Report and design	10
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Practical electronics workshop equipment • Electrical installation design and inspection Electrical circuit principles
Main references (sources)	• "الأجهزة الإلكترونية ونظرية الدوائر" بقلم بويلستاد وناشيلسكي
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	https://www.et3lemdelivery.com/2018/11/Electr y-Basics-Workshop-pdf.html

1. Course Name:	
Professional Ethics	
2. Course Code:	
NTU201	
3. Semester / Year:	
First Semester/ Second Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
6. Number of Credit Hours (Total) / Number of Units (Total)	
2 Hours - 2 Units	
7. Course administrator's name (mention all, if more than one name)	
Name: Email:	
8. Course Objectives	
Course Objectives	• **Introduce students to professional ethics** and familiarize them with fundamental ethical principles, moral reasoning, and their application in engineering practice • **Examine ethical responsibilities** of engineers toward society, environment, clients, and colleagues, emphasizing the professional duty and accountability • **Provide comprehensive understanding** of professional codes of ethics, standards of conduct, and regulatory frameworks governing engineering practice • **Develop critical thinking skills** to analyze ethical dilemmas, evaluate moral conflicts, and make sound ethical decisions in professional engineering contexts • **Explore contemporary ethical challenges** in engineering fields including sustainability, safety, technology ethics, and social responsibility • **Foster ethical leadership** and promote integrity, honesty, and ethical behavior in professional engineering practice
9. Teaching and Learning Strategies	
Strategy	**Teaching Methods:** • **Lectures:** Comprehensive lectures on ethical theories, professional

	responsibilities, and regulatory frameworks with multimedia presentations ● **Case Study Analysis:** Examination of real-world ethical dilemmas and professional misconduct cases in engineering practice ● **Interactive Discussions:** Student participation in ethical debates, moral reasoning exercises, and group problem-solving sessions ● **Role-Playing Activities:** Simulation of professional scenarios requiring ethical decision-making and moral judgment **Assessment Methods:** ● Continuous assessment through case study analyses and ethical reasoning assignments ● Group projects on contemporary ethical issues in engineering ● Written examinations on ethical theories and professional conduct standards ● Oral presentations on ethical dilemmas and proposed solutions

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**2T**	**Knowledge:** Understand fundamental concepts of ethics, morality, and their relevance to engineering practice **Skills:** Distinguish between ethical, legal, and practical considerations in professional contexts **Values:** Appreciate the importance of ethical behavior in professional engineering	Chapter One: Introduction to Professional Ethics	Theoretical lectures, discussions, and introductory case studies	Direct questions and participation assessment
2	**2T**	**Knowledge:** Learn major ethical theories including deontology, utilitarianism, and virtue ethics **Skills:** Apply different ethical frameworks to analyze moral problems **Values:** Develop appreciation for diverse	Chapter One: Ethical Theories and Moral Reasoning	Theoretical lectures, framework applications, and comparative analysis	Ethical reasoning exercises and discussions

		moral perspectives and reasoning approaches			
3	**2T**	**Knowledge:** Understand the history and development of engineering ethics and professional responsibility **Skills:** Trace the evolution of ethical standards in engineering practice **Values:** Recognize the importance of professional ethics in maintaining public trust	Chapter One: History and Development of Engineering Ethics	Historical analysis, cas studies, and professional development discussions	Historical analysis assignments and oral tests
4	**2T**	**Knowledge:** Study professional codes of ethics from major engineering societies and organizations **Skills:** Interpret and apply professional codes to specific engineering scenarios **Values:** Understand the binding nature of professional ethical commitments	Chapter One: Professional Codes of Ethics	Code analysi comparative studies, and application exercises	Code interpretation exercises and case applications
5	**2T**	**Knowledge:** Learn about professional responsibilities toward public safety, health, and welfare **Skills:** Evaluate engineering decisions based on public interest considerations **Values:** Develop commitment to prioritizing public welfare over personal or organizational interests	Chapter One: Professional Responsibility and Public Welfare	Public intere case studies, safety analys and responsibilit discussions	Public welfare assessment projects
6	**2T**	**Knowledge:** Understand legal and regulatory frameworks governing engineering practice **Skills:** Navigate legal requirements and professional licensing standards **Values:** Appreciate the relationship between legal	Chapter One: Legal and Regulatory Frameworks	Legal framework analysis, compliance studies, and regulatory discussions	Legal compliance assessments and discussions Written examination

		compliance and ethical behavior			
	2P	**Knowledge:** Assessment of foundational professional ethics knowledge **Skills:** Demonstrate mastery of ethical reasoning and professional responsibility concepts **Values:** Show development of ethical awareness and professional commitment	Mid-term Examination	Examination	
7	**2T**	**Knowledge:** Understand ethical obligations toward colleagues, employers, and professional relationships **Skills:** Manage conflicts of interest and maintain professional integrity **Values:** Foster respect for professional relationships and collaborative work environments	Chapter Two: Professional Relationships and Workplace Ethics	Workplace scenarios, conflict resolution, a professional relationship analysis	Professional relationship case studies
8	**2T**	**Knowledge:** Learn about intellectual property rights, confidentiality, and information ethics **Skills:** Protect proprietary information and respect intellectual property **Values:** Develop commitment to honesty and transparency in professional communication	Chapter Two: Intellectual Property and Confidentiality	IP case studi confidentiali scenarios, an information ethics discussions	IP and confidentialit y assessments
9	**2T**	**Knowledge:** Understand environmental ethics and sustainability in engineering practice **Skills:** Evaluate environmental impacts and promote sustainable engineering solutions **Values:** Develop environmental consciousness and commitment to sustainability	Chapter Two: Environmental Ethics and Sustainability	Environment case studies, sustainability analysis, and green engineering discussions	Environment al impact assessments and sustainability projects

10	**2T**	**Knowledge:** Study safety ethics, risk assessment, and liability in engineering practice **Skills:** Conduct ethical risk analysis and implement safety measures **Values:** Prioritize safety and develop accountability for engineering outcomes	Chapter Two: Safety Ethics and Risk Management	Safety case studies, risk analysis, and liability discussions	Safety ethics assessments and risk analysis projects
11	**2T**	**Knowledge:** Explore technology ethics, artificial intelligence, and emerging technological challenges **Skills:** Assess ethical implications of new technologies and digital innovations **Values:** Develop responsible approach to technological development and implementation	Chapter Two: Technology Ethics and Digital Responsibility	Technology ethics discussions, case studies, and digital responsibilit analysis	Technology ethics projects and presentations
12	**2T**	**Knowledge:** Understand global ethics, cultural considerations, and international engineering practice **Skills:** Navigate cross-cultural ethical differences and international standards **Values:** Develop cultural sensitivity and appreciation for diverse ethical perspectives	Chapter Three: Global Ethics and Cultural Considerations	Cross-cultur analysis, international case studies, and global ethics discussions	Cross-cultural ethics assessments and discussions
13	**2T**	**Knowledge:** Learn about ethical leadership, professional development, and continuous learning **Skills:** Develop leadership skills and promote ethical culture in organizations **Values:** Commit to lifelong learning and ethical professional development	Chapter Three: Ethical Leadership and Professional Development	Leadership scenarios, professional development planning, an mentorship discussions	Leaders p proje and profess al develop ent present ons
14	**2T**	**Knowledge:** Synthesize comprehensive understanding of	Chapter Three: Future of Professional	Personal ethi development future planni	Persona ethics stateme

		professional ethics and future challenges **Skills:** Develop personal code of ethics and professional action plans **Values:** Commit to ethical practice and moral courage in professional engineering career	Ethics and Personal Commitment	and comprehensi review	and fin present ons
15	**2T**	**Knowledge:** Understand fundamental concepts of ethics, morality, and their relevance to engineering practice **Skills:** Distinguish between ethical, legal, and practical considerations in professional contexts **Values:** Appreciate the importance of ethical behavior in professional engineering	Chapter One: Introduction to Professional Ethics	Theoretical lectures, discussions, and introductory case studies	Direct questio and particip on assessn t

11.Course Evaluation

The grades:

Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Engineering Ethics: Concepts and Cases by Charles B. Harris, Michael S. Pritchard, and Michael J. Rabins (2019 Edition)
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	IEEE Ethics and Member Conduct resources and case studies

1. Course Name:

English Language 2

2. Course Code:

NTU200

3. Semester / Year:

Second Semester / Second Stage

4. Description Preparation Date:

2023

5. Available Attendance Forms:

Weekly (theoretical lectures)

6. Number of Credit Hours (Total) / Number of Units (Total)

50 hours total / 2 credit units

7. Course administrator's name (mention all, if more than one name)

Name:
Email:

8. Course Objectives

Course Objectives	• **Introduce students to the concept and function of tenses** in English grammar. • **Enable accurate use of present tenses** (present simple and present continuous) in various contexts. • **Develop understanding and use of past tenses** (past simple and past continuous) in narration and description. • **Teach correct usage of quantity expressions and articles** (a, an, the, some, any, etc.). • **Familiarize students with common verb patterns**, including gerunds and infinitives. • **Enable students to express future intentions and plans** using future simple, "going to," and present continuous forms.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • **Interactive grammar presentations** using real-life examples to explain tenses and verb patterns. • **Context-based exercises** (dialogues, short texts) to practice present, past, and future tenses. • **Pair and group activities** for collaborative practice of articles, quantity expressions, and sentence formation. • **Controlled and free writing tasks** to reinforce grammar usage in context.

	• **Role-plays and speaking drills** to apply future intentions and verb patterns in communication. • **Use of visual aids and timelines** to clarify tense usage and differences. • **Error correction and peer feedback** to build accuracy and self-awareness in grammar use. Assessment Methods: • **Quizzes and grammar tests** to evaluate understanding of tenses, articles, and verb patterns. • **Written assignments and short paragraphs** to assess correct grammar usage in context. • **Oral presentations or dialogues** to measure spoken accuracy, especially in using tenses and future intentions. • **In-class activities and group tasks** for formative assessment through participation and collaboration. • **Error analysis exercises** to assess students' ability to identify and correct grammatical mistakes. • **Final exam** covering all course topics through a mix of objective and applied questions

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1&2	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understand the basic structure and usage of English verb tenses, including the **simple present**, **present continuous**, and an overview of **past** and **future** tenses. **Skills**: Accurately identify and use the correct present tense (simple and continuous) in both **spoken and written English**, and complete practical exercises with increased grammatical accuracy.	**Introduction to Tenses**	T	Tests and Reports

		Values: Develop an appreciation for the role of verb tenses in clear communication, and demonstrate **attention to grammatical correctness** in everyday language use.			
3&4	**2T**	**Knowledge**: Explain the differences between the **present simple**, **present continuous**, **present perfect**, and **present perfect continuous** tenses, including their structure and functions. **Skills**: Confidently use all forms of the present tense in **real-life speaking and writing situations**, and distinguish when to use each tense based on context and meaning. **Values**: Show increased **language awareness and responsibility** in selecting appropriate tenses for effective communication in personal, academic, or professional contexts.	Present tenses (present simple and present continuous)	T	Tests and Reports
5&6	**2T**	**Knowledge**: Understand the structure, usage, and key differences between the **past simple** and **past continuous** tenses. **Skills**: Correctly apply both tenses in writing and conversation to describe **past actions**, including actions that happened at a specific time and actions in progress in the past. **Values**: Appreciate the importance of **accurate tense usage** to clearly express events and timelines, and develop attention to detail in	Past tenses (past simple , past continuous)	T	Tests and Reports

		recounting past experiences.			
7	**2T**	**Knowledge**: Recall and apply key concepts and grammar rules related to **present** and **past tenses**, including correct usage and form of all tenses covered so far. **Skills**: Demonstrate proficiency in selecting and using appropriate verb tenses in **structured exercises**, **gap fills**, and **short writing tasks** that reflect everyday contexts **Values**: Reflect a growing sense of **language responsibility and self-assessment**, recognizing areas of strength and those needing further improvement in grammar and usage.	Mid-term exam	T	Tests and Reports
8&9	**2T**	**Knowledge**: Understand the rules and usage of **quantifiers** (e.g., *some, any, much, many, a few, a little*) and **articles** (*a, an, the*), including their meaning and grammatical functions. **Skills**: Accurately use quantifiers and articles in **spoken and written English**, especially in describing quantity and specificity in everyday contexts. **Values**: Develop a sense of **clarity and precision** in communication by using appropriate quantity expressions and articles, and show improved attention to grammatical detail.	**Quantity and Articles** o Quantifiers (some, any, much, many, a few, a little) o Definite and indefinite articles (a, an, the)	T	Tests and Reports
10&11	**2T**	**Knowledge**: Understand the rules and usage of **verb patterns** involving **gerunds**	Verb Patterns • Gerunds and	T	Tests and Reports

		and **infinitives**, including common structures like *verb + gerund*, *verb + infinitive*, and *verb + object + gerund/infinitive*. **Skills**: Use appropriate verb patterns in both **written and spoken communication**, and recognize which verbs require specific forms (e.g., *enjoy doing*, *want to do*, *advise someone to do*). **Values**: Show increased grammatical accuracy and **confidence in expressing actions, preferences, and intentions**, while respecting the rules that govern English verb combinations.	infinitives • Verb + infinitive, verb + gerund, verb + object + infinitive/gerund		
12&13	**2T**	**Knowledge**: Understand the differences in form and usage between **future simple** (*will*), **"going to"**, and **present continuous** when used for future meanings. **Skills**: Accurately use various future forms to **talk about plans, predictions, and intentions** in both spoken and written English, applying each form appropriately based on context. **Values**: Develop confidence in **expressing future events and commitments**, and appreciate the role of **tense choice** in communicating clarity and intent in everyday conversation.	**Future Intentions** o Future simple, going to, present continuous for future o Talking about plans, predictions, and intentions	T	Tests and Reports
14&15	**2T**	**Knowledge**: Consolidate understanding of all key grammar topics covered in the course, including **tenses, quantifiers, articles, verb patterns**, and **future forms**.	**Review and Application** o Comprehensive review of the entire course o Application	T	Tests and Reports

		Skills: Apply grammar rules accurately and fluently through **integrated practice activities**, demonstrating the ability to use correct structures in **real-life communication tasks** (speaking and writing). **Values**: Show **greater language awareness and independence**, recognizing the value of continuous practice and self-correction in developing effective English communication.	exercises covering all topics		

11.Course Evaluation	
The grades:	
Coursework	40
Midterm Exam	10
Final Exam	50
Total	100
12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	New-Headway 1-2 Authors: Richard Harrison
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	Online practice portals & YouTube/ Extra grammar, writing, and listening support outside class.

1. Course Name:	
MATH 3	
2. Course Code:	
TECK201	
3. Semester / Year:	
First Semester – Second year	
4. Description Preparation Date:	
2024	
5. Available Attendance Forms:	
Weekly (theoretical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
45 hours total / 3 credit units	
7. Course administrator's name (mention all, if more than one name)	
Name: Maroa Essam Baker Email: Maroa.baker@ntu.edu.iq	
8. Course Objectives	
Course Objectives	**This module aims to provide students with a foundational understanding of**: 1.Understanding Vectors: The primary goal is to provide students with Understanding the fundamental concepts of vectors 2.Coordinates: The objective of the course is to facilitate students in acquiring a comprehension of the connections and conversions among Cartesian, cylindrical, and spherical coordinates. 3.Partial Differentiation: The aim of this mathematics course is to provide students with a solid understanding of partial differentiation.
9. Teaching and Learning Strategies	
Strategy	**Teaching Methods:** •Theoretical lectures: to achieve cognitive objectives •Dialogues and discussions: during theoretical lectures to achieve •Using general engineering principles: for analyzing and designing engineering problems •Application of programming principles and rules: for programmable control systems design. **Assessment Methods:** •Theoretical examinations: periodic and semester exams to verify (A1-A4) •Short tests (Quizzes): continuous assessment •Classroom dialogues and discussions: to verify (A1-A2) •Assignments (Homework's): practical applications •Classroom result presentations: for discussion and student participation.

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge:** Introduction to Vectors Components of a vector Unit vectors Vector addition/subtraction **Skills:** Represent vectors in 2D/3D space Calculate magnitude and direction **Values:** Appreciate the role of vectors in physics/engineering		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
2	**2T**	**Knowledge**: Vector Algebra Dot product and cross product Scalar and vector projections **Skills:** Solve problems involving work, torque, and angles between vectors **Values:** Recognize real-world applications		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
3	**2T**	**Knowledge**: Cartesian Coordinates 2D/3D Cartesian systems Distance and midpoint formulas **Skills:** Plot points and vectors in Cartesian space **Values:** Understand precision in geometric representation		T	Tests and Reports

	2P	**Knowledge**: **Skills**: **Values**:		P	
4	2T	**Knowledge**: Cylindrical Coordinates Conversion from Cartesian to cylindrical Applications **Skills:** Transform equations between coordinate systems **Values:** Appreciate efficiency in problem-solving		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
5	2T	**Knowledge**: Spherical Coordinates Spherical coordinate definitions Conversions (Cartesian ↔ Spherical) **Skills:** Solving problems in astronomy/electrodynamics **Values:** Recognize coordinate systems in nature		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
6	2T	**Knowledge:** Gradient in Polar Coordinates Gradient operator in cylindrical/spherical systems Directional derivatives **Skills:** Compute gradients for scalar fields **Values:** Link math to physics		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
7	2T	**Knowledge**: First-Order Partial Derivatives Definition and notation		T	Tests and Reports

		Geometric interpretation **Skills:** Compute partial derivatives of multivariable functions **Values:** Appreciate incremental change analysis			
	2P	**Knowledge**: **Skills**: **Values**:		P	
8	**2T**	**Knowledge**: Higher-Order Derivatives Second-order partial derivatives Clairaut's theorem (symmetry of mixed derivatives) **Skills:** Verify continuity and differentiability **Values:** Precision in mathematical rigor		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
9	**2T**	**Knowledge**: Chain Rule Multivariable chain rule Implicit differentiation **Skills:** Apply to related rates problems **Values:** Problem-solving adaptability		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
10	**2T**	**Knowledge**: Double Integrals Iterated integrals Fubini's theorem **Skills:** Compute areas/volumes **Values:** Appreciate integration in engineering design		T	Tests and Reports

	2P	**Knowledge**: **Skills**: **Values**:		P	
11	2T	**Knowledge**: Changing Order of Integration Limits of integration Simplifying complex regions **Skills:** Switch integration order for efficiency **Values:** Strategic thinking in computation		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
12	2T	**Knowledge**: Double Integrals in Polar Coordinates Polar area elements Conversions (Cartesian ↔ Polar) **Skills:** Solving problems with circular symmetry **Values:** Recognize symmetry in nature		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
13	2T	**Knowledge**: Surface Area Parametric surfaces Surface integrals **Skills:** Calculate surface areas **Values:** Link to real-world applications		T	
	2P	**Knowledge**: **Skills**: **Values**:		P	
14	2T	**Knowledge**: Review & Applications Recap key concepts **Skills:** Solve integrated problems **Values:** Synthesize		T	

		interdisciplinary connections			
	2P	**Knowledge**: **Skills**: **Values**:		P	
15	**2T**	**Knowledge**: Comprehensive exam **Skills:** Demonstrate mastery of computations **Values:** Reflect on mathematical growth		T	
	2P	**Knowledge**: **Skills**: **Values**:		P	

11.Course Evaluation

The grades:

Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	'K.A.STROUD Engineering Mathematics' with DEXTER J. BOOTH, seventh edition 2013
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	The companion website – www.palgrave.com/stroud

1. Course Name:
MATH 4
2. Course Code:
TECK202
3. Semester / Year:
Second Semester – Second year
4. Description Preparation Date:
2025
5. Available Attendance Forms:
Weekly (theoretical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hours total / 3 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Maroa Essam Baker Email: Maroa.baker@ntu.edu.iq
8. Course Objectives

Course Objectives	This module aims to provide students with a foundational understanding of: 1. Partial Differentiation: The aim of this mathematics course is to provide students with a solid understanding of partial differentiation, enabling them to apply this powerful tool in solving problems involving functions of multiple variables, optimization, and real-world applications in various disciplines. 2. Multiple Integrals: The aim of a mathematics course focusing on Multiple Integrals, including Double Integrals, Changing the Order of Integration, Double Integrals in Polar Coordinates, and Surface Area. 3. Understanding Complex Numbers: The objective of this math course is to equip students with a comprehensive understanding of complex numbers and their properties. Through mastery of complex numbers, students will develop the ability to perform operations, solve equations, and apply complex numbers effectively in diverse mathematical and scientific scenarios 4. Understanding ODEs: The aims of a math course focused on Ordinary Differential Equations (ODEs) of first and second order. Through this course, students will develop a solid understanding of ODEs, acquire problem-solving skills, and apply these mathematical tools in various scientific and engineering contexts.

9. Teaching and Learning Strategies	
Strategy	**Teaching Methods:** •Theoretical lectures: to achieve cognitive objectives •Dialogues and discussions: during theoretical lectures to achieve •Using general engineering principles: for analyzing and designing engineering problems •Application of programming principles and rules: for programmable control systems design. **Assessment Methods:** •Theoretical examinations: periodic and semester exams to verify (A1-A4) •Short tests (Quizzes): continuous assessment •Classroom dialogues and discussions: to verify (A1-A2) •Assignments (Homework's): practical applications •Classroom result presentations: for discussion and student participation

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: **Complex Numbers & Polar Form** Definition of complex numbers Polar) and Euler's formula **Skills:** Convert between rectangular and polar forms Perform arithmetic operations (addition, multiplication) **Values:** Appreciate the elegance of complex numbers in unifying algebra and geometry		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
2	**2T**	**Knowledge**: Infinite Series & Power Series Definition of infinite		T	Tests and Reports

		series and partial sums Power series expansions **Skills:** Compute sums of simple series (geometric, telescoping) **Values:** Recognize series as foundations for approximations in engineering			
	2P	**Knowledge**: **Skills**: **Values**:		P	
3	**2T**	**Knowledge**: Convergence & Divergence of Series Tests for convergence (ratio, root, comparison) Absolute vs. conditional convergence **Skills:** Apply convergence tests to determine series behavior **Values:** Develop logical reasoning in mathematical analysis		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
4	**2T**	**Knowledge**: Complex Functions **Skills:** Visualize complex mappings **Values:** Connect complex analysis to fluid dynamics/electromagnetics		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
5	**2T**	**Knowledge**: Cauchy-Riemann Equations Necessary/sufficient conditions for differentiability Harmonic functions and conjugates		T	Tests and Reports

		Skills: Verify analyticity using Cauchy-Riemann equations **Values:** Appreciate mathematical rigor in defining "smooth" functions			
	2P	**Knowledge**: **Skills**: **Values**:		P	
6	**2T**	**Knowledge**: Taylor Series (Complex) Taylor expansions for analytic functions Radius of convergence **Skills:** Derive Taylor series **Values:** Understand how series enable solving ODEs		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
7	**2T**	**Knowledge**: First-Order ODEs – Separation of Variables Separable ODEs Initial value problems **Skills:** Solve population growth/decay problems **Values:** Model real-world phenomena		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
8	**2T**	**Knowledge**: Homogeneous Differential Equations Homogeneous ODEs Substitution methods **Skills:** Transform and solve homogeneous ODEs **Values:** Recognize scaling symmetries in		T	Tests and Reports

		physics/biology			
	2P	**Knowledge**: **Skills**: **Values**:		P	
9	**2T**	**Knowledge**: Linear & Bernoulli ODEs Linear first-order ODEs Bernoulli equations **Skills:** Integrate using integrating factors **Values:** Appreciate historical context		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
10	**2T**	**Knowledge**: Exact & Non-Exact ODEs Exact condition Integrating factors for non-exact ODEs **Skills:** Test for exactness and solve **Values:**Link to thermodynamics (differential forms)		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
11	**2T**	**Knowledge**: Applications of First-Order ODEs Newton's cooling law, RC circuits, mixing problems **Skills:** Model and solve application-driven ODEs **Values:** Ethical considerations in modeling		T	Tests and Reports
	2P	**Knowledge**: **Skills**: **Values**:		P	
12	**2T**	**Knowledge**: Second-Order Linear ODEs – Homogeneous Solutions Characteristic equation (constant coefficients) **Skills:** Solve spring-mass		T	Tests and Reports

		systems (damped/unforced) **Values:** Connect to harmonic motion in engineering			
	2P	**Knowledge**: **Skills**: **Values**:		P	
13	**2T**	**Knowledge**: Non-Homogeneous Linear ODEs Method of undetermined coefficients Superposition principle **Skills:** Solved oscillators **Values:** Understand resonance in bridges/machines		T	
	2P	**Knowledge**: **Skills**: **Values**:		P	
14	**2T**	**Knowledge**: Variation of Parameters Wronskian and fundamental sets **Skills:** Apply to ODEs with non-constant coefficients **Values:** Appreciate generalization in mathematical methods.		T	
	2P	**Knowledge**: **Skills**: **Values**:		P	
15	**2T**	**Knowledge**: Applications of Second-Order ODEs Electrical circuits (RLC), forced vibrations **Skills:** Model and interpreting solutions physically **Values:** Ethical design in engineering.		T	
	2P	**Knowledge**: **Skills**: **Values**:		P	

11.Course Evaluation	
The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	'K.A.STROUD Engineering Mathematics' with DEXTER J. BOOTH, seventh edition 2013
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	The companion website – www.palgrave.com/stroud

1. Course Name:	
Physics	
2. Course Code:	
TECK104	
3. Semester / Year:	
Second Semester / First Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Theoretical	
6. Number of Credit Hours (Total) / Number of Units (Total)	
125/ 3	
7. Course administrator's name (mention all, if more than one name)	
Name: Yahya Ghufran Khidhir Email: yahhya.khidhir24@ntu.edu.iq	
8. Course Objectives	
Course Objectives	• to provide students with basic knowledge and skills in the field of physics, • enabling them to understand natural phenomena • and apply physical principles in the fields of science, engineering and technology
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Traditional lectures, report writing, seminar conduct. Assessment Methods: • Daily written and oral tests, applied tests, seminars, semester and final exams, assignments, attendance and commitment, feedback (testing the student on the previous subject), • self-evaluation (questions are set for the student by the teacher and the student) • reports on scientific developments in the field of specialization, and asks analytical and deductive questions.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	**3T**	**If the student successfully completes this course, he will be able to:**	Physics and Measurement	T	Tests and Reports

		Knowledge: Understands fundamental physical quantities, units, and the importance of measurement precision. **Skills:** Converts between unit systems and performs dimensional analysis. **Values:** Develops accuracy, attention to detail, and appreciation for standardized measurement in engineering**.**			
2	**3T**	**Knowledge:** Understands concepts of displacement, velocity, acceleration, and uniformly accelerated motion. **Skills:** Analyzes motion graphs and solves kinematic equations. **Values:** Encourages logical reasoning and clarity in interpreting motion data.	motion in one dimension	T	Tests and Reports
3	**3T**	**Knowledge:** Understands Newton's laws and the relationship between force and motion. **Skills:** Applies Newton's laws to solve problems involving forces, friction, and inclined planes. **Values:** Promotes critical thinking and respect for fundamental principles of mechanics.	Laws of motion	T	Tests and Reports
4	**3T**	**Knowledge**: Understands kinetic and potential energy, work, power, and conservation of energy. **Skills:** Solves problems using work-energy	Energy and its transfer	T	Tests and Reports

		theorems and identifies energy transformations in systems. **Values:** Encourages appreciation for energy efficiency and sustainability.			
5	**3T**	**Knowledge:** Understands kinetic and potential energy, work, power, and conservation of energy. **Skills:** Solves problems using work-energy theorems and identifies energy transformations in systems. **Values:** Encourages appreciation for energy efficiency and sustainability.	Energy and its transfer	T	Tests and Reports
6	**3T**	**Knowledge:** Understands fluid properties, pressure, buoyancy, and Bernoulli's principle. **Skills:** Analyzes fluid systems using Pascal's and Archimedes' laws and Bernoulli's equation. **Values:** Develops an awareness of the practical implications of fluid behavior in engineering.	Fluid mechanics	T	Tests and Reports
7	**3T**	**Knowledge:** Reviews and reinforces understanding of motion, forces, energy, and fluid mechanics. **Skills:** Demonstrates the ability to apply concepts in solving integrated physics problems. **Values:** Reflects discipline, academic integrity, and preparedness.	Mid-term Exam	T	Tests and Reports

8	**3T**	**Knowledge**: Understands temperature, heat, internal energy, and the First Law of Thermodynamics. **Skills**: Analyzes energy flow in thermodynamic systems and solves problems related to heat transfer. **Values:** Encourages an appreciation of energy conservation in thermal processes.	Heat and the First Law of Thermodynamics	T	Tests and Reports
9	**3T**	**Knowledge:** Understands temperature, heat, internal energy, and the First Law of Thermodynamics. **Skills:** Analyzes energy flow in thermodynamic systems and solves problems related to heat transfer. **Values:** Encourages an appreciation of energy conservation in thermal processes.	Heat and the First Law of Thermodynamics	T	Tests and Reports
10	**3T**	**Knowledge**: Understands the concept of electric charge, Coulomb's law, and electric field intensity. **Skills:** Calculates electric field strength due to point charges and charge distributions. **Values:** Promotes a careful and systematic approach to solving electrostatic problems.	Electric Fields	T	Tests and Reports
11	**3T**	**Knowledge:** Understands the concept of electric charge, Coulomb's law, and electric field intensity. **Skills:** Calculates electric field strength due to point	Electric Fields	T	Tests and Reports

		charges and charge distributions. **Values:** Promotes a careful and systematic approach to solving electrostatic problems.			
12	**3T**	**Knowledge:** Understands the definition of capacitance, energy storage in capacitors, and the effect of dielectrics. **Skills:** Computes equivalent capacitance in circuits and analyzes energy in capacitive systems. **Values:** Encourages responsibility in handling and applying concepts of electrical energy storage.	Capacitance and Dielectrics	T	Tests and Reports
13	**3T**	**Knowledge:** Understands magnetic field concepts, Biot-Savart law, and forces on moving charges. **Skills:** Calculates magnetic forces and field lines for simple current-carrying systems. **Values:** Develops a curiosity-driven mindset for exploring electromagnetism.	Magnetic Fields	T	Tests and Rep
14	**3T**	**Knowledge:** Understands wave-particle duality, reflection, refraction, and lens/mirror laws. **Skills:** Solves problems related to image formation and light behavior in optical systems. **Values:** Fosters appreciation for light's role in modern technology and instrumentation.	The Nature of Light and the Laws of Geometric Optics	T	Tests and Rep

15	**3T**	**Knowledge:** Integrates physics knowledge across mechanics, thermodynamics, and electromagnetism. **Skills:** Develops holistic problem-solving techniques for comprehensive assessment. **Values:** Reinforces perseverance, academic responsibility, and continuous learning.	Preparatory work	T	

11.Course Evaluation

The grades:	
Quizzes	15
Onsite Assignments	15
Reports	5
Seminars	5
Midterm Exam	10
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	PHYSICS for Scientists and Engineers with Modern Physics', by Raymond A. Serway and John W. Jewett, Jr., Seventh Edition, 2008
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Physics for Scientists and Engineers with Modern Physics, 7th Edition
Electronic References, Websites	Physics for Scientists and Engineers Prof. John C. Armstrong URL: https://www.youtube.com/watch?v=_-xiXY99Rnk&list=PLF7j3NYlYyp0lIJC3N2IUGjGhcnZuYl

1. Course Name:	
Electromagnetic Fields (1)	
2. Course Code:	
ECE204	
3. Semester / Year:	
First Semester / Second Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (Theoretical Lectures)	
6. Number of Credit Hours (Total) / Number of Units (Total)	
45/3	
7. Course administrator's name (mention all, if more than one name)	
Name: Mayada Jasim Hamwdi Email: mayadajas@ntu.edu.iq	
8. Course Objectives	
Course Objectives	• Study the basic principles of electromagnetic fields. • Provide students with fundamental knowledge in electromagnetic fields required for several advanced courses in later years.
9. Teaching and Learning Strategies	
Strategy	Lectures, presentations, and documentation. - Inquiry-based learning: Encouraging students to ask questions and explore physical relationships through experiments or simulations. - Practical applications: Illustrating how concepts are used in designing capacitors, generators, or power transmission lines.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	3 hr.	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understanding basic concepts: Distinguishing between scalar quantities and vector quantities, and identifying the characteristics of each. **Skills:** Logical analysis: the ability to break down a	Scalars and Vectors, Vector Analysis, Cartesian Coordinate System	Theoretica	Exams and Oral Questions

		problem and understand the relationships between different quantities. Problem-solving: applying concepts to solve complex real-life or scientific problems. Values: **Values:** evaluating matters based on data and facts. Diligence and perseverance: especially when facing complex problems that require time.			
2	3 hr.	**Knowledge:** Understanding the concept of a unit vector and how to use it to determine direction, distinguishing between dot product and vector product in terms of definition, use, properties, and analyzing the vector into its components in the coordinate plane or three-dimensional space. **Skills:** Calculating vector components using angles and coordinates, applying the dot product to determine the angle or measure the work done in physics. Using the vector product to find a vector perpendicular to two planes or certain vectors. Representing vector operations graphically and analytically using geometric tools or computer programs. **Values:** Enhancing accuracy and mental discipline in processing complex problems. Instilling a spirit of cooperation when solving group exercises that depend on the	Vector Components and Unit Vector, Dot Product and Cross Product.	Theoretica	Exams and Oral Questions

		integration of solutions and fostering mathematical and geometric creativity in dealing with dimensions and directions.			
3	3 hr.	**Knowledge:** Understanding the characteristics of cylindrical and spherical coordinate systems and comparing them to the Cartesian system. Grasping how to convert coordinates from one system to another using appropriate mathematical relationships. Recognizing the advantages of using each coordinate system in different physical or engineering contexts and interpreting the mathematical representation of objects or points within the three systems. **Skills:** Accurately converting points and vectors between Cartesian, cylindrical, and spherical coordinate systems. Analyzing mathematical or physical problems and selecting the most suitable coordinate system for the solution. Representing data and fields using three-dimensional graphing tools. **Values:** Promoting mathematical accuracy and intellectual discipline when dealing with transformations of complex systems. Developing mental flexibility in switching perspectives or methods of	Co – ordinate System: Cylindrical and Spherical. Relation between Different Coordinate System.	Theoretica	Exams and Oral Questions

		analysis as needed. Elevating the practical application of mathematics in science and engineering. Encouraging a spirit of discovery and experimentation in dealing with various dimensions and geometric shapes.			
4	3hr.	**Knowledge:** Understanding Coulomb's law in terms of the mathematical formula and the physical meaning. Recognizing the factors affecting the electric force between two-point charges (distance, magnitude of charge, type of charge). **Skills:** Calculating the electric force between two-point charges using Coulomb's law. Determining the electric field strength produced by a point charge at a specific point. **Values:** Developing accuracy and attention to detail in handling sensitive mathematical relationships. Promoting a scientific and logical approach to interpreting electrical phenomena.	Coulomb's Law, Electric Field I3ntensity and its evaluation for Point Charge and Line charge	Theoretica	Exams and Oral Questions
5	3 hr.	**Knowledge:** Differentiating between the test charge and the source charge in electric field analysis. Understanding that the electric field is a vector quantity with both magnitude and direction. **Skills:** Analyzing and interpreting the results of numerical	Coulomb's Law, Electric Field Intensity and its evaluation for • Surface Charge • Volume Charge Distribution	Theoretica	Exams and Oral Questions

		problems related to the electric field and charges. **Values:** Encouraging collaboration in solving physical problems by exchanging ideas with others. Fostering an appreciation for scientific applications that rely on the fundamental concepts of electricity (such as electronics and smart devices).			
6	3 hr.	**Knowledge:** Understanding Coulomb's law to determine the electric force between two-point charges. Analyzing the electric field produced by a single charge and a group of charges, and recognizing the effect of distance, direction, and charge on the electric field. **Skills:** The ability to calculate the electric field intensity at a certain point resulting from N charges. Analyzing the directions and vectors associated with the field. Applying drawing and graphical representation skills for field lines. **Values:** Promoting accuracy and discipline in physical calculations. Fostering a spirit of scientific curiosity to understand electromagnetic phenomena. Developing teamwork through discussing and analyzing problems with others.	Field of N Point Charge	Theoretica	Exams and Oral Questions
7	3 hr.	**Knowledge:**	Midterm exam	Theoretica	Semester

		Understanding the fundamental principles of electricity and magnetism, such as Coulomb's law, electric field, and magnetic field. Recognizing how charges and electric currents interact with their surrounding fields. **Skills:** Analyzing electromagnetic problems and selecting appropriate laws for solutions. Graphically and quantitatively drawing and interpreting electric or magnetic field lines. **Values:** Promoting accuracy and attention to detail in analyzing equations and physical models. Fostering scientific curiosity to understand the electrical and magnetic phenomena around us.			exam
8	3 hr.	**Knowledge:** Understand the concept of electric flux through a closed surface. Recognize Gauss's law and its mathematical formulation, and connect it with Coulomb's law in suitable cases. Understand applications of Gauss's law in the distribution of symmetrical charges (spherical, cylindrical, planar). **Skills:** Ability to determine when and how Gauss's law can be effectively used to solve problems. Use geometric symmetry to simplify calculations related to electric fields.	Gauss Law	Theoretica	Exams and Oral Questions

		Solve problems involving the calculation of electric field or flux in various systems. **Values:** Promote discipline and accuracy in working with physical laws. Foster a scientific spirit and inquiry to understand theoretical models and their practical applications. Establish values of scientific integrity and objectivity in presenting solutions and results.			
9	3 hr.	**Knowledge:** A fundamental understanding of Gauss's Law in terms of the integral form and its relation to the concept of electric flux. Distinguishing the relationship between Gauss's Law and Coulomb's Law and their applications under different conditions. Recognizing the conditions for effectively using Gauss's Law (the presence of spherical, cylindrical, or planar symmetry). **Skills:** Identifying optimal Gaussian surfaces to simplify physical problems. The ability to analyze symmetrical charge distributions and accurately calculate the resulting fields. Using mathematical reasoning to simplify formulas and derive results in innovative ways, translating physical	Gauss Law and its Applications	Theoretical	Exams and Oral Questions

		scenarios into clear and computable mathematical models. **Values:** Developing a love for simplification and symmetry as a powerful intellectual tool in the sciences. Respecting accuracy and discipline in the use of physical laws and applying them in appropriate contexts.			
10	3 hr.	**Knowledge:** Understanding the physical significance of the equation and linking it to the concept of the electric field generated by the distribution of electric charges. Recognizing the mathematical connection between Gauss's Law and Maxwell's equations. Comprehending the concept of charge volume density (ρ) and its effect on the behavior of the electric field, as well as understanding the role of the permittivity of free space (ε_0) in determining the intensity of the field. **Skills:** The ability to analyze physical systems containing different charge distributions and to interpret the properties of the resulting electric field. Using the differential formula of Gauss's Law to calculate local values of the electric field and constructing mathematical models for electrostatic situations using Maxwell's first equation. **Values:** Promoting scientific	Maxwell’s First Equations (Electrostatics)	Theoretical	Exams and Oral Questions

		curiosity to discover how major laws in physics are built from simple concepts. Developing an awareness of precision and methodological rigor in constructing mathematical models. Instilling values of interconnectedness between mathematics and physics as a key to understanding nature and respecting the scientific and logical approach to interpreting phenomena and analyzing problems.			
11	3 hr.	**Knowledge:** Understanding the concept of divergence as the net flow rate from a point in space. Connecting vector fields with volumetric and surface integrals. Knowing the conditions for applying the theorem. **Skills:** Solving mathematical problems that require applying the divergence theorem to calculate surface flow. The ability to select the appropriate coordinate system (spherical, cylindrical, Cartesian) to simplify integrals. **Values**: Promoting a spirit of precision and order in addressing complex problems and using mathematical laws.	Divergence Theorem	Theoretica	Exams and Oral Questions
12-13	3 hr.	**Knowledge:** Understanding the concept of electric potential as a result of a point charge and its effect on other charges. Recognizing that the electric field is a	Energy and Potential and Energy expended in moving a point charge in an electric field.	Theoretica	Exams and Oral Questions

		conservative field, thus work depends only on the initial and final positions. **Skills:** Calculating the work done in moving a charge from one point to another within an electric field. Representing the relationships between voltage, energy, and field using graphs and equations. **Values:** Reinforcing understanding of causal and functional relationships between physical concepts. Enhancing accuracy and logical consistency in constructing and interpreting computational models.			
14	3 hr.	**Knowledge:** Understanding that the electric field is a conservative field, and the work done depends only on the starting and ending points. Distinguishing between electric **Skills:** The ability to calculate the work done through line integration using field data or from its equations. Analyzing the relationship between field, potential, and energy in real or hypothetical scenarios. Using graphical representation and trend analysis to determine the direction of forces and the amount of work. **Values:** Enhancing accuracy and methodic Alness in mathematical analysis and	Energy and Potential: Energy expended in moving a point charge in an electric field and the line integral	Theoretica	Exams and Oral Questions

		physical application.			
15	3 hr.	**Knowledge:** Understanding the fundamental principles of electricity and magnetism, such as Coulomb's law, electric field, and magnetic field. Recognizing how charges and electric currents interact with their surrounding fields. **Skills:** Analyzing electromagnetic problems and selecting appropriate laws for solutions. Graphically and quantitatively drawing and interpreting electric or magnetic field lines. **Values:** Promoting accuracy and attention to detail in analyzing equations and physical models. Fostering scientific curiosity to understand the electrical and magnetic phenomena around us.	Preparatory Week	Theoretica	Comprehensive review

11.Course Evaluation

The grades:	
Coursework	10
Midterm Exam	30
Final Exam	60
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Engineering Electromagnetics, William H. Hayt, Published by Mcgraw- Hill • Elements of Electromagnetics, Matthew N.O. Sadiku
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Electromagnetic Field Theory By Uday A. Bakshi, Late Ajay V. Bakshi · 2020
Electronic References, Websites	

1. Course Name:	
Electromagnetic Fields (2)	
2. Course Code:	
ECE204	
3. Semester / Year:	
First Semester / Second Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (Theoretical Lectures)	
6. Number of Credit Hours (Total) / Number of Units (Total)	
45/3	
7. Course administrator's name (mention all, if more than one name)	
Name: Mayada Jasim Hamwdi Email: mayadajas@ntu.edu.iq	
8. Course Objectives	
Course Objectives	• Study the basic principles of electromagnetic fields. • Provide students with fundamental knowledge in electromagnetic fields required for several advanced courses in later years.
9. Teaching and Learning Strategies	
Strategy	Lectures, presentations, and documentation. - Inquiry-based learning: Encouraging students to ask questions and explore physical relationships through experiments or simulations. - Practical applications: Illustrating how concepts are used in designing capacitors, generators, or power transmission lines.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	3 hr.	**If the student successfully completes this course, he will be able to: Knowledge:** Understanding that electric potential is a numerical quantity associated with electric potential energy. Distinguishing the difference between electric field (a vector quantity) and electric potential (a scalar	The potential field of a point charge and of a system of charge	Theoretical	Exams and Oral Questions

		quantity). **Skills:** Calculating the electric potential at a specific point due to a single charge or a system of charges. Using graphical representation to map voltages and interpret them. Choosing appropriate coordinates (Cartesian, spherical, cylindrical) according to charge distribution. **Values:** Promoting accuracy and discipline in using physical laws. Developing a causal understanding of the relationship between charge distribution and its field effects. Instilling a love for scientific exploration and reflective thinking about concepts of energy and potential.			
2	3 hr.	**Knowledge:** Understanding that the electric potential at a point is the potential energy per unit charge at that point. Realizing that the potential difference (ΔV) between two points represents the work done to move a unit charge from one point to another in the electric field. **Skills:** The ability to distinguish between voltage and potential difference both conceptually and mathematically. Solving practical problems that require calculating potential difference or the work done in moving a charge. Employing the relationship between work, force, and field to	Definition of potential difference and potential	Theoretica	Exams and Oral Questions

		explain the behavior of charges in electrical systems. **Values:** Promoting accuracy and logical analysis in using concepts and mathematical relationships. Fostering scientific curiosity to understand how electric charges produce differences in potential and energy.			
3	3 hr.	**Knowledge:** Recognizing that electric potential is a scalar quantity that represents energy per unit charge. Distinguishing between electric field (vector) and potential (scalar) and how they are related. Understanding equipotential maps and their role in visualizing the distribution of energy in the field. **Skills:** Calculating the potential at a point due to a single charge or a system of charges. Drawing and analyzing potential lines and equipotential lines and relating them to electric field lines. Applying the principle of superposition to calculate potential in complex scenarios. **Values:** Fostering a spirit of inquiry and scientific curiosity to understand energy distribution in space. Reinforcing the importance of theoretical relationships in explaining the electrical phenomena around us.	The potential field of a point charge and of a system of charge	Theoretica	Exams and Oral Questions

4	3hr.	**Knowledge:** Understanding that the voltage gradient is a vector quantity that indicates the direction and magnitude of the steepest descent of the voltage. **Skills:** Using the relationship between the field and voltage gradient to calculate one from the other. Analyzing voltage maps or voltage curves and estimating field values from them. Visually representing the voltage gradient and relating it to the behavior of charges in the field. **Values:** Enhancing precision and mathematical discipline in analyzing spatial changes. Developing a love for exploration and causal analysis to understand how the voltage gradient affects the movement of charges	Potential Gradient	Theoretica	Exams and Oral Questions
5	3 hr.	**Knowledge:** Understanding that electric current (I) is the rate of charge flow through a conductor section and realizing that current density (J) is the current per unit area. Distinguishing between total current and current density at a specific point. **Skills:** Calculating current intensity and current density in conductors of various shapes and dimensions. Analyzing current distribution in multiple systems, such as	Current and Current Density	Theoretica	Exams and Oral Questions

		wires, plates, or curved surfaces. **Values:** Enhancing mathematical precision and discipline in analyzing the movement of electric charges.			
6	3 hr.	**Knowledge:** Understanding the principle of the law of conservation of electric charge and how it relates to the continuity of current. Knowing the relationship between electric current intensity, time, and position in an electrical circuit. **Skills:** The ability to analyze simple and complex electrical circuits using Kirchhoff's and Ohm's laws. Drawing and interpreting electrical diagrams that illustrate current continuity. **Values:** Enhancing accuracy and attention to detail when dealing with electrical experiments. Fostering a spirit of verification and scientific research when interpreting electrical phenomena	Continuity of Current	Theoretica	Exams and Oral Questions
7	3 hr.	**Knowledge:** Understanding the fundamental principles of electricity and magnetism, such as Coulomb's law, electric field, and magnetic field. Recognizing how charges and electric currents interact with their surrounding fields. **Skills:** Analyzing electromagnetic problems	Midterm exam	Theoretica	Semester exam

		and selecting appropriate laws for solutions. Graphically and quantitatively drawing and interpreting electric or magnetic field lines. **Values:** Promoting accuracy and attention to detail in analyzing equations and physical models. Fostering scientific curiosity to understand the electrical and magnetic phenomena around us.			
8	3 hr.	**Knowledge:** Understanding the concept of electrical conductivity in metallic materials and the role of free electrons in it. Knowing the common types of metallic conductors (such as copper, aluminum, and gold) and the characteristics of each. **Skills:** The ability to design experiments to measure the resistance of metallic conductors and analyze the results. **Values:** Promoting awareness of the importance of choosing appropriate materials in technical applications to ensure efficiency and safety.	Metallic Conductors	Theoretica	Exams and Oral Questions
9	3 hr.	**Knowledge:** Understanding the nature of electrical conductivity in metals and the role of free electrons. Recognizing the properties of conductors such as resistivity, temperature, density, and conductivity. **Skills:**	Metallic Conductors. Conductor's properties and Boundary Conditions.	Theoretica	Exams and Oral Questions

		Analyzing circuits that contain conductors with multiple properties and applying boundary conditions to calculate voltage and current. **Values:** Enhancing accuracy and attentiveness in measurement and documentation in electrical experiments. Respecting safety rules when dealing with equipment and conductors.			
10	3 hr.	**Knowledge:** Understanding the Biot-Savart Law formulation and interpreting the mathematical relationship between current, position, and magnetic field. Recognizing the role of this law in determining the strength and direction of the magnetic field generated by an electric current. **Skills:** Applying the Biot-Savart Law to calculate the magnetic field in different locations around a current-carrying conductor. Representing the direction of the magnetic field using the right-hand rule and drawing vector field diagrams. **Values:** Enhancing accuracy and scientific discipline in calculations and the use of physical laws. Fostering a love for exploration and a deep understanding of the electromagnetic phenomena surrounding us.	Biot-Savart Law	Theoretica	Exams and Oral Questions

11	3 hr.	**Knowledge:** Understanding the form of Ampère's law and its connection to electric current and the resulting magnetic field. Recognizing how to use the law to calculate the magnetic field around different shaped conductors. **Skills:** Using Ampère's Law to calculate the intensity of the magnetic field at different locations within a given current distribution. **Values**: Enhancing accuracy and scientific discipline in the use of physical laws and integrals. Appreciating the importance of mathematical models in explaining complex natural phenomena.	Ampere’s circuital Law	Theoretica	Exams and Oral Questions
12-13	3 hr.	**Knowledge:** Understanding the definition of magnetic field strength (H) as a unit for measuring the effect of an electric current source on the surrounding space. Recognizing the relationship in different media using Biot-Savart law and Ampere's law. **Skills:** Calculating the magnetic field produced by a given current distribution using appropriate laws. Drawing magnetic lines and their density and determining their direction using the right-hand rule. **Values:** Cultivating accuracy and discipline in scientific	Magnetic Flux and Flux Density and Magnetic field intensity	Theoretica	Exams and Oral Questions

		calculations and interpreting physical phenomena. Respecting the importance of industrial applications of these concepts in fields such as generators, motors, and magnetic resonance devices.			
14	3 hr.	**Knowledge:** Understanding the concept of magnetic circuits and the similarities and differences between them and electrical circuits. Identifying the fundamental quantities in magnetic circuits. **Skills:** Analyzing magnetic circuits using equivalent laws such as magnetic Ohm's law. Calculating the amount of flux, reluctance, and efficiency in closed and open magnetic systems. **Values:** Promoting accuracy and discipline in performing calculations and analyzing physical systems. Focusing on improving design efficiency to reduce magnetic loss and wasted energy.	Magnetic circuits & materials	Theoretica	Exams and Oral Questions
15	3 hr.	**Knowledge:** Understanding the fundamental principles of electricity and magnetism, such as Coulomb's law, electric field, and magnetic field. Recognizing how charges and electric currents interact with their surrounding fields.	Preparatory Week	Theoretica	Comprehensive review

		Skills: Analyzing electromagnetic problems and selecting appropriate laws for solutions. Graphically and quantitatively drawing and interpreting electric or magnetic field lines. **Values:** Promoting accuracy and attention to detail in analyzing equations and physical models. Fostering scientific curiosity to understand the electrical and magnetic phenomena around us.			

11.Course Evaluation

The grades:

Coursework	10
Midterm Exam	30
Final Exam	60
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Engineering Electromagnetics, William H. Hayt, Published by Mcgraw- Hill • Elements of Electromagnetics, Matthew N.O. Sadiku
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Electromagnetic Field Theory By Uday A. Bakshi, Late Ajay V. Bakshi · 2020
Electronic References, Websites	

1. Course Name:
Electronic Circuits
2. Course Code:
ECE 201
3. Semester / Year:
First Semester / Second Year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
250 hours total / 10 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Mahmoud Shakir Wahhab Email: mahmoud.eng777@ntu.edu.iq
8. Course Objectives

Course Objectives	• Understanding fundamental concepts. • Developing electronic circuit analysis skills. • Familiarity with electronic components. • Developing amplifier design skills. • Practical circuit design and analysis.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: To achieve cognitive objectives • Practical laboratory application: To cover curriculum content and acquire skills • Dialogues and discussions: During theoretical and practical lectures • Use of general engineering principles: To analyze and design engineering problems.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	**4T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Distinguish between different types of diodes and their uses in electronic circuits. **Skills**: Design rectifier and voltage regulator	Review of basic concepts: Diode structure, operation, types and applications	T	Tests and Reports

		circuits and protection applications using appropriate diodes. **Values**: Appreciate the importance of selecting appropriate electronic components to achieve efficiency and reliability.			
	3P	**Knowledge**: Understanding the structure of a diode and its operation under different bias conditions. **Skills**: Analyzing and operating circuits containing diodes using measurement and simulation tools. **Values**: Commitment to accuracy and professionalism in conducting experiments and analyzing electronic results.	Characteristics of diode (forward and reverse bias), half-wave rectifier and wave rectifier	P	
2	**4T**	**Knowledge**: Understanding the operating principle in cutoff, saturation, and active region modes. **Skills**: Applying appropriate biasing techniques to ensure stability and good performance. **Values**: Developing analytical thinking to select the most appropriate electronic solutions.	Bipolar Junction Transistors (BJTs): BJT structure, operation, characteristics and biasing techniques.	T	Tests and Reports
	3P	**Knowledge**: Explain the structure of a BJT and the function of each terminal. **Skills**: Analyze circuits containing BJT transistors, both practically and theoretically. **Values**: Commitment to precision when designing and operating amplification or switching circuits.	Characteristics of NPN transistor	P	

3	**4T**	**Knowledge**: Understanding the physical properties and biasing techniques appropriate for each type. **Skills**: Analyzing FET circuits theoretically and practically using schematics and curves. **Values**: Promoting precision and discipline in the construction and operation of electronic circuits.	Field-Effect Transistors (FETs): (JFET and MOSFET) structure, operation, characteristics and biasing techniques.	T	Tests and Reports
	3P	**Knowledge**: Understanding the operating mechanism and operating zones (cutoff, ohmic, saturation). **Skills**: Designing circuits containing FETs and selecting the appropriate biasing technique. **Values**: Developing a spirit of innovation in selecting the most appropriate transistor for the application (amplification, control, efficiency).	Characteristics of JFET transistor	P	
4	**4T**	**Knowledge**: Identify the voltage, current, and gain characteristics of this configuration. **Skills**: Analyze the performance of a common-emitter amplifier in terms of gain and impedance. **Values**: Develop a practical understanding of the importance of amplifiers in electronic systems.	Amplifier configurations: BJT amplifiers: common emitter configuration.	T	Tests and Reports
	3P	**Knowledge**: Understand the working principle of the common emitter configuration and its role in signal amplification. **Skills**: Design and operate a BJT amplifier circuit.	common emitter amplifier	P	

		Values: Commitment to precision in component selection and analysis of results.			
5	**4T**	**Knowledge**: Distinguish between the characteristics of common-base and common-collector configurations. **Skills**: Analyze and operate amplifier circuits in both common-base and common-collector configurations. **Values**: Commitment to precision in measurement and analysis to evaluate amplifier performance.	Amplifier configurations: BJT amplifiers: common base, and common collector configurations.	T	Tests and Reports
	3P	**Knowledge**: Understand the effect of each configuration on gain, impedance, and signal response. **Skills**: Select the appropriate configuration based on gain or impedance requirements. **Values**: Promote engineering thinking in selecting the best configurations for a given application.	Common collector and base amplifier	P	
6	**4T**	**Knowledge**: Distinguish between BJT amplifier configurations in terms of construction and performance. **Skills**: Analyze and design amplifier circuits using the appropriate configuration. **Values**: Develop critical thinking in selecting the optimal configuration for the desired application.	Review of BJT amplifier configurations.	T	Tests and Reports
	3P	**Knowledge**: Understand the effect of each configuration on voltage, current, and impedance. **Skills**: Measure and interpret the gain and response characteristics of	Review of all types of amplifiers (common emitter, collector, and base)	P	

		each configuration. **Values**: Commitment to accuracy and professionalism in performing and analyzing experiments.			
7	**4T**	**Knowledge**: Identify the characteristics of common-source, common-gate, and common-drain configurations. **Skills**: Analyze and design amplifier circuits using FETs according to the appropriate configuration. **Values**: Promote logical thinking in selecting the optimal configuration for an electronic application.	FET amplifiers: common source, common gate, and common drain configurations.	T	Tests and Reports
	3P	**Knowledge**: Understanding the effect of each configuration on gain, impedance, and signal response. **Skills**: Using measuring tools to evaluate amplifier performance in practice. **Values**: Commitment to accuracy and documentation in conducting and analyzing experiments.	common source amplifier	P	
8	**4T**	**Knowledge**: Learn how to represent and analyze small-signal circuits theoretically. **Skills**: Calculate various types of gain values using small transistor models. **Values**: Develop precision in implementing and analyzing electronic circuits.	Amplifier circuits: BJT small-signal amplifiers: voltage gain, current gain, and power gain.	T	Tests and Reports
	3P	**Knowledge**: Understand the concepts of voltage gain, current gain, and power gain in small-signal amplifiers. **Skills**: Analyze circuit performance practically using measurement and	Calculating the voltage gain of a common emitter circuit	P	

		simulation tools. **Values**: Promote a deep understanding of the importance of signal gain in various amplification applications.			
9	**4T**	**Knowledge**: Understand the concepts of voltage, current, and power gain in small-signal amplifiers using FETs. **Skills**: Calculate and analyze various types of gain using small-signal FET modeling. **Values**: Develop an applied understanding of the importance of gain in various electronic circuits.	Amplifier circuits: FET small-signal amplifiers: voltage gain, current gain, and power gain.	T	Tests and Reports
	3P	**Knowledge**: Identify the characteristics of small-signal circuits and interpret their behavior. **Skills**: Implement amplifier circuits practically and evaluate their performance using measuring instruments. **Values**: Promote accuracy and discipline in practical design and analysis.	Calculating the voltage gain of a common source circuit	P	
10	**4T**	**Knowledge**: Understand the operating principle of multistage amplifiers and the effects of cascade on gain and bandwidth. **Skills**: Analyze and design multistage amplifiers to achieve higher gain or better frequency response. **Values**: Develop an engineering sense for improving amplifier performance and reducing distortion.	Multistage amplifiers and cascaded amplifiers.	T	Tests and Reports
	3P	**Knowledge**: Identify the types of interconnections between stages (resistive, capacitive, direct) and their impact on performance.	multistage amplifiers	P	

		Skills: Use simulation and measurement to evaluate the performance of each stage and its role in the overall system. **Values**: Commitment to precision in designing and implementing series circuits to achieve effective results.			
11	**4T**	**Knowledge**: Understand the operating principle of differential amplifiers and their importance in amplifying analog signals. **Skills**: Analyze and design differential amplifier circuits using BJTs or FETs. **Values**: Promote critical thinking in signal processing and noise filtering.	Differential amplifiers.	T	Tests and Reports
	3P	**Knowledge**: To understand the properties of symmetry, common-mode rejection ratio (CMRR), and their range of applications. **Skills**: To measure differential gain and common-mode rejection and interpret the results practically. **Values**: To appreciate the role of differential amplifiers in microelectronic systems.	Differential amplifiers.	P	
12	**4T**	**Knowledge**: Identify the operating characteristics of each class (A, B, AB, and C) of amplifiers. **Skills**: Analyze the performance of different class amplifiers in terms of gain, efficiency, and distortion. **Values**: Develop the ability to balance performance and efficiency in selecting the	Power Amplifiers: Class A, B, AB, and C power amplifiers	T	Tests and Reports

		appropriate design.			
	3P	**Knowledge**: Understanding the relationship between efficiency, distortion, and conduction angle in each class. **Skills**: Design and test amplifier circuits in practice and determine the appropriate class for the application. **Values**: Commitment to quality and accuracy in evaluating the practical performance of amplifiers.	Class A and B amplifiers	P	
13	**4T**	**Knowledge**: Understand the impact of low-frequency inputs on the performance of BJT and FET amplifiers. **Skills**: Analyze frequency response curves of amplifiers at low frequencies. **Values**: Understand the importance of frequency response in improving signal quality and audio applications.	Low frequency response BJT and FET amplifiers.	T	
	3P	**Knowledge**: Understand the role of capacitors and time elements in determining low-frequency response. **Skills**: Design amplifier circuits that take into account low-frequency limits and filter factors. **Values**: Enhance precision in selecting component values to achieve the desired performance at low frequencies.	Low frequency response BJT	P	
14	**4T**	**Knowledge**: Understanding the impact of high frequencies on the performance of BJT and FET amplifiers. **Skills**: Analyzing and designing amplifier	High frequency response BJT and FET amplifiers.	T	

		circuits capable of operating efficiently at high frequencies. **Values**: Commitment to design precision to achieve high-frequency signal stability and quality.			
	3P	**Knowledge**: Identify the factors that affect the stability and response of amplifiers at high frequencies. **Skills**: Use measurement tools to simulate and evaluate the high-frequency performance of amplifiers. **Values**: Develop an awareness of the importance of frequency control in advanced applications.	High frequency response BJT	P	
15	4T	**Knowledge**: Understanding the behavior of BJT and FET amplifiers at low and high frequencies. **Skills**: Analyzing and designing amplifiers that take into account the full frequency response. **Values**: Enhancing precision in tuning circuit components to achieve optimal performance.	Review of BJT and FET low and high frequency response amplifiers.	T	
	3P	**Knowledge**: Identify the factors affecting frequency limits and frequency response. **Skills**: Use simulation and instrumentation to measure and evaluate the frequency performance of amplifiers. **Values**: Develop a practical understanding of the importance of frequency response in signal quality and amplification.	Calculating bandwidth	P	

11.Course Evaluation	
The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Electronic Devices and Circuit Theory Electronic Principles
Main references (sources)	Analysis and Design of Analog Integrated Circu Microelectronic Circuits
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	https://www.electronics-tutorials.ws https://www.allaboutcircuits.com https://circuitdigest.com

1. Course Name:
Electronic circuits 2
2. Course Code:
ECE 205
3. Semester / Year:
Second Semester / Second Year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
250 hours total / 7 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Mahmoud Shakir Wahhab Email: mahmoud.eng777@ntu.edu.iq
8. Course Objectives

Course Objectives	1- Learn the basic principles of operational amplifiers and their ideal and realistic characteristics. 2- Analyze and design electronic circuits based on operational amplifiers, such as comparators, inverters, non-inverters, integration, and differentiation. 3- Use operational amplifiers in various applications, such as active filters and differential amplifiers. 4- Develop practical skills in simulating, building, and testing operational amplifier circuits using programming tools and laboratories. 5- Enhance the ability to diagnose faults and improve the performance of electronic circuits based on op-amps.

9. Teaching and Learning Strategies

Strategy	• This course aims to enable students to understand the theoretical foundations and practical applications of operational amplifiers by integrating diverse teaching methods that enhance analytical thinking and applied skills. Various teaching strategies are adopted to ensure effective achievement of learning outcomes. • The theoretical content is delivered through interactive lectures that focus on the analytical explanation of basic concepts, such as the characteristics of ideal operational amplifiers, inverting and

	non-inverting amplifier circuits, and differential amplifier configurations. Student understanding is enhanced through classroom discussions and guided questions that encourage critical thinking and self-exploration. • Laboratory sessions are held to apply theoretical knowledge through the design, simulation, and implementation of practical circuits involving operational amplifiers, such as inverting and non-inverting amplifiers, summer/difference amplifiers, integrators, and differentiators. Specialized simulation software such as Multisim or LTSpice is used alongside a physical breadboard to help students bridge the gap between theoretical understanding and practical application. The course also relies on problem-based learning, where students are required to analyze and design solutions for complex circuits, including multistage amplifiers and active filters such as Butterworth and Chebyshev designs. Mini-projects and practical exercises are integrated throughout the semester to encourage engineering problem-solving skills and foster creativity. • Collaborative learning is promoted by assigning students to small groups for design-based projects, including performance analysis and experimental reporting. These activities enhance communication, teamwork, and project management skills. • Multimedia tools, such as educational videos, interactive simulations, and digital learning platforms, are used to visually and dynamically illustrate complex topics. Course materials, lectures, and assignments are shared via an e-learning platform to support ongoing student-teacher interaction. • At the end of the course, students are required to complete a capstone project that involves the design and implementation of an integrated analog system using operational amplifiers, such as an instrumentation amplifier or an active filter. The project culminates in an oral presentation in which students demonstrate their theoretical understanding and practical proficiency.

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understanding the characteristics of ideal and real operational amplifiers and their basic applications in electronic systems. **Skills**: Analyzing and designing analog circuits using operational amplifiers, both manually and software-based. **Values**: Commitment to accuracy and responsibility in designing and testing electronic circuits.	Introduction to Operational Amplifiers:	T	Tests and Reports
	2P	**Knowledge**: Identify the terminal layout of the 741 operational amplifier and the function of each terminal. **Skills**: Properly connect terminals in practical circuits according to their specific functions. **Values**: Develop technical responsibility in using components according to their specifications to avoid errors or malfunctions.	Identifying the terminals of the 471 operational amplifier	P	
2	**2T**	**Knowledge**: Understanding the ideal characteristics of an operational amplifier, such as high gain, high input impedance, and low output impedance. **Skills**: Analyzing	Op-Amp basics: ideal characteristics, voltage and current modes, input and output terminals	T	Tests and Reports

		operational amplifier circuits in various voltage and current modes. **Values**: Promoting accuracy and discipline in the design and analysis of electronic circuits.			
	2P	**Knowledge**: Distinguish between the characteristics of an ideal operational amplifier (e.g., infinite gain, very high input impedance, zero output impedance) and a realistic one, which includes practical deviations from ideality. **Skills**: Conduct laboratory experiments to measure the actual characteristics of an operational amplifier (e.g., the 741) and compare them to ideal values. **Values**: Develop a sense of rigor and scientific observation in assessing differences between theoretical and applied models.	Measuring the characteristics of ideal and real operational amplifiers	P	
3	**2T**	**Knowledge**: Recognize standard operational amplifier symbols and understand their terminal configuration (positive terminal, negative terminal, output, positive and negative supply). **Skills**: Analyze the performance of operational amplifiers under open-loop conditions and deduce the effects of their characteristics on circuit behavior. **Values**: Develop precision and attention to detail in electronic connections and component selection.	Op-Amp symbols and pin configuration Op-Amp characteristics: open-loop gain, input and output impedance, bandwidth	T	Tests and Reports
	2P	**Knowledge**: Understand	Buffer / Voltage	P	

		the importance of relays in isolating circuits and preventing source loads. **Skills**: Implement a relay circuit using an operational amplifier and measure input and output voltages to verify the gain of a single voltage. **Values**: Develop a practical understanding of the importance of circuit isolation in signaling systems.	Follower Experience		
4	**2T**	**Knowledge**: Understanding the mathematical relationship between voltage gain and input and output impedance. **Skills**: Analyzing circuits using basic laws (Ohm's Law, Kirchhoff's Law). **Values**: Improving accuracy in performing mathematical analysis and connecting components.	Inverting amplifier configuration: circuit analysis, gain calculation, input and output impedance	T	Tests and Reports
	2P	**Knowledge**: Understanding the configuration of an inverting-mode operational amplifier and how it inverts and amplifies the input signal. **Skills**: Measuring and analyzing the output signal compared to the input signal to verify the design and performance. **Values**: Enhancing accuracy and attention when implementing and analyzing electronic circuits.	Inverting Amplifier and its Response Analysis	P	
5	**2T**	**Knowledge**: Understanding the configuration of a non-inverting operational amplifier and its connection method, where the signal is fed to the	Non-inverting amplifier configuration: circuit analysis, gain calculation, input and output impedance	T	Tests and Reports

		non-inverting (+) terminal. **Skills**: Analyzing the electrical circuit of a non-inverting amplifier and using rules to determine gain. **Values**: Enhancing accuracy and professionalism in circuit design and calibration to achieve the desired gain.			
	2P	**Knowledge**: Understanding the configuration of an operational amplifier in non-inverting mode and how to amplify an input signal without inverting its phase. **Skills**: Testing and analyzing the output signal against the input signal to verify performance. **Values**: Promoting accuracy and professionalism in the design and implementation of analog circuits.	Non-Inverting Amplifier and Voltage Gain Analysis	P	
6	**2T**	**Knowledge**: Understand the concept of frequency response and its relationship to operational amplifier performance in different frequency ranges. **Skills**: Analyze frequency response curves and determine the practical bandwidth of an amplifier. **Values**: Develop an awareness of the importance of frequencies in the practical design of electronic systems.	Frequency response and bandwidth considerations	T	Tests and Reports
	2P	**Knowledge**: Understand the function of a low-pass filter, which allows low frequencies to pass through and reduces high	Low Pass Filter and High Pass Filter	P	

		frequencies above the cutoff frequency. Understand the function of a high-pass filter, which allows high frequencies to pass through and reduces low frequencies below the cutoff frequency. **Skills**: Analyze and design filter circuits using resistors and capacitors to determine the appropriate cutoff frequency. **Values**: Develop precision in selecting appropriate component values to achieve the desired performance.			
7	**2T**	**Knowledge**: Understand the construction of a differential amplifier, which amplifies the difference between two input signals and reduces the influence of the common signals. **Skills**: Analyze a differential circuit using electrical laws and determine the required gains. **Values**: Develop engineering sense in designing circuits capable of isolating useful signals from noise.	Differential amplifier configuration: circuit analysis, common-mode and differential-mode gains, CMRR	T	Tests and Reports
	2P	**Knowledge**: Understand the importance of common-mode rejection ratio (CMRR) in improving amplifier performance. **Skills**: Design circuits to achieve high differential gain and good CMRR. **Values**: Value precision and discipline in designing and implementing noise-sensitive circuits.	Differential Amplifier	P	
8	**2T**	**Knowledge**: Recognize the advantages of	Instrumentation amplifier:	T	Tests and Reports

		instrumentation amplifiers, such as high gain, high input impedance, and high CMRR. **Skills**: Apply instrumentation amplifiers in the design of precision measurement circuits that require a clean and stable output signal. **Values**: Promote accuracy and discipline in the implementation and design of measurement circuits.	advantages, circuit analysis, gain calculation, applications in precision measurements		
	2P	**Knowledge**: Understand the function of a voltage comparator, which compares two input signals and produces a high or low digital output depending on the comparator signal. **Skills**: Design and analyze comparator and zero detector circuits using an operational amplifier. **Values**: Develop precision in connection and measurement to ensure accurate and precise response.	Voltage comparator and zero detector for sensing AC signals	P	
9	**2T**	**Knowledge**: Understand the construction of a summing amplifier and how to connect multiple input signals together at the input of an operational amplifier. **Skills**: Apply the concept of virtual ground to simplify circuit analysis and ensure its stability. **Values**: Enhance the ability to connect theoretical concepts with practical applications in circuit design.	Summing amplifier configuration: circuit analysis, weighted summing, virtual ground concept	T	Tests and Reports
	2P	**Knowledge**: Understand the working principle of a	voltage summing amplifier	P	

		summing amplifier, which combines multiple electrical input signals and produces an output signal representing their weighted sum. **Skills**: Calculate output signals resulting from a range of different input voltages. **Values**: Enhance accuracy in selecting resistor values to achieve the desired summation ratios.			
10	**2T**	**Knowledge**: Understand the configuration of a differential amplifier used to subtract two input signals (differential-difference operation). **Skills**: Evaluate the efficiency of a circuit in reducing noise and unwanted signals using the CMRR concept. **Values**: Promote analytical thinking in microcircuit design to separate useful signals from noise.	Difference amplifier configuration: circuit analysis, subtraction operation, common-mode rejection	T	Tests and Reports
	2P	**Knowledge**: Understand the working principle of a subtractive amplifier, which produces an output signal representing the difference between two input signals. **Skills**: Analyze and design subtractive amplifier circuits using operational amplifiers and resistors. **Values**: Develop an awareness of the importance of accurate signal processing in engineering applications.	Subtractor Amplifier	P	
11	**2T**	**Knowledge**: Understand the construction of integrator and differentiator circuits using operational	Integrators and Differentiators: Op-Amp integrator and differentiator	T	Tests and Reports

		amplifiers. **Skills**: Analyze integrator and differentiator circuits mathematically in terms of input and output voltages. **Values**: Enhance theoretical understanding for application in designing efficient analog signal processing circuits.	circuits: circuit analysis, frequency response, application in analog signal processing, application in waveform shaping.		
	2P	**Knowledge**: Understanding the working principle of an integrator/differential circuit that calculates the time integral and differentiation of an input signal. **Skills**: Analyzing and designing integrator/differential circuits using operational amplifiers and passive components (resistors and capacitors). **Values**: Developing analytical thinking and linking theory to practical application in the field of signal processing.	Integrator Circuit and Differentiator Circuit	P	
12	**2T**	**Knowledge**: Identify first- and second-order active filter types (low-pass, high-pass, band-pass, and band-stop). **Skills**: Analyze and design active filter circuits according to frequency requirements. **Values**: Develop engineering sense for designing microelectronic systems based on frequency processing.	Active Filters:First-order and second-order active filters: low-pass, high-pass, band-pass, and band-stop configurations	T	Tests and Reports
	2P	**Knowledge**: Understand the working principle of a first-order active low-cut filter, which uses an operational amplifier with resistors and capacitors to determine the cutoff	(Active Low-Pass Filter - First Order)	P	

		frequency. **Skills**: Measure the filter's frequency response and determine the actual cutoff frequency. **Values**: Enhance precision in selecting component values to achieve the desired performance.			
13	**2T**	**Knowledge**: Understand the basic concepts of filter and amplifier design. **Skills**: Identify the relationship between the quality factor and system selectivity, especially for second-order filters. **Values**: Enhance accuracy and professionalism in selecting component values to achieve optimal performance.	Design considerations: cutoff frequency, quality factor, selectivity, gain requirements	T	
	2P	**Knowledge**: Understand the concept of cutoff frequency, which is the frequency at which the filter response drops to 70.7% of its maximum value (−3 dB). **Skills**: Accurately calculate the cutoff frequency using the resistor and capacitor values in the circuit. **Values**: Develop precision and care in selecting appropriate components to achieve stable filter performance.	Cut-off Frequency Analysis of a First Order Filter	P	
14	**2T**	**Knowledge**: Distinguish between the characteristics of each filter in terms of shape, frequency response, and effectiveness in various applications. **Skills**: Select the appropriate filter type based on application requirements, such as resolution, transition sharpness, or ripple	Butterworth and Chebyshev filter responses	T	

		tolerance. **Values**: Enhance analytical thinking to select the most appropriate design in terms of performance and efficiency.			
	2P	**Knowledge**: Understand the characteristics of a second-order Butterworth low-pass filter, which has a flat frequency response within the passband without ripples. **Skills**: Design and analyze a second-order Butterworth low-pass filter circuit using an operational amplifier, resistors, and capacitors. **Values**: Enhance precision in component selection to achieve the desired signal processing performance.	Second-order Butterworth low-pass filter	P	
15	**2T**	**Knowledge**: Identify active filters that use operational amplifiers in combination with resistors and capacitors to determine the frequency response. **Skills**: Design and analyze first- and second-order active filter circuits using appropriate laws and equations. **Values**: Develop a deep understanding of the importance of frequency control in signal processing systems.	Active Filter Review: First and Second Class Active Filters	T	
	2P	**Knowledge**: Understand the characteristics of a second-order Butterworth high-pass filter, which allows high frequencies to pass through with a flat response within the passband. **Skills**: Calculate the cutoff frequency and quality	Second-order Butterworth high-pass filter	P	

		factor, and adjust component values to achieve the desired response. **Values**: Develop design sense and adherence to engineering standards in circuit implementation.			

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Operational Amplifiers and Linear Integra Circuits Electronic Devices and Circuit Theory" by Robe L. Boylestad & Louis Nashelsky
Main references (sources)	Design with Operational Amplifiers and Ana Integrated Circuits Operational Amplifiers and Linear Integra Circuits
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	**https://www.ti.com/amplifier-circuit/op-amps/overview.html** **https://www.analog.com/en/products/amplifiers/op-amps.html** **https://www.electronics-tutorials.ws/opamp/opamp_1.html**

1. Course Name:	
English Language 3	
2. Course Code:	
NTU300	
3. Semester / Year:	
First Semester / Third year	
4. Description Preparation Date:	
2023	
5. Available Attendance Forms:	
Weekly (theoretical lectures)	
6. Number of Credit Hours (Total) / Number of Units (Total)	
50 hours total / 2 credit units	
7. Course administrator's name (mention all, if more than one name)	
Name: Email:	
8. Course Objectives	
Course Objectives	Strengthen their understanding and use of advanced English grammar, including perfect tenses, conditionals, passives, and reported speech. Enhance their ability to write and speak using accurate, fluent, and context-appropriate English. Develop skills for effective academic communication, including structured writing and oral presentation. Expand their functional and academic vocabulary for everyday and professional use. Build confidence, collaboration, and critical thinking through practical language tasks and discussions.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • **Interactive Lectures:** Brief explanations followed by student interaction and Q&A. • **Task-Based Learning:** Grammar and vocabulary taught through real-life tasks (e.g., writing an email, giving directions). • **Group Discussions & Pair Work:** To practice speaking, express opinions, and exchange ideas. • **Grammar Drills & Sentence Construction:** Structured activities for accuracy and fluency. • **Use of Multimedia:** Videos, audio recordings, and online

	exercises to enhance listening and comprehension. Assessment Methods: • **Quizzes and Grammar Tests:** To assess understanding of specific structures. • **Speaking Tasks & Presentations:** Evaluate communication, fluency, and use of target language. • **Written Assignments:** Paragraphs, summaries, or reports to assess writing accuracy and coherence. • **Class Participation:** Ongoing observation of engagement and language use. • **Mid-Term and Final Exams:** Comprehensive testing of grammar, vocabulary, reading, and writing skills.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1&2	2T	**If the student successfully completes this course, he will be able to:** **Knowledge:** Identify and differentiate between perfect and simple tenses and their functions. **Skills:** Apply various tenses in writing and speaking with appropriate time expressions. **Values:** Develop accuracy and responsibility in using tense forms for clearer communication.	**Advanced Tense Usage and Review**	T	Tests and Reports
3&4	2T	**Knowledge:** Understand the meanings and uses of modal verbs (ability, advice, necessity, etc.). **Skills:** Use modal verbs appropriately in requests, suggestions, and obligations in real-life contexts. **Values:** Demonstrate	**Modal Verbs and Their Functions**	T	Tests and Reports

		politeness, empathy, and appropriateness in communication			
5&6	**2T**	**Knowledge:** Recognize and form passive constructions and reported speech across tenses. **Skills:** Transform active to passive sentences and report information accurately. **Values:** Value objectivity and accuracy in both spoken and written language.	**Passive Voice and Reported Speech**	T	Tests and Reports
7	**2T**	**Knowledge:** Recall perfect tenses, modals, passive voice, and reported speech. Understand their forms and basic uses **Skills:** Use tenses, modals, and passive/reporting structures correctly. Rewrite sentences and respond accurately in grammar tasks. **Values:** Show care for accuracy and proper language use. Take responsibility in self-review and improvement	**Mid-term exam**	T	Tests and Reports
8&9	**2T**	**Knowledge:** Understand types of conditional sentences (real, unreal, hypothetical). **Skills:** Use conditionals to express plans, possibilities, regrets, and consequences. **Values:** Think critically and reflectively about hypothetical scenarios and	**Conditionals**	T	Tests and Reports

		decision-making			
10&11	**2T**	**Knowledge:** Identify and distinguish between defining and non-defining relative clauses. **Skills:** Combine sentences using appropriate relative pronouns to form complex structures. **Values:** Develop clarity and precision in formal communication	**Relative Clauses and Complex Sentences**	T	Tests and Reports
12&13	**2T**	**Knowledge:** Recognize key academic vocabulary and language functions such as cause-effect and comparison. **Skills:** Express opinions, agreements, and contrasts in structured writing and speaking. **Values:** Engage in respectful dialogue and appreciate the importance of academic integrity	**Functional English & Academic Vocabulary**	T	Tests and Reports
14&15	**2T**	**Knowledge:** Recall and integrate key grammar, vocabulary, and functional language covered in the course. **Skills:** Apply language skills in group tasks, presentations, and application-based exercises. **Values:** Demonstrate collaboration, confidence, and readiness for real-world English usage.	**Review and Application**	T	Tests and Reports

11.Course Evaluation	
The grades:	
Coursework	40
Midterm Exam	10
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	New-Headway 2-3 Authors: Richard Harrison
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	Online practice portals & YouTube/ Extra grammar, writing, and listening support outside class.

1. Course Name:
Engineering Analysis
2. Course Code:
TECK300
3. Semester / Year:
First Semester / Third Year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (theoretical) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hours total / 3 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Tabreer T. Hasan Email: Tabreer.tareq23@ntu.edu.iq
8. Course Objectives

Course Objectives	• **Develop analytical and modeling skills**: Equip students with the analytical thinking and problem-solving skills essential for the engineering design process, emphasizing the role of modeling and simulation in improving design outcomes. • **Apply industry-standard engineering tools**: Train students to model, analyze, and solve engineering problems using widely adopted software tools such as MATLAB and Simulink, preparing them for real-world technical environments. • **Integrate testing and design practices**: Foster a critical understanding of circuit analysis, testing strategies, and the interplay between design and testing throughout the product life cycle in the electronics industry.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Dialogues and discussions: during theoretical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student

	participation

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**3T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understands the concept of representing periodic signals using Fourier series and the mathematical foundation behind signal decomposition into sine and cosine components. **Skills**: Develops the ability to compute Fourier series for basic periodic functions and interpret their frequency components in engineering applications. **Values**: Fosters appreciation for mathematical abstraction and precision in analyzing and representing periodic phenomena in engineering systems.	Introduction to Fourier series.	T	Quizzes, Homeworks, and Tests
	3T	**Knowledge**: Understands the symmetry properties of functions and how they influence Fourier series representations, including the use of half-range expansions. **Skills**: Applies techniques to derive Fourier series for even, odd, and half-range functions to simplify analysis and reduce computation in	Even and odd functions Fourier series & Half-range Fourier series	T	Quizzes, Homeworks, and Tests

		engineering problems. **Values**: Promotes structured thinking and efficient problem-solving by leveraging symmetry in signal and system analysis.			
3	**3T**	**Knowledge**: Understands the theory and solution methods for second-order differential equations, with emphasis on the variation of parameters technique. **Skills**: Solves second-order linear differential equations using both homogeneous and non-homogeneous methods, including variation of parameters, for modeling physical systems. **Values**: Encourages precision and persistence in solving complex mathematical models relevant to engineering applications	2nd order differential equations, Solution of differential equations (Variation of Parameters)	T	Quizzes, Homeworks, and Tests
4	**3T**	**Knowledge**: Understands how first- and second-order differential equations describe the dynamic behavior of electrical circuits, such as RC, RL, and RLC circuits. **Skills**: Analyzes and solves circuit problems using differential equations to determine time-domain responses of voltage and current. **Values**: Reinforces analytical discipline and real-world relevance by	Application 1st order & 2nd order differential equations in Electrical Circuits	T	Quizzes, Homeworks, and Tests

		connecting mathematical methods to practical circuit behavior.			
5	**3T**	**Knowledge**: Understands the general form and behavior of higher-order linear differential equations and the principles behind their solutions. **Skills**: Solves higher-order differential equations using appropriate analytical techniques for modeling advanced engineering systems. **Values**: Develops persistence and attention to detail in managing complex problem-solving tasks in engineering analysis.	High order differential equations, Solution of differential equations	T	Quizzes, Homeworks, and Tests
6	**3T**	**Knowledge**: Understands the fundamental principles of Laplace Transforms, including their use in solving differential equations and analyzing linear time-invariant systems. **Skills**: Applies Laplace Transform techniques to model, simplify, and solve complex engineering problems, particularly in control systems and circuit analysis. **Values**: Encourages logical thinking and systematic problem-solving in dynamic system analysis using mathematical transformations.	Laplace Transform	T	Quizzes, Homeworks, and Tests

7	**3T**	**Knowledge**: Understands key properties of the Laplace Transform, including linearity, time-shifting, frequency-shifting, and convolution. **Skills**: Utilizes Laplace Transform properties to simplify complex mathematical operations and solve engineering problems efficiently. **Values**: Encourages strategic thinking and mathematical flexibility in transforming and analyzing engineering systems.	Basic properties of Laplace transformation	T	Quizzes, Homeworks, and Tests
8	**3T**	**Knowledge**: Understands the concept and techniques of inverse Laplace transformation for converting functions from the s-domain back to the time domain. **Skills**: Applies inverse Laplace methods such as partial fraction decomposition and convolution to solve differential equations and analyze system responses. **Values**: Reinforces thoroughness and methodical reasoning in transitioning between domains in engineering problem-solving.	Inverse Laplace Transform	T	Quizzes, Homeworks, and Tests
9	**3T**		Mid-term Exam	T	Quizzes, Homeworks, and Tests
10	**3T**	**Knowledge**: Understands how Laplace Transforms	The solution of differential	T	Quizzes, Homeworks,

		convert differential equations into algebraic equations for simplified analysis of linear systems. **Skills**: Solves ordinary differential equations using Laplace Transform techniques to determine system behavior in electrical and mechanical contexts. **Values**: Promotes confidence and clarity in using systematic mathematical tools for solving real-world engineering problems.	equations using Laplace Transforms		and Tests
11	**3T**	**Knowledge**: Understands how Laplace Transform is applied to analyze and solve circuit equations, including transient and steady-state behaviors. **Skills**: Models and analyzes electrical circuits using Laplace techniques to determine voltage, current, and system response in the s-domain. **Values**: Encourages analytical rigor and practical insight by linking mathematical transforms to circuit design and troubleshooting.	Application Laplace Transform in Electrical Circuits	T	Tests and Reports
12	**3T**	**Knowledge**: Understands the definition and fundamental properties of the Z-transform, including linearity, time-shifting, and convolution, as applied to discrete-time signals and systems. **Skills**: Applies the Z-	Z transform and properties of Z transform	T	Quizzes, Homeworks, and Tests

		transform and its properties to analyze and solve difference equations and discrete-time system behavior in digital signal processing. **Values**: Fosters precision and analytical thinking in the study and design of discrete-time engineering systems.			
13	3T	**Knowledge**: Understands the concept and methods of the inverse Z-transform for converting discrete-time signals from the Z-domain back to the time domain. **Skills**: Applies techniques such as partial fraction expansion and power series to compute inverse Z-transforms and analyze discrete systems. **Values**: Encourages careful and systematic approaches in interpreting and reconstructing discrete-time signals from their transformed representations.	Inverse Z Transform	T	
14	3T	**Knowledge**: Understands how the Z-transform is used to represent and solve linear difference equations governing discrete-time systems. **Skills**: Employs Z-transform methods to analyze and solve difference equations, facilitating system behavior prediction in digital signal processing	Applications of Z transform to difference equations	T	

		and control. **Values**: Promotes analytical rigor and practical problem-solving skills in handling discrete-time engineering challenges.			
15	3T		Preparatory Week	T	
16	3T		Final Exam	T	

11.Course Evaluation

The grades:	
Coursework	10
Midterm Exam	30
Final Exam	60
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	1) Engineering Mathematics, by Anthony Croft, Robert Davison, Martin Hargreaves and James Flint, Fifth Edition. 2) Advanced Engineering Mathematics, by Erwin Kreyszig, 9th Edition.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	• VHDL: Programming by Examples • Introduction to Logic Circuits & Logic Design with VHDL
Electronic References, Websites	https://www.coursera.org/

1. Course Name:	
Numerical Analysis	
2. Course Code:	
TECK301	
3. Semester / Year:	
Second Semester / Third Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
60 hours total / 3 credit units	
7. Course administrator's name (mention all, if more than one name)	
Name: Tabreer T. Hasan Email: Tabreer.tareq23@ntu.edu.iq	
8. Course Objectives	
Course Objectives	• Introduce basic concepts of error analysis, iteration, and elementary numerical methods. • Develop and implement efficient numerical algorithms. • Understanding of numerical interpolation and linear algebra techniques.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of numerical methods for solving mathematical problems analytically challenging. Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	2T	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understands the fundamentals of numerical analysis and types of errors in numerical computations, including truncation and round-off errors. **Skills**: Identifies and evaluates computational errors in numerical methods and applies techniques to minimize them in practical problem-solving. **Values**: Demonstrates appreciation for precision, reliability, and ethical responsibility in numerical computations and result reporting.	Introduction of numerical analysis, Error in Numerical Computations	T	Tests and Reports
	2P	**Knowledge**: Understands the basics of MATLAB programming and its application in implementing numerical methods. **Skills**: Develops and executes MATLAB scripts to solve mathematical problems using numerical techniques. **Values**: Promotes computational thinking, efficiency, and ethical coding practices in scientific problem-solving.	An Introduction to Programming and Numerical Methods in MATLAB	P	
2	2T	**Knowledge**: Understands various numerical	Solution Of Nonlinear	T	Tests and Reports

		methods for solving nonlinear equations such as bisection, Newton-Raphson, and secant methods. **Skills**: Applies iterative techniques to find approximate roots of nonlinear equations and assesses convergence and accuracy. **Values**: Cultivates persistence and analytical rigor in approaching complex mathematical problems through systematic methods	Equations		
	2P	**Knowledge:** Understands the structure, purpose, and syntax of user-defined and built-in functions in MATLAB. **Skills:** Writes modular, reusable MATLAB functions to implement numerical algorithms efficiently. **Values:** Encourages clean, organized programming practices and responsibility in code development and documentation.	MATLAB functions.	P	
3	2T	**Knowledge**: Understands various numerical methods for solving nonlinear equations such as bisection, Newton-Raphson, and secant methods. **Skills**: Applies iterative techniques to find approximate roots of nonlinear equations and assesses convergence and	Solutions Of Nonlinear Equations	T	Tests and Reports

		accuracy. **Values**: Cultivates persistence and analytical rigor in approaching complex mathematical problems through systematic methods.			
	2P	**Knowledge**: Understands how MATLAB handles matrices and the fundamentals of matrix operations such as addition, multiplication, and inversion. **Skills**: Performs and manipulates matrix operations using MATLAB commands for solving engineering and mathematical problems. **Values**: Promotes precision, logical structure, and reliability in computational matrix-based problem-solving.	Matrices and Matrix Operations in MATLAB	P	
4	2T	**Knowledge**: Understands various numerical methods for solving nonlinear equations such as bisection, Newton-Raphson, and secant methods. **Skills**: Applies iterative techniques to find approximate roots of nonlinear equations and assesses convergence and accuracy. **Values**: Cultivates persistence and analytical rigor in approaching complex mathematical problems through systematic methods.	Solutions Of Nonlinear Equations	T	Tests and Reports
	2P	**Knowledge**: Understands how MATLAB handles	Matrices and Matrix	P	

		matrices and the fundamentals of matrix operations such as addition, multiplication, and inversion. **Skills**: Performs and manipulates matrix operations using MATLAB commands for solving engineering and mathematical problems. **Values**: Promotes precision, logical structure, and reliability in computational matrix-based problem-solving.	Operations in MATLAB		
5-6	2T	**Knowledge**: Understands direct and iterative methods for solving systems of linear equations, including Gaussian elimination and Gauss-Seidel methods. **Skills**: Solves linear systems numerically using appropriate algorithms and evaluates the stability and efficiency of the methods. **Values**: Encourages logical thinking and attention to detail in handling interdependent mathematical systems.	Systems Of Linear Equations	T	Tests and Reports
	2P	**Knowledge**: Understands the logic and syntax of loops (for, while) and conditional statements (if, else, switch) in MATLAB. **Skills**: Implements control flow structures to automate repetitive tasks and decision-making processes in numerical algorithms. **Values**: Encourages	Loops and Conditional Statements	P	

		structured thinking, clarity, and efficiency in programming for scientific and engineering applications.			
7	2T	**Knowledge**: Understands the concepts of eigenvalues and eigenvectors and their importance in engineering and scientific computations. **Skills**: Computes eigenvalues and eigenvectors using numerical methods such as power method and applies them in matrix analysis. **Values**: Develops appreciation for the role of mathematical abstraction in solving real-world engineering problems.	Eigen values & Eigen vectors	T	Tests and Reports
	2P	**Knowledge**: Understands the logic and syntax of loops (for, while) and conditional statements (if, else, switch) in MATLAB. **Skills**: Implements control flow structures to automate repetitive tasks and decision-making processes in numerical algorithms. **Values**: Encourages structured thinking, clarity, and efficiency in programming for scientific and engineering applications.	Loops and Conditional Statements	P	
8	2T	**Knowledge**: Understands the numerical techniques used for matrix inversion, including Gauss-Jordan elimination and LU	Numerical Matrix Inversion.	T	Tests and Reports

		decomposition. **Skills**: Applies numerical methods to compute matrix inverses and assesses their accuracy and computational cost. **Values**: Promotes accuracy, efficiency, and responsibility in implementing matrix operations in practical computations.			
	2P	**Knowledge**: Understands the theory and application of root-finding methods including bisection and secant methods for nonlinear equations. **Skills**: Applies bisection and secant methods to locate roots of equations numerically, and evaluates convergence criteria and accuracy. **Values**: Fosters methodical thinking, patience, and appreciation for iterative problem-solving techniques in numerical computation.	The Bisection Method and Locating Roots and Secant Methods	P	
9	2T		Mid-term Exam	T	Tests and Reports
	2P	**Knowledge**: Understands the theory and application of root-finding methods including bisection and secant methods for nonlinear equations. **Skills**: Applies bisection and secant methods to locate roots of equations numerically, and evaluates convergence criteria and accuracy. **Values**: Fosters methodical thinking,	The Bisection Method and Locating Roots and Secant Methods	P	

		patience, and appreciation for iterative problem-solving techniques in numerical computation.			
10	2T	**Knowledge**: Understands the principles of interpolation and the use of techniques like Newton's and Lagrange's formulas to estimate unknown values. **Skills**: Constructs and applies interpolation formulas to approximate data points and analyze their precision. **Values**: Fosters appreciation for approximation techniques and their importance in handling incomplete or experimental data.	Interpolation	T	Tests and Reports
	2P	**Knowledge**: Understands numerical integration techniques including the trapezium rule and Simpson's rule, along with associated error analysis. **Skills**: Implements integration methods using linear and quadratic approximations and evaluates their accuracy and limitations. **Values**: Promotes analytical rigor, accuracy, and a reflective approach to estimating integrals in practical applications.	Numerical Integration Errors in the Trapezium Method. Integration Using Quadratics.	P	
11	2T	**Knowledge**: Understands numerical techniques for estimating derivatives and integrals, including trapezoidal and Simpson's rules. **Skills**: Applies appropriate	Numerical integration and Differentiation.	T	Tests and Reports

		numerical methods to approximate definite integrals and derivatives of functions, and evaluates their accuracy. **Values**: Encourages precision and critical evaluation in numerical approximations of continuous mathematical processes.			
	2P	**Knowledge**: Understands numerical integration techniques including the trapezium rule and Simpson's rule, along with associated error analysis. **Skills**: Implements integration methods using linear and quadratic approximations and evaluates their accuracy and limitations. **Values**: Promotes analytical rigor, accuracy, and a reflective approach to estimating integrals in practical applications.	Numerical Integration Errors in the Trapezium Method. Integration Using Quadratics.	P	
12	2T	**Knowledge**: Understands the fundamental numerical methods for solving ordinary differential equations (ODEs), including Euler's and Runge-Kutta methods. **Skills**: Implements numerical algorithms to approximate solutions of initial value problems and assesses stability and accuracy. **Values**: Develops a systematic and responsible approach to modeling dynamic systems using numerical techniques.	Numerical Solution of ordinary differential equations:	T	Tests and Reports

	2P	**Knowledge**: Understands finite difference techniques for estimating derivatives and their role in solving real-world problems. **Skills**: Applies numerical differentiation methods to approximate first and higher-order derivatives and assesses error behavior. **Values**: Encourages precision, consistency, and critical evaluation in interpreting numerical derivative results.	Numerical Differentiation	P	
13	2T	**Knowledge**: Understands the concepts and techniques of curve fitting, including least squares approximation and polynomial regression. **Skills**: Applies curve fitting methods to model empirical data and evaluate the goodness of fit. **Values**: Encourages data-driven reasoning and ethical interpretation of modeled results for real-world applications.	Curve Fitting	T	Tests and Reports
	2P	**Knowledge**: Understands numerical methods for computing eigenvalues and eigenvectors and their significance in system analysis. **Skills**: Uses techniques such as the power method and inverse iteration to compute dominant eigenvalues and	Eigenvalues and Eigenvectors	P	

		corresponding eigenvectors. **Values**: Promotes appreciation for the practical applications of matrix theory in engineering and encourages accuracy in computational analysis.			
14	2T	**Knowledge**: Understands the concepts and techniques of curve fitting, including least squares approximation and polynomial regression. **Skills**: Applies curve fitting methods to model empirical data and evaluate the goodness of fit. **Values**: Encourages data-driven reasoning and ethical interpretation of modeled results for real-world applications.	Curve Fitting	P	Tests and Reports
	2P	**Knowledge**: Understands the extension of Newton's Method to systems of nonlinear equations and the conditions for its convergence. **Skills**: Applies Newton's Method to solve nonlinear systems numerically, including Jacobian computation and iterative refinement. **Values**: Encourages systematic analysis, persistence, and critical evaluation when dealing with complex nonlinear	Nonlinear Systems - Newton's Method	T	

		models.			
15	2T		Preparatory Week	P	Tests and Reports
	2P			T	
16	2T		Final Exam	P	Tests and Reports
	2P			P	

11.Course Evaluation

The grades:

Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Numerical Analysis, Temothy Sauer, 2nd Edition • Numerical Analysis, Richard L. Burden, J. Douglas Faires and Annette M. Burden, 10th Edition
Main references (sources)	
Recommended books and references (scientific journals, reports...)	

1. Course Name:	
Control Theory 1	
2. Course Code:	
ECE300	
3. Semester / Year:	
First Semester / Third Year	
4. Description Preparation Date:	
2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
60 hours total / 3 credit units	
7. Course administrator's name (mention all, if more than one name)	
Name: Kaesar Sabah Khalaf Email: kaesarsabah@ntu.edu.iq	
8. Course Objectives	
Course Objectives	This module aims to provide students with a foundational understanding of control systems and to develop their analytical skills in modeling, analyzing, and interpreting system behavior. Specifically, the module aims to: 1. Introduce students to the basic concepts of control systems, including system classification (open-loop and closed-loop) and the role of feedback in improving system performance. 2. Enable students to apply standard test signals such as step, impulse, and sinusoidal functions to analyze system behavior in the time domain. 3. Develop an understanding of the transfer function and its properties, including the identification of poles, zeros, and the characteristic equation used to assess system stability. 4. Train students in constructing and simplifying block diagrams to determine the relationship between system inputs and outputs. 5. Equip students with the ability to use signal-flow graphs and apply Mason's Gain Formula to evaluate system gain and interrelationships. 6. Provide students with the tools to perform time-domain analysis of control systems, including the study of transient and steady-state responses and the calculation of steady-state error. 7. Conduct a detailed analysis of second-order systems, including parameters such as damping ratio, natural frequency, and settling time, to evaluate system dynamics.

9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design. Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learnin g method	Evaluation method
1	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Introduction of control systems Basic definitions Classification of control systems **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Introduction to MATLAB and Simulation Tools		P	

<table>
<tr><td></td><td></td><td>Skills: Develops the ability to analyze Control System using appropriate mathematical tools
Using MATLAB
Values: Values: Promotes accuracy and discipline in analyzing and designing Control systems</td><td></td><td>P</td><td></td></tr>
<tr><td rowspan="2">2</td><td>2T</td><td>Knowledge: Open- loop system
Closed- loop systems.
Skills: Develops the ability to analyze Control System using appropriate mathematical tools
Values: Values: Promotes accuracy and discipline in analyzing and designing Control systems</td><td></td><td>T</td><td rowspan="2">Tests and Reports</td></tr>
<tr><td>2P</td><td>Knowledge: Transfer Function of Control System Representations in MATLAB
[Polynomial form method] and [Factor form method]
Skills: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB
Values: Values: Promotes accuracy and discipline in analyzing and designing Control systems</td><td></td><td>P</td></tr>
<tr><td rowspan="2">3</td><td>2T</td><td>Knowledge: Effects of feedback on control system
Standard test signals
Impulse function
Skills: Develops the ability to analyze Control System using appropriate mathematical tools
Values: Values: Promotes accuracy and discipline in analyzing and designing Control systems</td><td></td><td>T</td><td rowspan="2">Tests and Reports</td></tr>
<tr><td>2P</td><td>Knowledge: Transfer Function of Control System Representations in</td><td></td><td>P</td></tr>
</table>

		MATLAB [Polynomial form method] and [Factor form method] **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
4	**2T**	**Knowledge**: Transfer function Properties of transfer function **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Zero and pole points of the Control System in MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
5	**2T**	**Knowledge**: Poles and zeros of a transfer function Characteristic equation **Skills**: Develops the ability to analyze Control System using **appropriate** mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Transfer function analysis of 3rd order using Simulink **Skills**: Develops the		P	

		ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
6	**2T**	**Knowledge**: Block diagram **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Block Diagram Reduction technique in MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
7	**2T**	**Knowledge**: Definition of basic elements of block diagram Procedure for reduction of block diagram **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Block Diagram Reduction technique in MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB		P	

		Values: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
8	**2T**	**Knowledge**: Definition of basic elements of block diagram Procedure for reduction of block diagram **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Block Diagram Reduction technique in MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
9	**2T**	**Knowledge**: Signal-flow graphs Mason's gain formula **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Unity and non-unity feedback system using MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing		P	

		Control systems			
10	**2T**	**Knowledge**: Time domain analysis of control systems **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Determination of Step & Impulse Response For 2nd order system In MATLAB. **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
11	**2T**	**Knowledge**: Classification of time responses **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Determination of Step & Impulse Response For 2nd order system In MATLAB. **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	

12	**2T**	**Knowledge**: System time response **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Stability Checking of The Control System by Using Routh-Hurwitz Method in MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
13	**2T**	**Knowledge**: Analysis of steady state error **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	
	2P	**Knowledge**: Determination of Root Locus Plot of control System For 2nd Order System In MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
14	**2T**	**Knowledge**: Analysis of second-order system **Skills**: Develops the		T	

		ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
	2P	**Knowledge**: Stability analysis using bode plote using matlab **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
15	**2T**	**Knowledge**: Analysis of second-order system **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	
	2P	**Knowledge**: Stability analysis using bode plote using matlab **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems using MATLAB.		P	

11.Course Evaluation

The grades:

Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	"Modern Control Systems" – Richard C. Dorf & Robert H. Bishop .
Main references (sources)	
Recommended books and references (scientific journals, reports...)	"Automatic Control Systems" Benjamin C. Kuo
Electronic References, Websites	

1. Course Name:	
Control Theory 2	
2. Course Code:	
ECE304	
3. Semester / Year:	
Second Semester / Third Year	
4. Description Preparation Date:	
2025	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
60 hours total / 3 credit units	
7. Course administrator's name (mention all, if more than one name)	
Name: Kaesar Sabah Khalaf Email: kaesarsabah@ntu.edu.iq	
8. Course Objectives	
Course Objectives	This module aims to provide students with a comprehensive understanding of advanced control system concepts and techniques. Specifically, the module aims to: 1. **Introduce students to stability analysis techniques**, including the **Routh-Hurwitz method** and **Root Locus analysis**, enabling them to assess and determine the stability of control systems. 2. **Equip students with tools for frequency domain analysis**, allowing them to analyze system behavior using **Bode plots** and evaluate performance metrics such as phase margin and gain margin. 3. **Enable students to design and analyze compensators** (lag, lead, and lag-lead) to modify system dynamics and improve performance in terms of steady-state accuracy and transient response. 4. **Provide an understanding of PID control theory**, including the roles of proportional, integral, and derivative actions, and their impact on system behavior. 5. **Develop practical skills in implementing and tuning PID controllers**, covering various tuning methods and understanding the challenges associated with PID control in real-world applications. 6. **Offer hands-on experience in applying PID control** to practical systems, such as designing a PID controller for a DC motor, to solidify theoretical knowledge through simulation and experimentation. 7. **Introducing advanced control strategies**, such as **cascade control**, to enhance system performance in

	complex or multi-variable environments. 8. **Develop troubleshooting skills for PID control systems**, equipping students with the ability to diagnose and resolve common issues in PID control loops, ensuring optimal system performance.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design. Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Stability analysis control system **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in		T	Tests and Reports

		analyzing and designing Control systems			
	2P	**Knowledge**: Introduction to VHDL and Simulation Tools **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
2	**2T**	**Knowledge**: Routh-Hurwitz method **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Basic VHDL Modeling and Simulation **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
3	**2T**	**Knowledge**: Routh-Hurwitz method **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Combinational Circuit Design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using		P	

		MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
4	**2T**	**Knowledge**: Root locus analysis **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Combinational Circuit Design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
5	**2T**	**Knowledge**: Root locus analysis **Skills**: Develops the ability to analyze Control System using **appropriate** mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Combinational Circuit Design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
6	**2T**	**Knowledge**: Frequency analysis		T	Tests and Reports

		Skills: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
	2P	**Knowledge**: Sequential Circuit Design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
7	**2T**	**Knowledge**: Frequency analysis **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge** Sequential Circuit Design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
8	**2T**	**Knowledge**: Frequency analysis **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Finite State		P	

		Machines (FSMs) **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
9	**2T**	**Knowledge**: Compensators: Lag Compensator **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Finite State Machines (FSMs) **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
10	**2T**	**Knowledge**: Compensators: Lead Compensator **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Finite State Machines (FSMs) **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes		P	

		accuracy and discipline in analyzing and designing Control systems		T	
11	**2T**	**Knowledge**: Compensators: Lag-Lead Compensator **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Behavioral Modeling **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
12	**2T**	**Knowledge**: Fundamentals of PID Control: Proportional control **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Structural Modeling **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
13	**2T**	**Knowledge**: Fundamentals of PID Control: Proportional		T	

		control **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
	2P	**Knowledge** Testbench Development **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
14	**2T**	**Knowledge**: Fundamentals of PID Control: Integral control **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	
	2P	**Knowledge**: Testbench Development **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
15	**2T**	**Knowledge**: Implementation of PID control **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in		T	

		analyzing and designing Control systems			
	2P	**Knowledge**: Testbench Development **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems using MATLAB.		P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	"Modern Control Systems" – Richard C. Dorf & Robert H. Bishop
Main references (sources)	
Recommended books and references (scientific journals, reports...)	"Automatic Control Systems" Benjamin C. Kuo
Electronic References, Websites	

1. Course Name:	
Microcontrollers	
2. Course Code:	
ECE307	
3. Semester / Year:	
2 / 3	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
(2 th. + 2 pr.)*15 = 60 hrs / Units 3	
7. Course administrator's name (mention all, if more than one name)	
Name: Abdulrahman Ikram Siddiq Email: draisiddiq@ntu.edu.iq	
8. Course Objectives	
Course Objectives	1. Understand the architecture and programming model of AVR microcontrollers. 2. Develop skills in embedded C programming for AVR using tools like Atmel Studio. 3. Design and implement interfacing circuits for sensors, actuators, and communication modules. 4. Apply real-time embedded systems concepts through hands-on projects and debugging.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2)

	• Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2T	**If the student successfully completes this course, he will be able to:** Knowledge: Introduction to microcontroller architecture Skills: Identify AVR microcontroller families Values: Appreciate microcontroller applications	Introduction to AVR Microcontrollers	T	Tests and Reports
	2P	Knowledge: Understand development tools Skills: Install and set up Atmel Studio Values: Value the importance of toolchain setup	Setting up AVR Development Environment	P	
2	2T	Knowledge: Internal architecture of AVR Skills: Analyze block diagram of AVR Values: Attention to microcontroller design	AVR Architecture Overview	T	Tests and Reports
	2P	Knowledge: GPIO concepts Skills: Program GPIO to toggle LEDs Values: Discipline in debugging	Basic GPIO Programming	P	
3	2T	Knowledge: AVR instruction set basics Skills: Write simple assembly code Values: Precision in logic flow	AVR Assembly Language Introduction	T	Tests and Reports
	2P	Knowledge: Assembly and C interface Skills: Write LED blink in both languages	Assembly vs C Programming	P	

		Values: Flexibility in coding styles			
4	2T	Knowledge: Memory organization in AVR Skills: Analyze memory mapping Values: Awareness of memory limits	Memory System in AVR	T	Tests and Reports
	2P	Knowledge: Code and data section handling Skills: Optimize memory usage Values: Efficiency in coding	Memory Allocation Practices	P	
5	2T	Knowledge: Digital input and output concepts Skills: Read/write I/O ports Values: Careful hardware interfacing	Digital I/O in AVR	T	Tests and Reports
	2P	Knowledge: Button press logic Skills: Build digital input circuit Values: Patience in circuit building	Digital Input with Switches	P	
6	2T	Knowledge: Timers and counters Skills: Configure timer registers Values: Respect for timing accuracy	Timers and Counters	T	Tests and Reports
	2P	Knowledge: Timer0 operation Skills: Create delay using timer Values: Importance of timing precision	Timer Delay Application	P	
7	2T	Knowledge: Interrupt mechanism Skills: Enable/disable interrupts Values: Responsibility in interrupt design	Interrupts in AVR	T	Tests and Reports
	2P	Knowledge: External interrupt use Skills: Use INT0 for event handling Values: Logical thinking	Handling External Interrupts	P	
8	2T	Knowledge: Analog to Digital Conversion	ADC in AVR	T	Tests and Reports

		Skills: Configure ADC module Values: Accuracy in signal processing			
	2P	Knowledge: Potentiometer input Skills: Read analog voltage via ADC Values: Curiosity in real-world signals	ADC Voltage Reading	P	
9	**2T**	Knowledge: Serial communication protocols Skills: Describe USART basics Values: Order in data exchange	USART Communication	T	Tests and Reports
	2P	Knowledge: Serial terminal setup Skills: Send/receive via UART Values: Reliability in communication	UART Communication Setup	P	
10	**2T**	Knowledge: SPI protocol basics Skills: Master-slave data flow Values: Collaboration in system design	SPI Communication in AVR	T	Tests and Reports
	2P	Knowledge: SPI data exchange Skills: Connect SPI sensors Values: Diligence in multi-device setup	SPI Device Interfacing	P	
11	**2T**	Knowledge: I2C protocol basics Skills: Addressing and control logic Values: Attention to bus structure	I2C Communication in AVR	T	Tests and Reports
	2P	Knowledge: EEPROM via I2C Skills: Store and retrieve data Values: Security in data handling	I2C EEPROM Access	P	
12	**2T**	Knowledge: Power management techniques Skills: Use sleep modes Values: Energy conservation	Low Power Modes in AVR	T	Tests and Reports

	2P	Knowledge: Sleep mode operation Skills: Wake up via interrupt Values: Responsibility in power use	Sleep and Wake-up Demo	P	
13	**2T**	Knowledge: Real-time applications Skills: Design timed tasks Values: Professionalism in planning	Real-Time System Concepts	T	Tests and Reports
	2P	Knowledge: RT clock simulation Skills: Manage periodic tasks Values: Timing discipline	Real-Time Task Example	P	
14	**2T**	Knowledge: Embedded system integration Skills: System design outline Values: Systematic thinking	Project Planning and Integration	T	Tests and Reports
	2P	Knowledge: Prototype building Skills: Combine modules logically Values: Team collaboration	Mini Project Preparation	P	
15	**2T**	Knowledge: Final review and troubleshooting Skills: Analyze and debug full systems Values: Self-evaluation	System Debugging and Final Review	T	Tests and Reports
	2P	Knowledge: Project presentation Skills: Demonstrate final system Values: Confidence and clarity	Final Project Demo	P	

11.Course Evaluation

The grades:

Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	A. Mazidi, S. Naimi, and S. Naimi, *The AVR Microcontroller and Embedded Systems: Using Assembly and C*, 1st ed. Upper Saddle River, NJ

	USA: Pearson Education, 2014.
Main references (sources)	J. Morton, *AVR: An Embedded C Programming Tutorial for AVR Microcontrollers Using WINAVR/GCC*, 1st ed. Oxford, UK: Newnes, 20
Recommended books and references (scientific journals, reports...)	A. S. Tannenbaum and J. L. Lang, "Design of an embedded system using AVR microcontroller," *Proc. IEEE SoutheastCon*, Richmond, VA, USA Mar. 2007, pp. 388–392. doi: 10.1109/SECON.2007.342896 R. Kamal, *Embedded Systems: Architecture, Programming and Design*, 3rd ed. New Delhi, India: McGraw Hill Education, 2021.
Electronic References, Websites	Microchip Technology Inc., “AVR Microcontrollers,” *Microchip Technology*, 2024. [Online]. Available: https://www.microchip.com/design-centers/8-bit/avr-mcus Atmel Corporation, “AVR Libc Home Page,” *nongnu.org*, 2024. [Online]. Available: https://www.nongnu.org/avr-libc/

1. Course Name:	
Computer Architecture	
2. Course Code:	
ECE303	
3. Semester / Year:	
Second semester / Third year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
(2 th. + 2 pr.)*15 = 60 hrs / Units 3	
7. Course administrator's name (mention all, if more than one name)	
Name: Abdulrahman Ikram Siddiq Email: draisiddiq@ntu.edu.iq	
8. Course Objectives	
Course Objectives	This course aims to familiarize students with the fundamental concepts of computer architecture, enabling them to understand the design and functionality of computer systems. The course covers theoretical and practical aspects to prepare students for advanced studies and professional work in the field. **Key Objectives:** 1. **Understanding Computer Architecture:** o Introduce students to the basics of computer architecture, including the structure and components of a computer system (e.g., CPU, memory, I/O systems). o Explain the principles of modular design and how they apply to computer systems. 2. **Instruction Sets:** o Study instruction sets and their role in computer operations. o Enable students to analyze and design simple instruction sets. 3. **Modular Design:** o Teach students how to design modular systems and understand their advantages. o Apply modular design principles to computer architecture. 4. **Performance Evaluation:** o Introduce methods for evaluating computer system performance. o Discuss trade-offs in design and optimization

	techniques. **Special Objectives for the Course:** • Provide students with the skills to analyze and design computer architectures. • Enhance problem-solving abilities in hardware and software integration.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	**2T**	**If the student successfully completes this course, he will be able to:** Knowledge: Introduction to microcontroller architecture Skills: Identify AVR microcontroller families Values: Appreciate	Introduction to Computer Architecture	T	Tests and Reports

		microcontroller applications			
	2P	Knowledge: Understand development tools Skills: Install and set up Atmel Studio Values: Value the importance of toolchain setup	Introduction to Computer Components	P	
2	**2T**	Knowledge: Internal architecture of AVR Skills: Analyze block diagram of AVR Values: Attention to microcontroller design	Von Neumann Architecture	T	Tests and Reports
	2P	Knowledge: GPIO concepts Skills: Program GPIO to toggle LEDs Values: Discipline in debugging	Hardware Components	P	
3	**2T**	Knowledge: AVR instruction set basics Skills: Write simple assembly code Values: Precision in logic flow	Harvard Architecture	T	Tests and Reports
	2P	Knowledge: Assembly and C interface Skills: Write LED blink in both languages Values: Flexibility in coding styles	Software Components	P	
4	**2T**	Knowledge: Memory organization in AVR Skills: Analyze memory mapping Values: Awareness of memory limits	CPU Organization and Instruction Set Architecture	T	Tests and Reports
	2P	Knowledge: Code and data section handling Skills: Optimize memory usage Values: Efficiency in coding	Memory and Storage	P	
5	**2T**	Knowledge: Digital input and output concepts Skills: Read/write I/O ports	Addressing Methods and Data Types	T	Tests and Reports

		Values: Careful hardware interfacing			
	2P	Knowledge: Button press logic Skills: Build digital input circuit Values: Patience in circuit building	Processor Architecture and Instruction Execution	P	
6	**2T**	Knowledge: Timers and counters Skills: Configure timer registers Values: Respect for timing accuracy	Memory Hierarchy and Organizational Principles	T	Tests and Reports
	2P	Knowledge: Timer0 operation Skills: Create delay using timer Values: Importance of timing precision	Input, Output, and Buses	P	
7	**2T**	Knowledge: Interrupt mechanism Skills: Enable/disable interrupts Values: Responsibility in interrupt design	Memory Management and Modern Techniques	T	Tests and Reports
	2P	Knowledge: External interrupt use Skills: Use INT0 for event handling Values: Logical thinking	USB Port Operation Simulation and Communicati on Protocols	P	
8	**2T**	Knowledge: Analog to Digital Conversion Skills: Configure ADC module Values: Accuracy in signal processing	Organization of Input/Output Units	T	Tests and Reports
	2P	Knowledge: Potentiometer input	Peripheral Devices and	P	

		Skills: Read analog voltage via ADC Values: Curiosity in real-world signals	Control		
9	**2T**	Knowledge: Serial communication protocols Skills: Describe USART basics Values: Order in data exchange	Computer System Design (1)	T	Tests and Reports
	2P	Knowledge: Serial terminal setup Skills: Send/receive via UART Values: Reliability in communication	Virtual Storage Technologies	P	
10	**2T**	Knowledge: SPI protocol basics Skills: Master-slave data flow Values: Collaboration in system design	Computer System Design (2)	T	Tests and Reports
	2P	Knowledge: SPI data exchange Skills: Connect SPI sensors Values: Diligence in multi-device setup	Hardware Security and Energy Efficiency	P	
11	**2T**	Knowledge: I2C protocol basics Skills: Addressing and control logic Values: Attention to bus structure	Pipelining Technique	T	Tests and Reports
	2P	Knowledge: EEPROM via I2C Skills: Store and retrieve data Values: Security in data handling	Processor Cooling Techniques and Their Impact on Performance	P	

12	**2T**	Knowledge: Power management techniques Skills: Use sleep modes Values: Energy conservation	Stability Analysis of Systems and Subsystems	T	Tests and Reports
	2P	Knowledge: Sleep mode operation Skills: Wake up via interrupt Values: Responsibility in power use	Building a Simple Computer System from Scratch	P	
13	**2T**	Knowledge: Real-time applications Skills: Design timed tasks Values: Professionalism in planning	Parallel Processing and Multicore Processors	T	Tests and Reports
	2P	Knowledge: RT clock simulation Skills: Manage periodic tasks Values: Timing discipline	Comparison between CPU and GPU Performance in Parallel Data Processing	P	
14	**2T**	Knowledge: Embedded system integration Skills: System design outline	Emerging Trends in Computer Architectur	T	Tests and Reports

		Values: Systematic thinking	e		
	2P	Knowledge: Prototype building Skills: Combine modules logically Values: Team collaboration	Virtual Memory Manager Simulation	P	
15	**2T**	Knowledge: Final review and troubleshooting Skills: Analyze and debug full systems Values: Self-evaluation	Sustainable Computing and Energy Saving	T	Tests and Reports
	2P	Knowledge: Project presentation Skills: Demonstrate final system Values: Confidence and clarity	Direct Memory Access (DMA) Programming	P	

11.Course Evaluation

The grades:

Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	[1] D. A. Patterson and J. L. Hennessy, *Computer Organization* *Design: The Hardware/Software Interface*, 6th ed. San Francisco, USA: Morgan Kaufmann, 2020. [2] J. L. Hennessy and D. A. Patterson, *Computer Architecture* *Quantitative Approach*, 6th ed. San Francisco, CA, USA: Mor Kaufmann, 2019.
Main references (sources)	[3] N. P. Jouppi, "Improving Direct-Mapped Cache Performance by Addition of a Small Fully-Associative Cache and Prefetch Buffers," *Pr* *17th Annu. Int. Symp. Comput. Archit. (ISCA)*, Seattle, WA, USA, 19

	pp. 364–373.
Recommended books and references (scientific journals, reports...)	[4] L. Hammond, B. A. Nayfeh, and K. Olukotun, "A Single-C Multiprocessor," *Computer*, vol. 30, no. 9, pp. 79–85, Sep. 1997.
Electronic References, Websites	1. IEEE Xplore Digital Library [1] IEEE Xplore, "Digital Library for Computer Architecture Research." [Online]. Available: https://ieeexplore.ieee.org/ 2. ACM Digital Library [2] Association for Computing Machinery (ACM), "ACM Digital Library for Computer Architecture Publications." [Online]. Available: https://dl.acm.org/

1. Course Name:
Power electronics 1
2. Course Code:
ECE302
3. Semester / Year:
First Semester / Third Year
4. Description Preparation Date:
25-06-2025
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
200 hours total / 3 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Nidam mohammed Email: nizamm20@ntu.edu.iq
8. Course Objectives

Course Objectives	The **Course Objectives** of a **Power Electronics** course typically aim to provide students with foundational and applied knowledge in the conversion, control, and conditioning of electric power using electronic devices. Here are **8 standard course objectives** that can be adapted to most undergraduate or graduate-level Power Electronics syllabi:

9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • To effectively teach **Power Electronics**, a mix of theoretical, practical, and digital learning strategies should be used. Here are key **teaching methods and strategies** commonly applied in engineering education for this subjec Assessment Methods: • To effectively evaluate students' understanding and practical skills in **Power Electronics**, a combination of assessment methods should be employed. These assessments should cover theoretical knowledge, practical application, problem-solving, and design capabilities.

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1	**2T**	**If the student successfully completes**	Introduction to power electronics	T	Tests and Reports

		this course, he will be able to: **Knowledge**: **Introduction to Power Electronics** course or module provides foundational knowledge that prepares students to understand, analyze, and apply electronic systems for power conversion and control. Below is a structured summary of the **key knowledge areas** students are expected to gain **Skills**: equips students with a range of theoretical, analytical, and practical skills necessary for designing and understanding modern power conversion systems. Below is a list of core **skills** developed through this module:			
	2P	**Knowledge**: **Skills**: equips students with a range of theoretical, analytical, and practical skills necessary for designing and understanding modern power conversion systems. Below is a list of core **skills** developed through this module: **Skills** practical skills necessary for designing and understanding modern power conversion systems. Below is a list of core **skills** developed		P	
2,3	**2T**	**Knowledge**: Understanding **switching**, **power**, and **control**	Switching devices, power& control devices	T	Tests and Reports

		devices is essential in power electronics, as these components are the building blocks for energy conversion and regulation systems. Below is a structured overview of the **key knowledge** areas related to these devices: **Skills**: Mastering **switching, power, and control devices** enables students and engineers to build and manage efficient energy conversion systems. Below are the key **technical and practical skills** developed in this area of Power Electronics			
	2P	**Knowledge**: to build and manage efficient energy conversion systems. Below are the key **technical and practical skills** developed in this area of Power Electronics **Skills**: enables students and engineers to build and manage efficient energy conversion systems. Below are the key **technical and practical skills** developed in this area of Power Electronics		P	

4,5	**2T**	**Knowledge**:
		Understanding different devices used in power electronics:
		
		Diodes:
		
		• Power Diode
		  ○ Fast Recovery Diode
		  ○ Schottky Diode
		  ○ Zener Diode
		  ○ Avalanche
			Types and characteristics,rating(diode,transistor,..)	T	Tests and Reports

		Diode • **Thyristors (SCRs)**: ○ Silicon Controlled Rectifier (SCR) **Skills**: **Select appropriate power devices** (diodes, MOSFETs, IGBTs, etc.) based on: • Required voltage, current, and power ratings • Switching frequency • Application type (e.g., rectifier, inverter, chopper) Distinguish between different types of devices by analyzing their symbols, structures, and datasheets.			
	2P	• **Knowledge**: Understanding key parameters and how they affect performance: • On-state voltage drop • Breakdown voltage • Forward and reverse recovery time (for diodes) • Switching speed (rise and fall times) • Gate/base drive requirements • Current gain (for transistors) • Latch-up (for thyristors) •		P	

		Skills: Measure device characteristics using lab instruments (oscilloscopes, curve tracers, multimeters). • Test for: • Forward voltage drop • Switching times • Current and thermal behavior • Evaluate and compare performance under different load conditions.			
6,7,8	**2T**	**Knowledge**: the **knowledge of methods of turning ON and OFF power semiconductor devices** refers to understanding how different devices (like diodes, transistors, and thyristors) are **controlled or switched** during circuit operation. This is a critical area because proper switching affects efficiency, speed, and reliability. **Skills**: the **key skills** related to the **methods of turning ON and OFF power semiconductor devices** in Power Electronic :	Methodes of turning on-off	T	Tests and Reports
	2P	*Knowledge:* Diodes *,tyristor,…*Turns ON automatically when forward biased and load current flows.		P	

		- OFF: Turns OFF when reverse biased or when forward current goes to zero. - No external control signal is needed. Skills: Ability to: - Apply gate pulses accurately to trigger SCRs or TRIACs. - Calculate and set threshold gate voltages for MOSFETs and IGBTs. - Drive BJT base currents correctly for full saturation and quick turn-off.			
9,10	**2T**	**Knowledge**: **protection of power devices** is crucial to ensure **safe, reliable, and long-term operation** of components like **diodes, MOSFETs, IGBTs, SCRs**, etc. Power semiconductors are sensitive to over-voltage, over-current, high temperature, and incorrect switching, so specific protection strategies are used. **Skills**: **key skills** related to the **protection methods of power devices** in Power Electronics	Protection of power devices	T	Tests and Reports
	2P	**Knowledge**:		P	

		1. **Over-Voltage Protection** Over-Current Protection Over-Temperature Protection Gate Protection (for MOSFETs, IGBTs, SCRs) **Skills**: Design and implement: • **Snubber circuits** (RC, RCD) to limit dv/dt and voltage spikes. • **Freewheeling diodes** for inductive load protection. • **TVS, MOVs, and Zener diode circuits** for transient voltage suppression. Calculate proper component values (resistance, capacitance, diode ratings) based on device and circuit parameters.			
11,12	**2T**	**Knowledge**: **triggering and base drive circuits** are essential for **controlling the switching** of power semiconductor devices like **SCRs, BJTs, MOSFETs, and IGBTs**. These circuits ensure that power devices turn ON and OFF safely, quickly, and efficiently. **Skills**:	Triggering and base drive circuits	T	Tests and Reports
	2P	**Knowledge: SCRs / Thyristors / TRIACs (Semi-Controlled Devices)**			

		• **Triggering Circuit** applies a gate pulse to turn the device ON. SCRs remain ON once triggered until the current goes to zero. **key skills** related to **Triggering and Base Drive Circuits** in Power Electronics: **Skills:** **Key Features:** • Gate current pulse (few mA) at forward voltage. • Isolation often via **pulse transformers** or **optocouplers**. • Often include **RC or UJT triggering** for control. **Skills**: Design triggering circuits using: • **Resistor-Capacitor (RC) circuits** • **Unijunction Transistors (UJT)** or **Diacs** for pulse generation • **Microcontroller-triggered opto-isolators** (e.g., MOC3021) Calculate required **gate current**, **pulse width**, and **triggering angle** (for phase control)			
13,14,15	**2T**	**Knowledge**: Basic	Controlled	T	Tests and

		Understanding of Controlled Rectifiers ontrolled rectifiers are AC-to-DC converters that use **thyristors (SCRs)** or other controlled devices. Unlike diodes in uncontrolled rectifiers, SCRs can be **turned on at a desired angle (firing angle α)** to control the output voltage and power. **Skills**:	rectifier,1 phase and 3-phase circuits		Reports

	2P	**Knowledge**:
		
		A.Single-Phase Controlled Rectifiers
		
		• **Half-wave Controlled Rectifier**
		  ○ Uses 1 SCR and 1 diode or just 1 SCR
		  ○ Operates only on the positive half of the AC input
		  ○ Output is discontinuous
		• **Full-wave Controlled Rectifier**
		  ○ **Center-tap configuration**: Uses 2 SCRs
		  ○ **Bridge configuration**: Uses 4 SCRs
		  ○ Provides full utilization of the AC
				P	

		cycle ◦ Output can be made more continuous and smooth **Fully-Controlled vs Half-Controlled** ◦ Fully-controlled: All SCRs ◦ Half-controlled: Mix of diodes and SCRs --- **B. Three-Phase Controlled Rectifiers** • Provide smoother DC output with lower ripple than single-phase. • Common topologies: ◦ **3-phase Half-wave Controlled Rectifier** (3 SCRs) ◦ **3-phase Full-wave (Bridge) Controlled Rectifier** (6 SCRs) • Used in high-power industrial applications (e.g., motor drives, DC link supplies) **Skills**: Circuit Design and Construction			

		Firing Angle Control and Triggering			

11. Course Evaluation	
The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100
12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Fundamentaals of Power Electronics 2ed R.W. Erickson & Dragan Maksimovic
Main references (sources)	Elements of Power Electronics by P.K.Krein
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	Electronic Devices 9ed by Thomas L. Floyd Answer

1. Course Name:
Power electronics 2
2. Course Code:
ECE306
3. Semester / Year:
First Semester / Third Year
4. Description Preparation Date:
25-06-2025
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
200 hours total / 3 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Nidam mohammed Email: nizamm20@ntu.edu.iq

8. Course Objectives	
Course Objectives	The **Course Objectives** of a **Power Electronics** course typically aim to provide students with foundational and applied knowledge in the conversion, control, and conditioning of electric power using electronic devices. Here are **8 standard course objectives** that can be adapted to most undergraduate or graduate-level Power Electronics syllabi:

9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • To effectively teach **Power Electronics**, a mix of theoretical, practical, and digital learning strategies should be used. Here are key **teaching methods and strategies** commonly applied in engineering education for this subject Assessment Methods: • To effectively evaluate students' understanding and practical skills in **Power Electronics**, a combination of assessment methods should be employed. These assessments should cover theoretical knowledge, practical application, problem-solving, and design capabilities.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learnin g method	Evaluation method
1,2,3	**2T**	**Knowledge**: Uses **one diode (uncontrolled)** or **one SCR (controlled)**. Only conducts during **one half-cycle** (positive or negative) of the AC input. Simple but inefficient, with a **pulsating DC output** and **high ripple** **Skills**: the **key skills** associated with **Half-Wave and Full-Wave Rectifier Circuits**, which are fundamental in both **Power Electronics** and **Basic Electrical Engineering**	Half wave and full wave circuits	T	Tests and Reports
	2P	**Knowledge: Output Characteristics:** • Output voltage: resistive load) • High ripple factor and poor transformer utilization. • Low average and RMS output. **skills** **Circuit Design and Construction** • Design and build: ○ **Half-wave**		P	

		rectifier using a single diode or SCR. ○ **Full-wave rectifier** using center-tap transformer or bridge configuration. • Select appropriate components: ○ **Diodes/SCRs** based on voltage and current ratings. ○ **Transformers** for center-tap or bridge circuits.			
		2. Triggering and Control (for Controlled Rectifiers) • Apply **firing angle control (α)** for SCRs in half- and full-wave rectifiers. • Generate synchronized gate pulses using: ○ Pulse transformers ○ Opto-isolators ○ Microcontroller-based triggering circuits			

		3. Waveform Observation and Analysis
		
		• Analyze and sketch:
		  o Input AC waveform
		  o Output voltage and current waveforms
		  o Effect of different firing angles (α) on the output voltage (for SCR-based circuits)
		• Identify waveform characteristics such as **ripple**, **peak value**, and **average DC level**.			

		4. Mathematical Calculation
		
		• Calculate:
		  o **Average DC voltage**
		  o **RMS value**, **ripple factor**, and **efficiency**
		  o Power delivered to the load
		  o Impact of **firing angle** on in controlled circuits			

		5. Simulation and Modeling
		
		• Use simulation tools (e.g., **LTspice**, **PSIM**, **Multisim**, **MATLAB/Simulink**) to:
		  ○ Simulate half-wave and full-wave rectifiers
		  ○ Apply firing control and study output variation
		  ○ Analyze transient response and harmonic distortion			

		6. Practical Testing and Measurement
		
		• Use instruments such as:
		  ○ **Oscilloscope** to measure output waveform
		  ○ **Multimeter** to check average DC voltage and peak values
		• Measure the effect of **load variations** (resistive or inductive) on the rectifier			

		performance.			

		7. Load Impact Analysis
		
		• Understand how different types of loads affect output:
		  ○ **Resistive loads**: Output follows the voltage waveform
		  ○ **Inductive loads**: May cause delayed current turn-off; require freewheeling diodes
		• Identify **discontinuous conduction** conditions and how to mitigate them.			

		8. Fault Diagnosis and Troubleshooting
		
		• Detect and correct:
		  ○ Shorted or open diodes/SCRs
		  ○ Incorrect gate triggering (SCRs not firing)
		  ○ Improper output due to wrong transformer configurati			

		on or diode placement • Ensure safe operation by checking **voltage polarity**, **component ratings**, and **load conditions**.			
4,5,6	**2T**	**Knowledge: . Definition and Purpose** • **DC Choppers** are static power electronic devices that convert **fixed DC voltage** to a **variable DC voltage**. • They are the **DC equivalent of AC transformers** (without a transformer). • Widely used in **DC motor control**, **battery-powered systems**, **renewable energy systems**, etc.	DC Choppers step up step down choppers	T	Tests and Reports
		2. Step-Down Chopper (Buck Converter) **Basic Concept** • Converts **high DC voltage to a lower DC voltage**. • Operates by rapidly switching a power semiconductor (like a transistor or MOSFET) ON and OFF. • The **average**			

		output voltage is controlled by adjusting the **duty cycle (D)**. **Skills**: **Circuit Design and Implementation** Control of Duty Cycle and Switching Waveform Analysis and Monitoring			
	2P	**Knowledge**: **Key Formula** **Key Knowledge Points** • Works efficiently when **load current is continuous**. • Includes **freewheeling diode** to maintain current flow when the switch is OFF. • Used in **DC-DC converters**, **motor speed controllers**, and **regulated DC supplies**. **Skills**: Design and build: • **Step-down (buck)** chopper circuits • **Step-up (boost)** chopper circuits Select and size: • **Switching devices** (MOSFET, IGBT) based on voltage and current ratings • **Inductors and capacitors** for energy storage and output filtering		P	

		Freewheeling diodes (fast recovery types) - Implement **Pulse Width Modulation (PWM)** to control: - Duty cycle DDD to adjust output voltage - Switching frequency to reduce ripple and component size - Use: - Analog circuits (e.g. 555 timer-based PWM) - Digital control (e.g. microcontroller or DSP-based PWM generation)			
7,8	**2T**	**Knowledge**: AC phase control is a method of **regulating the power delivered** to an AC load by **delaying the firing (turn-on) angle** of a semiconductor switch (typically an SCR or TRIAC) within each AC cycle. **Power control** is achieved by adjusting the **firing angle (α)**. **Phase angle delay** determines how	AC phase control	T	Tests and Reports

		much of the AC waveform is allowed through to the load. • Common in **lighting dimmers**, **fan speed controllers**, **AC motor drives**, and **heating systems**. **Skills**: **key skills** related to **AC Phase Control** in Power Electronics. These skills are essential for students, engineers, and technicians working with power regulation in AC circuits using thyristors like **SCRs** or **TRIACs**.			
	2P	• **Knowledge**: • In each AC cycle (50 or 60 Hz), the power device is **turned ON** after a delay from the **zero crossing** of the input waveform. • The **firing angle α** (0° to 180°) determines how much of the AC waveform reaches the load. **Power delivered ∝ cos(α)** • **α = 0°** → Full power (SCR triggered at the start of each half-cycle) • **α = 90°** → Half power • **α close to 180°** → Almost no power		P	

		3. Types of AC Phase Control **Type** **Half-wave control** — Control **Full-wave control** — Control **halves**			
		4. Key Components • **SCRs / TRIACs**: Main power control elements • **Diacs**: Triggering aid for TRIACs • **Opto-isolators / Pulse transformers**: Provide gate signal isolation • **Zero-crossing detectors**: Synchronize triggering with AC waveform • **Resistor-Capacitor (RC) phase shift networks**: Delay triggering angle			
		5. Output Waveform Characteristics • The output waveform is **non-sinusoidal** and rich in **harmonics**. • Power factor reduces as **firing angle increases**. • **RMS and average voltage** across the load decrease with			

		higher α.			
		6. Load Types and Behavior • **Resistive loads**: e.g., lamps, heaters – linear and simple behavior • **Inductive loads**: e.g., fans, motors – need careful triggering and often require **snubber** circuits or **commutation aids**			
		7. Mathematical Formulas • **Average output voltage (** • **Output power** and **RMS voltage** also depend on α			
		8. Applications of AC Phase Control • **Light dimmers** • **Fan speed controllers** • **Industrial heaters** • **AC motor soft-starters** • **Welding machines**			
		Skills: **Circuit Design and Implementation** • Design and construct:			

		◦ **Half-wave phase control circuits** using SCRs or TRIACs ◦ **Full-wave phase control circuits** (e.g., using two SCRs or a TRIAC with a Diac) • Select and size components: ◦ SCRs/TRIACs with suitable voltage and current ratings ◦ Diacs, resistors, and capacitors for triggering networks • Add **snubber circuits** to protect from voltage spikes in inductive loads			
		2. Firing Angle Control • Adjust and control the **firing angle (α)** to regulate output voltage or power • Use: ◦ **Resistor-Capacitor (RC) phase-shift circuits** for			

		analog delay control ◦ **Diac-triggered TRIAC circuits** for lamp/fan dimming ◦ **Microcontroller/DSPs** to generate precisely timed gate pulses			
9,10,11	**2T**	• Knowledge n **inverter** is a power electronic device that converts **DC power to AC power**. • Used in applications like **UPS systems**, **motor drives**, **renewable energy systems**, and **electric vehicles**. • Output can be **single-phase or three-phase**, with various waveform types (square, quasi-sine, or pure sine wave). • • • Skills: • Circuit Design and Construction • PWM and Switching Control	INVERTERS 1-phase,3phase bridges	T	Tests and Reports

		• • :			
	2P	**Half-Bridge Inverter** • Uses **two switching devices** (IGBTs/MOSFETs) and two capacitors. • Provides a two-level output • Suitable for low-power applications. **Full-Bridge (H-Bridge) Inverter** • Uses **four switches** arranged in an H-shape. • Output waveform swings from +V_{dc} to –V_{dc}. • More efficient and commonly used. **Skills**: . Design and build: • **1-phase half-bridge and full-bridge inverter circuits** • **3-phase six-switch bridge inverter circuits** Select components: • Appropriate **power switches** (IGBTs, MOSFETs) based on voltage/current ratings • **Freewheeling**		P	

		diodes for safe current paths • Proper **gate driver circuits** for reliable switching Implement various **Pulse Width Modulation (PWM)** techniques: • **Sinusoidal PWM (SPWM)** • **Unipolar and Bipolar PWM** • **Space Vector PWM (SVPWM)** for 3-phase inverters Generate accurate and synchronized gate signals for switche			
12,13	**2T**	**Knowledge**: An **Uninterruptible Power Supply (UPS)** is an electrical device that provides **backup power** to a load when the **main power source fails** or experiences disturbances like voltage sags, surges, or blackouts. • It ensures **continuous, clean, and stable power**. • Common in hospitals, data centers, telecom systems, and industrial control units. **Skills**:	Uninterrp table power supply UPS	T	Tests and Reports

		skills related to **Uninterruptible Power Supply (UPS)** systems — covering design, analysis, implementation, and troubleshooting. These skills are highly relevant for students, technicians, and engineers in **Power Electronics, Electrical Engineering, and Industrial Systems**.			

	2P	**Knowledge**:
		
		Maintain **power continuity** during outages
		
		Provide **voltage regulation** against sags/surges
		
		Allow **safe shutdown** of equipment during power failure
		
		Protect against **power quality issues** (harmonics, frequency variation)
		
		Skills:
		System Design and Configuration
		
		• Design UPS systems based on:
		    ○ **Load requirements (kW/kVA)**
		    ○ **Backup time**
		    ○ **Input/output voltage and frequency**
		• Select appropriate UPS type:
				P	

		◦ **Offline**, **Line-Interactive**, or **Online (Double Conversion)** • Choose compatible **battery banks** (voltage, Ah rating, type)			
		2. Battery Management and Sizing • Calculate: ◦ Required **battery capacity** for a given load and backup duration ◦ **Series/parallel** configuration to meet voltage and current needs • Select battery type: ◦ **Lead-acid**, **Li-ion**, or **VRLA** • Perform: ◦ Battery **charging/discharging cycle testing** ◦ Battery **health monitoring and maintenance**			

		3. Operation and Mode Control
		
		• Operate UPS in different modes:
		  ○ **Normal mode, Battery mode, Bypass mode**
		• Understand and configure:
		  ○ **Static transfer switches**
		  ○ **Manual bypass switch** for maintenance
		  ○ **Start-up/shutdown sequences**			

		4. Waveform and Power Quality Analysis
		
		• Analyze output waveform:
		  ○ Verify **sine wave quality** using oscilloscope
		  ○ Measure **THD (Total Harmonic Distortion)**
		• Check input/output:
		  ○ Voltage and current balance
		  ○ Voltage			

		sag/swell response
		• Measure performance parameters:
		  ○ **Power factor**
		  ○ **Efficiency** (AC-DC-AC conversion loss)			

		5. Monitoring and Control
		
		• Monitor key UPS parameters:
		  ○ **Input/output voltage and frequency**
		  ○ **Load percentage**
		  ○ **Battery charge level**
		  ○ **Temperature**
		• Configure and use:
		  ○ **LCD interfaces**
		  ○ **SNMP/SCADA** for remote UPS monitoring
		  ○ **Alarms and fault indicators**			

14,151	**2T**	**Knowledge**:. A **Switched-Mode Power Supply UPS** is a type of **uninterruptible power supply** that uses **high-frequency switching circuits** (rather than	UPS b-switched mode power supply SMP	T	Tests and Reports

		traditional linear regulators) to efficiently convert and regulate electrical power. These are used to supply continuous power to critical loads like computers, servers, telecom systems, etc. **Skills**: Circuit Analysis and Design Skills Power Electronics Proficiency Battery Management Skills			
	2P	**Knowledge:** **Key Components** 1. **Rectifier/Charger (AC to DC)** – Converts AC input to DC and charges the battery. 2. **Battery Bank** – Stores energy to provide power during mains failure. 3. **Inverter (DC to AC)** – Converts stored DC power back into AC for the load. 4. **Controller/Processor** – Monitors voltages, switching states, and battery health. 5. **Switching Devices (MOSFETs, IGBTs)** – Used in both rectifier and inverter stages.			

		Skills: Ability to analyze UPS circuit blocks: **rectifier, inverter, battery charger, and controller**. Skill in designing **high-frequency SMPS circuits** (e.g., buck, boost, flyback, full-bridge topologies). Understanding how to size and select components: **MOSFETs/IGBTs, transformers, inductors, capacitors**. • Knowledge of **DC-DC and DC-AC conversion** principles. • Proficient in **PWM (Pulse Width Modulation)** control for inverters and converters. • Ability to handle **high-frequency switching** components and their thermal/electrical constraints.			

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Fundamentaals of Power Electronics 2ed by R.W Erickson & Dragan Maksimovic

Main references (sources)	Elements of Power Electronics by P.K.Krein
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	Electronic Devices 9ed by Thomas L. Floyd Answer

1. Course Name:
Communication Principles
2. Course Code:
ECE303
3. Semester / Year:
First semester / Third year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hours total / 3 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Lana Omar Ameen Email: Lana.omar23@ntu.edu.iq
8. Course Objectives

Course Objectives	• To **introduce the foundational principles of communication systems**, focusing on the nature, types, and classifications of signals relevant to electronic and control applications. • To **develop students' ability to analyze signals** in both time and frequency domains using mathematical tools such as the Fourier series and Fourier transform — essential for system analysis and control. • To **explore modulation techniques** (amplitude and angle modulation) and their role in transmitting information over electrical and electromagnetic media, enabling integration with control and embedded systems. • To **explain the impact of signal distortion and channel impairments**, such as linear/nonlinear distortion and fading, and understand how to mitigate them in real-world control and communication environments. • To **familiarize students with key system components**, including filters and antennas, and their function in the design and performance of communication and electronic systems. • To **bridge the gap between signal theory and practical engineering**, preparing students to apply communication principles in electronic circuits, industrial automation, control systems, and IoT networks. • To **equip students with analytical thinking and problem-solving skills**, enabling them to design, analyze, and evaluate communication subsystems within larger electronic and control engineering applications.

9. Teaching and Learning Strategies	
Strategy	**Teaching Methods:** • Theoretical Lectures: To deliver foundational knowledge on signals, Fourier analysis, modulation, and communication systems (Supports A1–A4). • Practical Laboratory Sessions :To apply signal analysis, modulation, and spectrum evaluation techniques using real equipment and simulation tools (Supports B1–B4). • Dialogues and Discussions: To enhance conceptual understanding and encourage critical thinking in classroom and lab settings (Supports A2, C1–C3). • Case Studies and Real-world Examples: To connect theory to practical engineering problems in communication and control (Supports A4, C2). • Mini-projects and Group Assignments: To foster teamwork, creativity, and interdisciplinary communication (Supports D1–D4). **Assessment Methods** • Theoretical Exams (Midterm, Final) To assess understanding of fundamental concepts, signal properties, modulation, and channel effects (A1–A4). • Practical Exams and Lab Reports: To evaluate hands-on skills in signal generation, modulation/demodulation, and spectral analysis (B1–B4). • Quizzes and Continuous Assessments: To reinforce knowledge and ensure ongoing engagement (A1–A3). • Homework and Assignments: To apply theoretical knowledge to practical scenarios and simulation (B2–B4). • Classroom Discussions and Project Presentations: To assess and verify communication, teamwork, engagement and affective outcomes (C1–C3, D1–D4).

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understand different types and properties of signals in both time and frequency domains. **Skills**: Identify, classify,	Signals and Signal Space	T	Tests and Reports

		and mathematically express various types of signals used in communication systems. **Values:** Appreciate the importance of precise signal classification in control and electronic system design.			
	2P	**Knowledge:** Understand the function and safety operation of basic lab instruments (oscilloscope, signal generator, multimeter). **Skills:** Properly connect, operate, and calibrate communication lab equipment**.** **Values:** Demonstrate responsibility, safety, and discipline in handling lab tools	Introduction to Lab Equipment	P	
2	**2T**	**Knowledge:** Explain the concept of signal correlation and its significance in measuring signal similarity**.** **Skills:** Perform correlation operations between signals and interpret the results**.** **Values:** Develop attention to detail and analytical thinking in comparing signal characteristics	Correlation of Signals	T	Tests and Reports
	2P	**Knowledge:** Understand time and frequency domain representations of signals. **Skills:** Analyze signal waveform parameters using an oscilloscope. **Values:** Appreciate the importance of signal analysis in communication systems.:	Signal Analysis	P	
3	**2T**	**Knowledge:** Understand the concept of orthogonality and its role in signal representation	Orthogonality of Signals	T	Tests and Reports

		and multiplexing. **Skills:** Test signals for orthogonality and apply the principle in basis function analysis. **Values:** Value mathematical clarity and efficiency in signal decomposition**.**			
	2P	**Knowledge**: Understand the working principle of the Colpitts oscillator circuit. **Skills**: Build and test a Colpitts oscillator and measure its output frequency. **Values**: Value precision and accuracy in tuning frequency-generating circuits.	Colpitts Oscillator	P	
4-5	**2T**	**Knowledge:** Describe how periodic signals can be represented using exponential Fourier series. **Skills:** Derive Fourier coefficients and construct signal representations. **Values:** Recognize the usefulness of frequency-domain tools in practical communication design	The Exponential Fourier Series	T	Tests and Reports
	2P	**Knowledge:** Understand the operating principle of the Hartley oscillator. **Skills**: Construct a Hartley oscillator and verify its waveform characteristics. **Values:** Encourage careful observation and troubleshooting of analog oscillator circuits	Hartley Oscillator	P	
6-7	**2T**	**Knowledge:** Understand the theory and properties of the Fourier transform and spectral analysis. **Skills:** Apply Fourier transform to analyze and interpret real-world communication signals. **Values:** Embrace	The Fourier Transform	T	Tests and Reports

		analytical rigor and abstraction in signal processing applications.			
	2P	**Knowledge:** Understand the concept and circuit operation of amplitude modulation. **Skills**: Generate and observe an AM signal using a practical modulator circuit. **Values**: Appreciate the foundational role of AM in communication history.	Amplitude Modulator	P	
8-9	**2T**	**Knowledge:** Explain the principles and types of amplitude modulation**.** **Skills:** Analyze and simulate AM systems; perform demodulation mathematically and practically. **Values:** Appreciate AM's historical and ongoing relevance in communication systems.	Amplitude Modulation and Demodulation	T	Tests and Reports
	2P	**Knowledg**e: Understand the working principle of envelope detection using diodes and learn the concept of synchronous (product) demodulation **Skills**: Build and analyze a diode detector for AM demodulation and assemble a product detector and compare its output with envelope detection. **Values**: Promote systematic testing and interpretation of demodulated signals and Foster critical thinking in evaluating demodulation performance	AM Demodulator (Diode Detector) & AM Demodulator (Product Detector)	P	
10	**2T**	**Knowledge:** Understand the concepts of frequency and phase modulation. **Skills:** Design and evaluate FM and PM	Angle Modulation and Demodulation	T	Tests and Reports

		systems; understand bandwidth and spectral effects. **Values:** Recognize the importance of noise-resilient modulation in modern systems.			
	2P	**Knowledge:** Understand frequency modulation theory and practical implementation. **Skills:** Generate an FM signal and observe its deviation and bandwidth. **Values:** Cultivate attention to modulation index and spectral efficiency**.**	Frequency Modulator	P	
11-12	**2T**	**Knowledge:** Identify types and causes of signal distortion in physical communication channels. **Skills:** Analyze signal degradation due to channel effects; apply correction/mitigation methods. **Values:** Develop problem-solving mindset to maintain signal integrity in real-world systems	Signal Distortion Over Communication Channel	T	Tests and Reports
	2P	**Knowledge**: Learn the principle of FM signal recovery. **Skills**: Build a frequency demodulator circuit and evaluate its performance. **Values**: Reinforce accuracy and patience in tuning FM demodulation systems:	Frequency Demodulator	P	
13	**2T**	**Knowledge:** Understand the role of filters in frequency selection and signal shaping**.** **Skills:** Analyze and design basic filters (low/high/band pass) in communication circuits. **Values:** Appreciate filtering as a critical	Filters	T	Tests and Repo

		process in both communication and control systems.			
	2P	**Knowledge:** Understand frequency response and characteristics of second-order LPF. **Skills:** Design and test low-pass filters; measure cutoff frequency and attenuation. **Values**: Encourage precision in analog signal conditioning**.**	Second-Order Low-Pass Filter	P	
14	2T	**Knowledge:** Understand light propagation, mode principles, and radiating modes in optical fibers. **Skills:** Analyze single/multi-mode operation and differentiate guided vs. radiating modes**.** **Values:** Appreciate the efficiency of optical fiber and its role in modern communication systems**.**	Optical Fiber Communication	T	Tests and Repo
	2P	**Knowledge:** Understand frequency response and characteristics of second-order LPF. **Skills:** Design and test low-pass filters; measure cutoff frequency and attenuation. **Values**: Encourage precision in analog signal conditioning**.**	Second-Order Low-Pass Filter	P	
	2P	**Knowledge:** Describe antenna operation, types, radiation patterns, and applications**.** **Skills:** Match antenna types with communication requirements; evaluate basic parameters (gain, bandwidth). **Values:** Recognize antennas as a vital interface between electromagnetic signals	Antenna	P	Tests and Repo

		and electrical systems.			
	2P	**Knowledge**: Understand high-pass filter theory and its role in communication circuits. **Skills**: Build second-order HPF and analyze its performance using signal input/output comparison. **Values**: Promote structured testing and result interpretation in filtering applications.	Second-Order High-Pass Filter	P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	**Modern Digital and Analog Communication Syste**
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

1. Course Name:
Digital communication
2. Course Code:
ECE 308
3. Semester / Year:
Second semester / Third year
4. Description Preparation Date:
01-09-2024
5. Available Attendance Forms:
Weekly (theoretical lectures)
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hour / 3 credit
7. Course administrator's name (mention all, if more than one name)
Name: Asst. lect. Lana Omar Ameen Email: lana.omar23@ntu.edu.iq
8. Course Objectives

Course Objectives	Upon successful completion of this course, students will be able to: 1. **Understand the Structure and Importance of Digital Communication Systems** Identify the components of a digital communication system, its operational block diagram, and its advantages and disadvantages over analog systems. 2. **Comprehend and Analyze Pulse Modulation Techniques** Learn and compare various pulse modulation methods such as PAM, PWM, PCM, delta modulation, and understand the principles and implementation of QAM. 3. **Understand and Apply Multiplexing Techniques** Gain knowledge of multiplexing theory and apply different multiplexing methods including TDM, FDM, CDM, OFDM, and OTFS. 4. **Grasp the Fundamentals of Probability and Error Analysis** Understand probability theory, random variables, and probability density functions, and their application in analyzing the probability of error in digital systems. 5. **Explain Sampling and Quantization Concepts** Apply the sampling theorem, distinguish between types of sampling, and understand quantization and coding techniques. 6. **Analyze Digital Modulation and Demodulation Schemes** Study ASK, FSK, PSK, and QPSK modulation and demodulation techniques, and evaluate their

	performance in communication systems. 7. **Evaluate Digital Communication System Performance** Assess the performance of modulation schemes in terms of bandwidth, power efficiency, and probability of error. 8. **Understand the Basics of Information Theory** Learn how information is measured and understand the concept of channel capacity in digital communication systems.

9. Teaching and Learning Strategies

Strategy	**Teaching Methods:** • **Lectures** – To explain theoretical concepts, mathematical models, and communication techniques. • **Interactive Discussions** – Encourage critical thinking and deeper understanding through class participation and Q&A. • **Problem-Solving Sessions** – Apply theory to solve numerical and analytical problems on modulation, multiplexing, and error performance. • **Multimedia Presentations** – Use of diagrams, animations, and videos to visualize modulation schemes and system components. • **Homework Assignments** – Reinforce weekly topics through take-home tasks and problem sets. **Assessment Methods:** • **Theoretical examinations**: Midterm and final exams to assess knowledge-based outcomes (A1–A4). • **Quizzes** – Short tests throughout the semester to assess comprehension of recent topics (e.g., sampling, ASK/FSK/PSK). • **Assignments** – Graded exercises focusing on calculations, system analysis. • **Classroom dialogues and discussions:** Used to assess cognitive outcomes (A1–A2) and stimulate reflective thinking • **Project or Case Study (Optional)** – Mini-project on a selected modulation or multiplexing method, encouraging independent research and application to support collaborative and communication skills (D2–D4).

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3T	**If the student**	Introduction to	T	Tests

		successfully completes this course, he will be able to: **Knowledge**: Understand digital communication basics, block diagram, pros/cons. **Skills**: Identify system components. **Values**: Appreciate the move from analog to digital systems.	Digital Communication		
2-3	**3T**	**Knowledge**: Learn PAM, PWM, PCM, Delta, and QAM principles. **Skills**: Implement and analyze modulation techniques. **Values**: Show curiosity about digital signals:	Pulse Modulation & QAM	T	Tests
4-5	**3T**	**Knowledge:** Understand TDM, FDM, CDM, OFDM, OTFS. **Skills**: Apply and differentiate multiplexing methods. **Values**: Value bandwidth efficiency:	Multiplexing Techniques	T	Tests
6-7	**3T**	**Knowledge**: Learn probability, random variables, PDFs. **Skills**: Calculate error probabilities. **Values:** Develop analytical precision:	Probability of Error	T	Tests
8-9	**3T**	**Knowledge:** Understand sampling theorem, quantization, coding. **Skills:** Apply digitization techniques. **Values**: Respect accuracy in signal conversion.	Sampling and Quantization	T	Tests
10	**3T**	**Knowledge**: Understand ASK modulation/demodulation. **Skills:** Analyze ASK performance. **Values:** Show interest in modulation trade-offs.	Amplitude Shift Keying (ASK)	T	Tests
11-12	**3T**	**Knowledge:** Learn FSK operation and	Frequency Shift Keying (FSK)	T	Tests

		performance. **Skills:** Implement and assess FSK. **Values:** Value reliability in transmission			
13	**3T**	**Knowledge:** Understand PSK techniques. **Skills:** Analyze PSK systems. **Values:** Engage with practical modulation concepts.	Phase Shift Keying (PSK)	T	Tests
14	**3T**	**Knowledge:** Learn QPSK and compare to PSK. **Skills:** Evaluate QPSK performance. **Values:** Appreciate spectral efficiency.	Quadrature PSK (QPSK)	T	Tests
15	**3T**	**Knowledge:** Understand information measures and channel capacity. **Skills:** Calculate entropy and capacity. **Values:** Value theoretical communication limits.	Information Theory	T	Tests

11.Course Evaluation

The grades:

Coursework	10
Midterm Exam	30
Final Exam	60
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	MODERN DIGITAL AND ANALOG COMMUNICATION SYSTEM, B.P. Lathi,201(
Main references (sources)	
Recommended books and references (scientific journals, reports...)	PRINCIPLES OF DIGITAL COMMUNICATI(Robert G. Gallager,2007
Electronic References, Websites	

1. Course Name:
Supervisory Control and Data Acquisition System
2. Course Code:
ECE408
3. Semester / Year:
First Semester / Third Year
4. Description Preparation Date:
27-06-2025
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
7. Course administrator's name (mention all, if more than one name)
Name: Ahmed Kamal Ibrahim Email: ahmed.kamal23@ntu.edu.iq

8. Course Objectives	
Course Objectives	• Provide students with basic knowledge of industrial control principles and industrial control systems, particularly supervisory control and data acquisition. • Develop students' skills in designing industrial control systems using industrial controllers. • Enable students to use specialized tools and software for programming industrial controllers.

9. Teaching and Learning Strategies	
Strategy	• Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learnin g method	Evaluation method
1	**2T**	1. Overview of industrial automation. 2. Role of PLCs and	Introduction to Automation	T	Tests, H.W and Reports

		SCADA in control systems.	and Control Systems		
	2P	To study about the programmable logic controller (PLC) field interface module, hardware working and application and programming software	Getting familiar with ISPSoft , COMMGR and the DELTA PLC	P	
2	**2T**	1. Introduction to SCADA and PLC 2. History and evolution of PLCs. 3. Advantages of PLCs over traditional control systems.	Fundamentals of PLCs	T	Tests, H.W and Reports
	2P	1. Identify the basic components of the control board. 2. Assemble and arrange a simple control board. 3. Explain the operation of electromagnetically controlled circuits. 4. Operate a simple loads using relays, switches and pushbuttons.	Operating a simple loads using relays, switches and pushbuttons.	P	
4 - 3	**4T**	1. PLC components and architecture 2. Input and output devices (sensors, actuators) 3. CPU, memory, and communication modules	PLC Hardware.	T	Tests, H.W and Reports
	4P	To start and stop motors using direct on line starter method using PLC	Direct On Line motor starter using PLC	P	
6- 5	**4T**	1. Binary Concept 2. Logic gates and Boolean algebra 3. Ladder Logic concept	PLC Logic	T	Tests, H.W and Reports
	4P	To design and test the various logic gates using PLC ladder logic.	LOGIC GATES USING PLC	P	
7-8	**4T**	1. Programming languages 2. Creating and editing PLC programs	PLC Programming	T	Tests, H.W and Reports

		3. Addressing and data types			
	4P	1. Identify the level switch and solenoid valve. 2. Identify Internal Relay and Battery-backed relays Instructions. 3. Identify latching and unlatching process.	Control the level of water in a storage tank using PLC	P	
9	**2T**	Midterm Exam	Midterm Exam	T	Midterm Exam
	1P	Midterm Exam	Midterm Exam	P	
10	**2T**	1. Understanding SCADA architecture and components 2. Role of SCADA in process visualization and control	Introduction to SCADA Systems	T	Tests, H.W and Reports
	2P	Learn about the software used in SCADA systems	Introduction to SCADA Systems	P	
12 - 11	**4T**	1**.** Designing effective user interfaces for SCADA systems 2. Real-time data visualization and trending	HMI (Human-Machine Interface) Design	T	Tests, H.W and Reports
	4P	1. Learn how to reverse the direction of rotation of motors. 2. Learn about the electrical interlocking system.	Forward and Reverse direction control of Motors using PLC.	P	
13	**2T**	1. Communication protocols (e.g., Modbus) used in PLC-SCADA communication. 2. Establishing connections between PLCs and SCADA	Data Acquisition and Communication	T	Tests, H.W and Reports
	2P	1. Identify the Timer instruction. 2. Learn about star delta motor starter connection and its benefits. 3. Learn about over load relay.	Star delta motor starter using PLC	P	
14-15	**4T**	1. Integrating PLC control with SCADA systems	Integration of PLCs and	T	Tests, H.W and Reports

		2. Data exchange and synchronization.	SCADA		
	4P	1. Identify the Counter instruction. 2. Learn about Proximity switches.	Packing system on counter basis using plc	P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. Automating Manufacturing Systems with PLCs by Hugh Jack 2. Programmable Controllers Theory and Implementation \ Second Edition by L.A. Bryan and E.A. Bryan. 3. Programmable Logic Controllers \ Fourth Edition by W. Bolton. Programmable Logic Controllers \ Fifth Edition Frank D. Petruzella
Main references (sources)	Automating Manufacturing Systems with PLCs by Hugh Jack
Recommended books and references (scientific journals, reports...)	Automating Manufacturing Systems with PLCs by Hugh Jack
Electronic References, Websites	

1. Course Name:	
Project Engineering Management	
2. Course Code:	
TECK400	
3. Semester / Year:	
First Semester / Fourth Year	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Theoretical	
6. Number of Credit Hours (Total) / Number of Units (Total)	
125/ 3	
7. Course administrator's name (mention all, if more than one name)	
Name: Abbas Yuldurum Saleh Email: abbas.yuldurum23@ntu.edu.iq	
8. Course Objectives	
Course Objectives	• Enabling students to understand the fundamental concepts of project management, • such as the project life cycle, stakeholders, Work Breakdown Structure (WBS), and project scope. • Developing skills in project planning and organization, • including scheduling, cost estimation, and resource allocation.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Traditional lectures, report writing, seminar conduct. Assessment Methods: • Daily written and oral tests, applied tests, seminars, semester and final exams, assignments, attendance and commitment, feedback (testing the student on the previous subject), • self-evaluation (questions are set for the student by the teacher and the student) • reports on scientific developments in the field of specialization, and asks analytical and deductive questions.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3T	**Knowledge**: Management concepts and functions. **Skills**: Understanding the	**Introduction to Engineering Management**	T	Tests and Reports

		role of management in projects. **Values**: Respect for the importance of management in success.			
2	**3T**	**Knowledge**: Planning fundamentals and tools. **Skills**: Preparing time-based plans and goals. **Values**: Commitment to plans for goal achievement.	**Project Planning in Engineering**	T	Tests and Reports
3	**3T**	**Knowledge**: Types of resources and organization methods. **Skills**: Efficient resource allocation. **Values**: Cooperation and teamwork.	**Resource Organization in Projects**	T	Tests and Reports
4	**3T**	**Knowledge**: Leadership theories and motivation methods. **Skills**: Leading and motivating teams. **Values**: Responsibility and mutual respect.	**Guidance, Motivation, and Leadership**	T	Tests and Reports
5	**3T**	**Knowledge**: Control methods and follow-up tools. **Skills**: Comparing performance with plans. **Values**: Accuracy and transparency in work.	**Project Monitoring and Control**	T	Tests and Reports
6	**3T**	**Knowledge**: Relationship between time, cost, and quality. **Skills**: Balancing these factors. **Values**: Commitment to quality and effectiveness.	**Project Triple Constraints (Time – Cost – Performance)**	T	Tests and Reports
7	**3T**	**Knowledge**: Review and deepen understanding of management and productivity. **Skills**: Demonstrate ability to apply concepts in integrated management topics. **Values**: Reflects discipline, academic integrity, and readiness.	**Midterm Exam**	T	Tests and Reports

8	3T	**Knowledge**: Basics of cost estimation and budgeting. **Skills**: Preparing and monitoring budgets. **Values**: Integrity in spending.	**Cost and Budget Management**	T	Tests and Reports
9	3T	**Knowledge**: Scheduling tools (Gantt, PERT). **Skills**: Creating effective schedules. **Values**: Respecting and adhering to deadlines.	**Project Scheduling**	T	Tests and Reports
10	3T	**Knowledge**: Quality standards and concepts. **Skills**: Applying and improving quality. **Values**: Excellence and commitment to quality standards.	**Quality Management in Projects**	T	Tests and Reports
11	3T	**Knowledge**: Types of risks and assessment methods. **Skills**: Developing risk mitigation plans. **Values**: Prevention and responsibility.	**Risk Management**	T	Tests and Reports
12	3T	**Knowledge**: Principles of employee selection and training. **Skills**: Performance evaluation and team management. **Values**: Fairness and professional development.	**Human Resource Management**	T	Tests and Reports
13	3T	**Knowledge**: Project management software tools. **Skills**: Effective use of MS Project. **Values**: Innovation and use of technology.	**Project Management Software**	T	Tests and Rep
14	3T	**Knowledge**: Connecting basic concepts to practical aspects. **Skills**: Holistic evaluation of project performance. **Values**: Enhancing analytical thinking and responsibility.	**Comprehensive Review**	T	Tests and Rep
15	3T	**Knowledge**: Use of	**Comprehensive**	T	

		summaries and mind maps. **Skills**: Solving practical problems and review questions. **Values**: Self-discipline and appreciation of continuous development.	**Review (Practice Focused)**		

11.Course Evaluation

The grades:

Quizzes	10
Onsite Assignments	10
Reports	10
Midterm Exam	10
Final Exam	60
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Project Management: A Systems Approach to Planning, Scheduling, and Controlling By Harold Kerzner
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Construction Project Management: A Practical Guide to Field Construction Management. By , S Keoki Sears, Glenn A. Sears, Richard H. Clough
Electronic References, Websites	Project engineering mangemant for Engineers Prof. Max Mao URL: https://www.youtube.com/watch?v=bw-NvGvLHtM

<table>
<tr><td colspan="2">1. Course Name:</td></tr>
<tr><td colspan="2">Computer networks</td></tr>
<tr><td colspan="2">2. Course Code:</td></tr>
<tr><td colspan="2">ECE400</td></tr>
<tr><td colspan="2">3. Semester / Year:</td></tr>
<tr><td colspan="2">First semester / Fourth years</td></tr>
<tr><td colspan="2">4. Description Preparation Date:</td></tr>
<tr><td colspan="2">01-09-2024</td></tr>
<tr><td colspan="2">5. Available Attendance Forms:</td></tr>
<tr><td colspan="2">Weekly (theoretical and practical lectures) - Mandatory</td></tr>
<tr><td colspan="2">6. Number of Credit Hours (Total) / Number of Units (Total)</td></tr>
<tr><td colspan="2">60 Hour / 3 credit</td></tr>
<tr><td colspan="2">7. Course administrator's name (mention all, if more than one name)</td></tr>
<tr><td colspan="2">Name: Lana Omar Ameen
Email: lana.omar23@ntu.edu.iq</td></tr>
<tr><td colspan="2">8. Course Objectives</td></tr>
<tr><td>Course Objectives</td><td>Upon successful completion of this course, students will be able to:

1. Understand the basic structure and components of computer networks
Identify key network devices (e.g., routers, switches, terminals) and classify networks by size and scope (LAN, MAN, WAN), recognizing their roles in data communication.
2. Distinguish between transmission media and analyze their properties
Differentiate between guided (wired) and unguided (wireless) media, and evaluate the impact of attenuation, interference, and propagation (including line-of-sight transmission) on signal quality.
3. Comprehend network topology and physical structure
Understand network criteria, types of connections (point-to-point, multipoint), and how different topologies affect performance and reliability.
4. Analyze channel performance and data transmission efficiency
Interpret channel capacity, signal-to-noise ratio (SNR), and bit error rate (BER) to evaluate network performance.
5. Apply error detection and correction techniques
Use methods such as Automatic Repeat Request (ARQ), Forward Error Correction (FEC), and Cyclic Redundancy Check (CRC) to ensure data integrity.
6. Understand network models and architectures
Analyze the OSI and TCP/IP reference models and explain the function of each layer in organizing</td></tr>
</table>

	communication between devices. 7. **Explain switching and routing principles** Differentiate switching techniques, understand static and dynamic routing, configure routing tables, and explore VLANs for segmenting networks. 8. **Understand Ethernet technologies and standards** Learn about Ethernet evolution including Standard Ethernet, Fast Ethernet, and Gigabit Ethernet, and their role in wired communication. 9. **Gain comprehensive knowledge of wireless networks** Study the architecture and components of WLANs, IEEE 802.11 standards, and the role of satellite networks in global communication. 10. **Grasp the fundamentals of network security and protection methods** Understand common threats and vulnerabilities, and apply encryption, cryptography, firewalls, VPNs, and intrusion detection systems to secure networks.
9. Teaching and Learning Strategies	
Strategy	**Teaching Methods:** • **Theoretical lectures:** to achieve cognitive objectives (A1–A7) by explaining fundamental concepts, models, protocols, and network security. • **Practical laboratory applications:** for curriculum components to achieve skills (B1–B4), including network simulation, configuration, and performance analysis. • **Dialogues and discussions:** during theoretical and practical sessions to deepen understanding and stimulate critical thinking. • **Using general engineering principles:** for analyzing and designing networking solutions and troubleshooting communication issues. • **Application of network simulation tools and software:** for hands-on learning and design of network topologies, routing, and security implementations. **Assessment Methods:** • **Theoretical examinations:** periodic quizzes and mid term exams to verify knowledge and understanding of core concepts (A1–A7). • **Practical examinations:** lab tests and project evaluations to verify applied skills in configuring and analyzing networks (B1–B4). • **Short tests (Quizzes):** regular assessments for continuous evaluation of recent topics such as addressing, switching,

	and network security. • **Classroom dialogues and discussions:** used to assess comprehension and encourage reflective thinking on theoretical topics (A1–A4). • **Assignments (Homework):** practical exercises on network design, simulation, and problem-solving tasks. • **Classroom presentations:** for student participation, discussion, and demonstration of project results to develop communication skills (D2).

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learnin g method	Evaluation method
1	2T	**If the student successfully completes this course, he will be able to:** **Knowledge:** Understand basic concepts and types of networks. **Skills:** Identify network components. **Values:** Appreciate the role of networks in communication.	Introduction to Computer Networks, Data Flow, Network Categories (LAN, MAN, WAN)	T	Tests and Reports
	2P	**Knowledge:** Identify types of network devices and media. **Skills**: Differentiate between end and intermediary devices. **Values**: Appreciate the foundational role of networking	Introduction to Networks- End Devices- Intermediary Devices- Network Media	P	
2	2T	**Knowledge:** Know different transmission media and wireless propagation. **Skills:** Select appropriate transmission media. **Values:** Value quality and reliability of transmission	Transmission Media, Guided and Wireless Media, Wireless Propagation, Line-of-Sight Transmission	T	Tests and Reports
	2P	**Knowledge:** Understand cable types and their functions. **Skills:** Construct and test straight-through and crossover cables. **Values:** Commit to	UTP & STP cables- Straight-through & Crossover cables	P	

		accuracy in cable connections.			
3	**2T**	**Knowledge:** Understand network topologies and connection types. **Skills:** Design basic network topologies. **Values:** Apply systematic thinking in network design.	Network Topology, Network Criteria, Connection Types (Point-to-Point, Multipoint)	T	Tests and Reports
	2P	**Knowledge:** Learn simulation environment basics. **Skills:** Use Packet Tracer to simulate simple networks. **Values:** Value the importance of simulation in learning.	Introduction to Packet Tracer	P	
4	**2T**	**Knowledge:** Understand channel impairments and performance metrics. **Skills:** Evaluate channel quality. **Values:** Commit to improving communication quality.	Transmission Channel, Impairments (Noise, Distortion, Attenuation, Interference), Channel Capacity, SNR, BER	T	Tests and Reports
	2P	**Knowledge:** Understand device configuration and addressing. **Skills:** Configure IP settings on switches, routers, and PCs. **Values:** Develop discipline in configuring real systems.	Configuration of Network Devices- Switch & Router Initial Settings- IP & MAC Addresses- Basic Connectivity Setup	P	
5	**2T**	**Knowledge:** Know error detection and correction techniques. **Skills:** Apply error control methods. **Values:** Ensure data accuracy and reliability.	Error Detection and Correction (ARQ, FEC, CRC)	T	Tests and Reports
	2P	**Knowledge:** Understand device configuration and addressing. **Skills:** Configure IP settings on switches, routers, and PCs.	Configuration of Network Devices- Switch & Router Initial Settings- IP & MAC Addresses-	P	

		Values: Develop discipline in configuring real systems.	Basic Connectivity Setup		
6	**2T**	**Knowledge:** Understand OSI and TCP/IP layers and functions. **Skills:** Analyze network architecture. **Values:** Appreciate structured network design.	Network Models and Architectures (OSI, TCP/IP)	T	Tests and Reports
	2P	**Knowledge:** Understand device configuration and addressing. **Skills:** Configure IP settings on switches, routers, and PCs. **Values:** Develop discipline in configuring real systems.	Configuration of Network Devices- Switch & Router Initial Settings- IP & MAC Addresses- Basic Connectivity Setup	P	
7-8	**2T**	**Knowledge:** Understand addressing schemes. **Skills:** Assign and manage network addresses. **Values:** Value precise and effective addressing	Addressing: Physical, Logical, Specific Addresses	T	Tests and Reports
	2P	**Knowledge:** Understand inter-network communication. **Skills:** Implement routing between different networks. **Values:** Promote logical thinking in problem-solving	Connect Different Networks Using Router	P	
9	**2T**	**Knowledge:** Know switching and routing principles. **Skills:** Configure routing and switching. **Values:** Emphasize teamwork in network management.	Switching and Routing, VLANs, Routing Protocols and Tables, Static and Dynamic Routing	T	Tests and Reports
	2P	**Knowledge:** Understand subnetting principles. **Skills:** Apply subnetting to design IP addressing. **Values:** Accuracy and attention to detail in addressing.	Subnetting Scenario in Packet Tracer- Network Classes- Subnetting- Addressing Table	P	
10	**2T**	**Knowledge:** Understand Ethernet technologies.	Ethernet Standards	T	Tests and Reports

		Skills: Differentiate Ethernet types. **Values:** Adopt modern networking standards.	(Standard, Fast, Gigabit)		
	2P	**Knowledge:** Understand subnetting principles. **Skills:** Apply subnetting to design IP addressing. **Values:** Accuracy and attention to detail in addressing.	Subnetting Scenario in Packet Tracer- Network Classes- Subnetting- Addressing Table	P	
11	**2T**	**Knowledge:** Know wireless LAN architectures and standards. **Skills:** Setup and manage wireless networks. **Values:** Promote innovation in wireless communication.	Wireless LANs, IEEE 802.11, Satellite Networks	T	Tests and Reports
	2P	**Knowledge:** Understand routing process and protocols. **Skills:** Configure and troubleshoot routing in networks. **Values:** Appreciate efficient and secure data delivery.	Routing	P	
12	**2T**	**Knowledge:** Understand cryptography and encryption. **Skills:** Apply encryption techniques. **Values:** Respect data privacy and confidentiality	Network Security Part 1: Cryptography and Encryption	T	Tests and Reports
	2P	**Knowledge:** Understand routing process and protocols. **Skills:** Configure and troubleshoot routing in networks. **Values:** Appreciate efficient and secure data delivery.:	Routing	P	
13	**2T**	**Knowledge:** Identify network threats and vulnerabilities. **Skills:** Assess network risks. **Values:** Commit to	Network Security Part 2: Threats and Vulnerabilities	T	

		cybersecurity principles.			
	2P	**Knowledge:** Understand basic network security practices. **Skills:** Implement security configurations on devices. **Values:** Promote ethical responsibility and data protection.	Network Security- Best Practices-Securing Switches and Routers	P	
14-15	2T	**Knowledge:** Understand firewall, VPN, and IDS concepts. **Skills:** Implement security measures. **Values:** Maintain network security and integrity.	Network Security Part 3: Firewalls, VPNs, Intrusion Detection	T	
	2P	**Knowledge:** Understand basic network security practices. **Skills:** Implement security configurations on devices. **Values:** Promote ethical responsibility and data protection.	Network Security- Best Practices-Securing Switches and Routers	P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Data and Computer Communications', by S. William, Tenth Edition, 2014.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	http://www.pearsonhighered.com/stallings

1. Course Name:	
Digital Control 1	
2. Course Code:	
ECE 401	
3. Semester / Year:	
First Semester / Fourth Year	
4. Description Preparation Date:	
2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
200 hours total / 8 credit units	
7. Course administrator's name (mention all, if more than one name)	
Name: Koran Ali Namuq Email: gorannamuq@ntu.edu.iq	
8. Course Objectives	
Course Objectives	This module aims to provide students with a foundational understanding of digital control systems and to develop their analytical skills in modeling, analyzing, and interpreting system behavior. Specifically, the module aims to: 1. Introduction to control systems: The module aims to provide students with a foundational understanding of control systems, including the basic concepts, principles, and terminology. Students learn about the different types of control systems and their components, such as sensors, actuators, controllers, and feedback loops. 2. Digital control theory: The module aims to introduce students to the theory and techniques of digital control. This includes studying concepts like discrete-time systems, Z-transform, transfer functions, stability analysis, pole placement, and system response analysis. Students learn how to design and analyze digital control systems using various methods, such as root locus, frequency response, and state-space approaches. 3. Discretization of continuous-time systems: One of the primary aims is to teach students how to convert continuous-time control systems into their discrete-time counterparts. This involves studying different discretization methods, such as the zero-order hold, first-order hold, and Tustin's approximation. Students learn about the implications and limitations of discretization and how to choose an appropriate sampling rate. 4. Digital controller design: The module aims to

	provide students with the knowledge and skills to design digital controllers for various applications. Students learn about different controller design techniques, such as proportional-integral-derivative (PID) control, state-space control, and optimal control. They also explore methods for tuning and optimizing digital controllers to meet desired performance specifications. 5. Implementation of digital control systems: A practical aim of the module is to familiarize students with the implementation aspects of digital control systems. This includes topics like analog-to-digital conversion, digital-to-analog conversion, anti-aliasing filters, sampling effects, quantization, and digital signal processing techniques used in control systems. 6. Analysis and simulation of digital control systems: The module aims to develop students' abilities to analyze and simulate digital control systems using appropriate software tools or programming languages. Students learn how to model control systems, simulate their behavior, and evaluate performance using tools like MATLAB, Simulink, or specialized control system simulation software. 7. Application of digital control: The module aims to expose students to various real-world applications of digital control systems. This may include areas such as robotics, mechatronics, automation, process control, power systems, and aerospace systems. Students learn about the specific challenges and considerations in implementing digital control in these domains and explore case studies and examples.
9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Lectures: Lectures are a common teaching strategy for introducing and explaining key concepts, theories, and principles of digital control. Lectures can include multimedia presentations, demonstrations, and examples to enhance understanding. It is important to provide clear explanations and engage students through interactive discussions and questions. • Practical Work: Practical work plays a crucial role in understanding digital control. Students should have hands-on experience with implementing control algorithms using software tools or hardware platforms. This can involve simulation exercises, programming assignments, or using hardware-in-the-loop systems. Practical work helps students apply theoretical concepts and develop problem-

	solving skills. • Case Studies and Examples: Case studies and real-world examples provide students with a practical perspective on digital control applications. They can analyze and discuss the control systems used in different industries, such as robotics, process control, or aerospace. Case studies help students understand the challenges, design considerations, and implementation issues in digital control systems. • Group Discussions and Peer Learning: Encouraging group discussions and peer learning activities can enhance students' understanding of digital control. Students can form study groups to solve problems, discuss concepts, and share their insights. Group discussions promote active learning, collaboration, and the exchange of ideas. • Computer-Based Simulations and Software Tools: Utilizing computer-based simulations and software tools is valuable for visualizing and analyzing digital control systems. Students can use simulation software like MATLAB, Simulink, or specialized control system software to simulate and validate control algorithms. Software tools provide an interactive environment for exploring different control techniques and system responses. • Assessment and Feedback: Assessment methods should align with the learning outcomes of the module. These can include assignments, quizzes, exams, or project work. Providing timely and constructive feedback on students' performance helps them gauge their understanding and progress. Feedback can be given through written comments, individual discussions, or online platforms. • Guest Lectures and Industry Visits: Inviting guest speakers from industry or academia who specialize in digital control can provide valuable insights and practical perspectives. Industry visits to companies that implement digital control systems can offer students exposure to real-world applications and the opportunity to interact with professionals in the field. • Self-directed Learning: Encouraging self-directed learning is essential for students to deepen their understanding of digital control. This can involve independent study, reading relevant textbooks, research articles, or online resources. Providing a list of recommended readings or additional resources can support self-directed learning. Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment

	• Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2T	**If the student successfully completes this course, he will be able to:** **Knowledge**: Introduction to digital Control Systems: Basic concepts and terminology of control systems Types of control systems: open-loop and closed-loop control Block diagram representation of control systems Feedback and its importance in control systems **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Introduction to MATLAB and Simulation Tools **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
2	2T	**Knowledge**: Discrete-		T	Tests and

		Time Systems and Sampling: Discrete-time signals and systems Sampling theorem and sampling process Discrete-time representation of continuous-time signals Aliasing and anti-aliasing filters **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			Reports
	2P	**Knowledge**: Design by Emulation Time-domain controller emulation Frequency-domain controller emulation **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
3	**2T**	**Knowledge**: Z-Transform and Transfer Functions: • Z-transform and its properties • Transfer functions and their relationship to system response • Analysis of discrete-time systems using		T	Tests and Reports

		the Z-transform **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
	2P	**Knowledge**: Digital Effects • Sampling, aliasing, zero-order hold • Discrete-time plant modeling • **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
4	2T	**Knowledge**: Stability Analysis: • Stability criteria for discrete-time systems • Stability analysis using the Z-transform • Routh-Hurwitz stability criterion • Jury's stability criterion **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Digital		P	

		Effects • Sampling, aliasing, zero-order hold • Discrete-time plant modeling **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
5	**2T**	**Knowledge**: Controller Design Techniques: • Proportional-Integral-Derivative (PID) control • Root locus analysis and design • Frequency response analysis and design • State-space control design **Skills**: Develops the ability to analyze Control System using **appropriate** mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Digital Effects • Sampling, aliasing, zero-order hold • Discrete-time plant modeling **Skills**: Develops the ability to analyze Control System using appropriate		P	

		mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
6	**2T**	**Knowledge**: Discretization of Continuous-Time Systems: • Sampling methods: zero-order hold, first-order hold • Tustin's approximation (bilinear transformation) • Effects of discretization on system behavior • Selection of sampling rate and considerations **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Transfer Function Controller Design • Frequency-response controller design • Numeric optimal PID controller design • Ragazzini's direct control design method **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	

7	**2T**	Mid-Term Exam		T	Exam
	2P	Mid-Term Exam		P	
8	**2T**	**Knowledge**: Digital Controller Implementation: • Analog-to-Digital (A/D) conversion • Digital-to-Analog (D/A) conversion • Effects of quantization and resolution • Digital signal processing techniques for control • PID Control via Emulation **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: State-Space Controller Design • State-feedback controller design • State estimation and control design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
9	**2T**	**Knowledge**: Performance Analysis and Optimization: • Performance specifications: rise time, settling time, overshoot, etc. • Time-domain and frequency-domain		T	Tests and Reports

		performance analysis • PID tuning methods: Ziegler-Nichols, Cohen-Coon, etc. • Optimal control and optimization techniques **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
	2P	**Knowledge**: State-Space Controller Design • State-feedback controller design • State estimation and control design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
10	**2T**	**Knowledge**: Simulation and Design Tools: • Simulation of digital control systems using software tools (e.g., MATLAB, Simulink) • Control system design using simulation software • Analysis of system response and parameter tuning **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes		T	Tests and Reports

		accuracy and discipline in analyzing and designing Control systems			
	2P	**Knowledge**: State-Space Controller Design • State-feedback controller design • State estimation and control design **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
11	**2T**	**Knowledge**: Steady-State Error of Discrete-Time Control Systems: • Steady-State Error for open loop system • Steady-State Error for closed loop system **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Temperature controller • Temperature controller using PID **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	

12	**2T**	**Knowledge**: Advantages of Digital control: • Coding of digital signal and digital • Time sharing • Control system with inherent sampling • Digital computer implementation of sophisticated control law **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	Tests and Reports
	2P	**Knowledge**: Effect of feedback • Effect of feedback on DC servo motor **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
13	**2T**	**Knowledge**: Disadvantages of Digital control: • System design • System stability • Loss of signal information • Controller dynamic update • Software errors **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values:		T	

		Promotes accuracy and discipline in analyzing and designing Control systems			
	2P	**Knowledge**: Stability analysis Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools Using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		P	
14	**2T**	**Knowledge**: Applications of Digital Control: • Case studies and examples of digital control in various domains (e.g., robotics, automation, process control) • Practical considerations and challenges in implementing digital control systems • Emerging trends and advancements in digital control • **Skills**: Develops the ability to analyze Control System using appropriate mathematical tools **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems		T	
	2P	**Knowledge**: Stability		P	

		analysis Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB **Values**: Values: Promotes accuracy and discipline in analyzing and designing Control systems			
15	**2T**	**Preparatory Week – Final Exam**		T	
	2P	**Preparatory Week – Final Exam**		P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	" Digital Control of Dynamic Systems', by Gene F. Franklin, J. David Powell, Third edition, 2006. .
Recommended books and references (scientific journals, reports...)	1. " Digital Control of Dynamic Systems 2. Digital Control Systems
Electronic References, Websites	https://www.mathworks.com/products/control.html https://systemcontrol.readthedocs.io/en/latest/index.h

1. Course Name:	
Power System Control	
2. Course Code:	
ECE 402	
3. Semester / Year:	
2 / 4	
4. Description Preparation Date:	
01-09-2024	
5. Available Attendance Forms:	
Weekly (theoretical and practical lectures) - Mandatory	
6. Number of Credit Hours (Total) / Number of Units (Total)	
60 hrs / Units 3	
7. Course administrator's name (mention all, if more than one name)	
Name: Maher Faeq Mohammed Email: maher_usm@ntu.edu.iq	
8. Course Objectives	
Course Objectives	The course 'Power System Control' aims to equip students with the knowledge and skills necessary to understand the design and organization of power system components and electrical machines, enabling them to analyze the performance of various systems and design effective control systems." **Key Objectives:** 1. **Understanding Power Systems:** ○ Introduce students to the basics power system, including the power electronics circuit and electrical machines. ○ Explain the principles of control circuits and how they apply to power systems. 2. **Controlled Rectifier:** ○ Study controlled rectifier and their role in electrical machines control. ○ Enable students to analyze and design simple circuits. 3. **DC Choppers:** ○ Teach students how to design modular systems and understand their advantages. ○ Apply modular design principles to computer architecture. 4. **Performance Evaluation:** ○ Introduce methods for evaluating computer system performance. ○ Discuss trade-offs in design and optimization techniques. **Special Objectives for the Course:** • Provide students with the skills to analyze and design computer architectures. • Enhance problem-solving abilities in hardware and

	software integration.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1	**2T**	**If a student completes this effective course, they will be able to:** **Knowledge: Understand single-phase components with resistive loads** **Skills for analyzing single-phase components with**	Single-phase half-wave rectifier circuits with resistive load	T	Tests and Reports

		resistive load			
	2P	**Knowledge: The student will be familiar with single-phase rectifier circuits with resistive loads.** **Skills: They will be able to assemble circuit components and diagnose simple results. They will be safe with electronic components and work in teams.** **Values: They will learn the importance of handling**	Single-phase half-wave rectifier circuits with resistive load	P	
2	**2T**	**Knowledge: The student will be familiar with single-phase rectifier circuits with a capacitive load.** **Skills: They will be able to assemble circuit components and diagnose simple results.** **Values: They will learn the importance of safe handling of electronic components and teamwork.**	Single-phase half-wave rectifier circuits with resistive load	T	Tests and Reports
	2P	**Knowledge: The student will be familiar with single-phase rectifier circuits with a capacitive load.** **Skills: They will be able to assemble circuit components and diagnose simple results.** **Values: They will learn the importance of safe handling of electronic components and teamwork.**	Single-phase half-wave rectifier circuits with resistive load	P	
3	**2T**	Knowledge: The student will be introduced to single-phase, full-wave rectifier circuits with a capacitive load. Skills: They will be able	Single-phase full-wave rectifier circuits	T	Tests and Reports

		to assemble circuit components, diagnose simple results, and thyristor operation. Values: They will learn the importance of safe handling of electronic components and teamwork.	controlled by capacitive load		
	2P	Knowledge: Understanding the types of single-phase capacitive-loaded full-wave rectifier circuits. Skills: Developing and integrating single-phase capacitive-loaded full-wave rectifier circuit components. Values: Appreciating the importance of modular design and collaboration in power electronics development.	Single-phase full-wave rectifier circuits controlled by capacitive load	P	
4	**2T**	Knowledge: Understanding the operation of three-phase half-wave rectifier circuits Skills: Analyzing the performance of three-phase half-wave rectifier circuits with output voltage waves Values: Emphasis on efficiency and accuracy in designing three-phase controlled half-wave rectifier circuits	Three-phase controlled half-wave rectifier	T	Tests and Reports
	2P	Knowledge: Understanding the operation of three-phase half-wave rectifier circuits Skills: Analyzing the performance of three-phase half-wave rectifier circuits with output voltage waves Values: Emphasis on	Three-phase controlled half-wave rectifier	P	

		efficiency and accuracy in designing three-phase controlled half-wave rectifier circuits			
5	**2T**	Knowledge: Understanding the operation of three-phase full-wave rectifier circuits Skills: Analyzing the performance of three-phase full-wave rectifier circuits with output voltage waves Values: Focusing on efficiency and accuracy in the design of three-phase controlled full-wave rectifier circuits	Three-phase controlled full wave rectifier	T	Tests and Reports
	2P	Knowledge: Understanding the operation of three-phase full-wave rectifier circuits Skills: Analyzing the performance of three-phase full-wave rectifier circuits with output voltage waves Values: Focusing on efficiency and accuracy in the design of three-phase controlled full-wave rectifier circuits	Three-phase controlled full wave rectifier	P	
6	**2T**	Knowledge: Understanding the components of DC chopper circuits Skills: Analyzing the performance of DC chopper circuits using mathematical model Values: Focusing on efficiency and accuracy in the design of interrupter circuits	DC chopper circuits	T	Tests and Reports
	2P	Knowledge: Understanding the components of DC interrupter circuits	DC chopper circuits	P	

		Skills: Analyzing the performance of DC chopper circuits using Values: Focusing on efficiency and accuracy in the design of chopper circuits			
7	**2T**	Knowledge: Understanding the operation of a single-phase inverter (transistor operation sequence) and the relationship between voltage and current. Skills: The ability to select the appropriate transistor type and addressing method to optimize inverter performance. Values: Paying attention to accuracy and efficiency in using switches.	single-phase bridge inverter	T	Tests and Reports
	2P	Knowledge: Understanding the operation of a single-phase inverter (transistor operation sequence) and the relationship between voltage and current. Skills: The ability to select the appropriate transistor type and addressing method to optimize inverter performance.	single-phase bridge inverter	P	
8	**2T**	Knowledge: Understand the operation of a quasi-square-wave inverter. Skills: Analyze circuit performance and its equations. Values: Estimate design efficiency and the impact of control techniques on inverter performance.	Quasi-square wave inverter	T	Tests and Reports
	2P	Knowledge: Understand the components and functions of an inverter circuit.	Quasi-square wave inverter	P	

		Skills: Ability to analyze and program the operation of power switches (transistors). Values: Emphasize efficiency and reliability in designing quasi-square-wave inverter circuits.			
9	**2T**	Knowledge: Understanding the 120-degree three-phase bridge inverter circuit Skills: Analyzing inverter performance using switching sequences Values: Estimating design efficiency and the impact of control techniques on inverter performance	Three phase bridge inverters (120-degree mode)	T	Tests and Reports
	2P	Knowledge: Understanding circuit fundamentals and current and voltage waveforms Skills: Ability to simulate inverter circuits in MATLAB or specialized software Values: Paying attention to circuit operation accuracy and promoting teamwork in developing inverter circuits	Three phase bridge inverters (120-degree mode) Vi Sto Te s	P	
10	**2T**	Knowledge: Understanding the 180-degree three-phase bridge inverter circuit Skills: Analyzing inverter performance using switching sequences Values: Estimating design efficiency and the impact of control techniques on inverter performance	Three phase bridge inverters (180-degree mode) Co Sy De	T	Tests and Reports
	2P	Knowledge: Understanding circuit fundamentals and current and voltage waveforms Skills: Ability to simulate inverter circuits in MATLAB or specialized		P	

		software Values: Paying attention to circuit operation accuracy and promoting teamwork in developing inverter circuits	Three phase bridge inverters (180-degree mode)		
11	**2T**	Knowledge: Understanding circuit components, their functions, and interactions Skills: Ability to analyze and design AC voltage controllers Values: Innovation, precision, and teamwork in developing technical solutions	AC voltage controllers	T	Tests and Reports
	2P	Knowledge: Understanding circuit outputs Skills: Analyzing and simulating circuit performance using MATLAB Values: Estimating design efficiency and the impact of control techniques on circuit performance	AC voltage controllers	P	
12	**2T**	Knowledge: Understanding the mathematical and physical principles of cyclic frequency converter operation Skills: Ability to analyze the operation of a cyclic frequency converter circuit Values: Commitment to accuracy and scientific methodology in analyzing engineering systems	cycloconve rter	T	Tests and Reports
	2P	Knowledge: Understanding the mathematical and physical principles of cyclic frequency converter		P	

		operation Skills: Ability to simulate the operation of a cyclic frequency converter circuit using a computer Values: Commitment to accuracy and scientific methodology in analyzing engineering systems	cycloconve rter		
13	**2T**	Knowledge: Understanding the working principle and components of DC machines Skills: The ability to explain the components and working principle of DC machines Values: Appreciating the importance of DC machine components	DC machines	T	Tests and Reports
	2P	Knowledge: Understanding the working principle and components of DC machines Skills: The ability to explain the components and working principle of DC machines Values: Appreciating the importance of DC machine components	DC machines	P	
14	**2T**	Knowledge: Understanding torque and speed equations and their variables in DC machines Skills: Analyzing and calculating speed and torque for DC machines Values: Innovating in machine design and contributing to the development of	Speed and Torque in DC machines	T	Tests and Reports

		sustainable and effective technical solutions.			
	2P	Knowledge: Understanding torque and speed equations and their variables in DC machines Skills: Analyzing and calculating speed and torque for various types of DC machines Values: Evaluating the operation of various types of motors using a simulation system in MATLAB	Speed and Torque in DC machines	P	
15	**2T**	Knowledge: Understanding the process of controlling DC motors using power electronics circuits Skills: Controlling the operation of DC motors using power electronics circuits Values: Enhancing the efficiency of control systems	Speed control of DC machine s	T	Tests and Reports
	2P	Knowledge: Understanding the process of controlling DC motors using power electronics circuits Skills: Controlling the operation of DC motors using power electronics and computer circuits Values: Enhancing the efficiency of control systems	Speed control of DC machines	P	

11.Course Evaluation

The grades:

Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	1] Muhammad H. Rashid, Power Electronics: Devices, Circuits, and Applications, Publisher: Pearson 2013 . [2] J. Robert W. Erickson, Dragan Maksimović, Fundamentals of Po Electronics Publisher: Springer, 2001.
Main references (sources)	[3] Paul C. Krause, with Oleg Wasynczuk, Scott D. Sudhoff, Ste Pekarek, " Analysis of Electric Machinery and Drive Systems," Publis Wiley-IEEE Press 2022
Recommended books and references (scientific journals, reports...)	[4] Haroon Ashfaq " Power Electronics and Electric Machines," Publisher: Dhanpat Rai & Co. 2017
Electronic References, Websites	1. IEEE Xplore Digital Library [1] IEEE Xplore, "Digital Library for power electronics Research." [Online]. Available: https://ieeexplore.ieee.org/ 2. ACM Digital Library

1. Course Name:
Digital Signal Processing
2. Course Code:
ECE405
3. Semester / Year:
Second Semester / Fourth Year
4. Description Preparation Date:
2024
5. Available Attendance Forms:
Weekly (theoretical and practical lectures) - Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
200 hours total / 3 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Email:
8. Course Objectives

Course Objectives	• To teach students the fundamentals of "Digital Signal Processing" and provide them with the knowledge and skills necessary to understand, analyze, and design digital signal processing systems, enabling them to apply these techniques in engineering and communications fields. • To develop students' capabilities in designing and analyzing digital filters and digital systems using appropriate mathematical tools. • To enable students to use specialized software and tools in signal processing applications.

9. Teaching and Learning Strategies

Strategy	Teaching Methods: • Theoretical lectures: to achieve cognitive objectives • Practical laboratory applications: for curriculum components to achieve skills • Dialogues and discussions: during theoretical and practical lectures to achieve • Using general engineering principles: for analyzing and designing engineering problems • Application of programming principles and rules: for programmable control systems design

	Assessment Methods: • Theoretical examinations: periodic and semester exams to verify (A1-A4) • Practical examinations: periodic and semester exams to verify (B1-B4) • Short tests (Quizzes): continuous assessment • Classroom dialogues and discussions: to verify (A1-A2) • Assignments (Homework's): practical applications • Classroom result presentations: for discussion and student participation

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learnin g method	Evaluation method
1	**2T**	**If the student successfully completes this course, he will be able to:** **Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Introducti on to Digital Signal Processin g	T	Tests and Reports
	2P	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Uses specialized software,	Introduction to Signal Processing	P	

		such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems			
2	**2T**	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Basic Signals	T	Tests and Reports
	2P	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Continuous Time Signal Generation	P	
3	**2T**	**Knowledge**: Comprehends sampling theory and its importance	Sampling and Reconstruction	T	Tests and Reports

		in converting analog signals to digital and vice versa **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems			
	2P	**Knowledge**: Comprehends sampling theory and its importance in converting analog signals to digital and vice versa **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Discrete Time Signal Generation	P	
4-5	**2T**	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate	Discrete Time Signals and Systems	T	Tests and Reports

		mathematical tools **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems			
	2P	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Basic Signals and Impulse Function	P	
6	**2T**	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Develops skills in designing and implementing digital filters to achieve specific frequency response	Time Domain Representation of Systems	T	Tests and Reports

		Values: Promotes accuracy and discipline in analyzing and designing digital signal processing systems			
	2P	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Develops skills in designing and implementing digital filters to achieve specific frequency response Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms frequency response **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Step Function	P	
7	**2T**	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics Knows the design of digital filters of various types, such as FIR and IIR, and their applications in processing **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Uses specialized software,	Midterm Exam	T	Tests and Reports

		such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Develops appreciation for the importance of digital signal processing in modern engineering and technological applications Encourages critical and creative thinking in developing innovative solutions to signal processing problems Promotes commitment to ethical and professional standards in practicing signal processing engineering			
	2P	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics Knows the design of digital filters of various types, such as FIR and IIR, and their applications in processing **Skills**: Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Ramp Function	P	

		Develops appreciation for the importance of digital signal processing in modern engineering and technological applications Encourages critical and creative thinking in developing innovative solutions to signal processing problems Promotes commitment to ethical and professional standards in practicing signal processing engineering			
8	**2T**	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Develops skills in designing and implementing digital filters to achieve specific frequency response **Values**: Develops appreciation for the importance of digital signal processing in modern engineering and technological applications	Block Diagram Representation	T	Tests and Reports
	2P	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools	Basic Signal Operations	P	

		Develops skills in designing and implementing digital filters to achieve specific frequency response Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Develops appreciation for the importance of digital signal processing in modern engineering and technological applications			
9-10	**2T**	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Develops appreciation for the importance of digital signal processing in modern engineering and technological applications	Fourier Analysis of Discrete Time Signals (DFT and FFT)	T	Tests and Reports
	2P	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools	Basic Signal Operations	P	

		Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Develops appreciation for the importance of digital signal processing in modern engineering and technological applications			
11	**2T**	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Develops skills in designing and implementing digital filters to achieve specific frequency response **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Encourages critical and creative thinking in developing innovative solutions to signal processing problems	Z-Transform and Transfer Function Analysis	T	Tests and Reports
	2P	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals	Signal Classification	P	

		Skills: Develops the ability to analyze digital signals using appropriate mathematical tools Develops skills in designing and implementing digital filters to achieve specific frequency response **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Encourages critical and creative thinking in developing innovative solutions to signal processing problems			
12-133	**2T**	**Knowledge**: Knows the design of digital filters of various types, such as FIR and IIR, and their applications in processing **Skills**: Develops skills in designing and implementing digital filters to achieve specific frequency response Applies digital signal processing techniques in fields such as audio and image processing and communications Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing	Digital Filter Design (FIR and IIR)	T	Tests and Reports

		systems Encourages critical and creative thinking in developing innovative solutions to signal processing problems			
	2P	**Knowledge**: Knows the design of digital filters of various types, such as FIR and IIR, and their applications in processing **Skills**: Develops skills in designing and implementing digital filters to achieve specific frequency response Applies digital signal processing techniques in fields such as audio and image processing and communications **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Encourages critical and creative thinking in developing innovative solutions to signal processing problems	Even and Odd Signals and Signal Addition	P	
14	**2T**	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals Knows the design of digital filters of various types, such as FIR and IIR, and their applications in processing **Skills**: Applies digital signal processing techniques in fields such	Wavelet Transform and Applications	T	Tests and Reports

		as audio and image processing and communications Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Encourages critical and creative thinking in developing innovative solutions to signal processing problems			
	2P	**Knowledge**: Recognizes discrete Fourier transforms and Z-transform and their use in analyzing digital signals Knows the design of digital filters of various types, such as FIR and IIR, and their applications in processing **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools Uses specialized software, such as MATLAB, to implement and analyze signal processing algorithms **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems Encourages critical and creative thinking in	Signal Multiplication	P	

		developing innovative solutions to signal processing problems			
15	**2T**	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Preparatory Week	T	Tests and Reports
	2P	**Knowledge**: Understands basic concepts of digital signals and systems, including types of signals and their characteristics **Skills**: Develops the ability to analyze digital signals using appropriate mathematical tools **Values**: Promotes accuracy and discipline in analyzing and designing digital signal processing systems	Linear Time-Invariant System	P	

11.Course Evaluation

The grades:	
Coursework	10
Practical	10
Midterm Exam	30
Final Exam	50
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Digital Signal Processing: Principles, Algorithm and Applications (4th Edition) Authors: John G. Proakis & Dimitris G. Manolal
Main references (sources)	
Recommended books and references (scientific	Digital Signal Processing Using MATLAB

journals, reports...)	Authors: Vinay K. Ingle & John G. Proakis
Electronic References, Websites	MIT OpenCourseWare - Digital Signal Processi URL: https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011

1. Course Name:
Internet of Things (IoT)
2. Course Code:
ECE408
3. Semester / Year:
1st semester / Fourth Year
4. Description Preparation Date:
1-9-2024
5. Available Attendance Forms:
In-person lectures
6. Number of Credit Hours (Total) / Number of Units (Total):
3 Hours
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Sarmad Nozad Mahmood Email: Sarmad.nozad23@ntu.edu.iq
8. Course Objectives
Course Objectives 1. Introduce the fundamental concepts and architecture of the Internet of Things (IoT), including hardware, software, and communication technologies. 2. Develop the ability to interface sensors and actuators with microcontrollers for real-time data acquisition and control. 3. Enable students to design and implement IoT systems using common platforms such as Arduino, Raspberry Pi, and cloud-based services. 4. Explore key IoT communication protocols such as MQTT, HTTP, and CoAP, and their application in networked embedded systems. 5. Analyze the challenges of security, privacy, and scalability in IoT environments, and investigate real-world applications across various domains.

9. Teaching and Learning Strategies	
Strategy	Teaching Methods: • Interactive Lectures • Presentations • Group Projects • Case Studies • Discussions Assessment Methods: • Quizzes and Homework • Practical reports • Midterm Exam • Final Exam • Group Project and Presentations

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learnin g method**	**Evaluation method**
1	3T	Knowledge: Understand IoT definitions, history, and applications Skills: Identify domains where IoT is used Values: Appreciate IoT's impact on daily life	Introduction to IoT	Interactive Lecture	Tests and Reports
2	3T	Knowledge: Describe layered architecture of IoT systems Skills: Relate components to real-world cases Values: Promote systematic thinking	IoT Architecture and Ecosystem	Lecture an Concept Mapping	Tests and Reports
3	3T	Knowledge: Identify types and functions of sensors and actuators Skills: Analyze signal conversion from physical to digital Values: Value accurate data acquisition	Sensors and Actuators	Illustrated Lecture + Demonstra n	Tests and Reports
4	3T	Knowledge: Explain microcontroller roles in IoT Skills: Compare embedded hardware options Values: Acknowledge technical constraints	Embedded Systems for IoT	Comparati Analysis	Tests and Reports
5	3T	Knowledge: Recognize wireless standards used in IoT Skills: Choose suitable communication protocols Values: Value reliability and compatibility	IoT Communication Technologies	Problem-Solving Session	Quiz
6	3T	Knowledge: Understand how devices connect over IP networks Skills: Describe addressing and routing mechanisms Values: Appreciate robust networking	Networking Basics for IoT	Lecture + Visual Aid	Tests and Reports
7	3T	Knowledge: Differentiate	IoT Protocols	Case Study	Tests and R

		among IoT communication protocols Skills: Evaluate protocol use in constrained environments Values: Promote efficient communication	(MQTT, CoAP, HTTP)	Discussion	eports
8	3T	Knowledge: Understand the flow and value of IoT data Skills: Describe how data is collected, stored, and analyzed Values: Promote data-driven thinking	Data Collection and Analytics	Lecture + Data Flow Analysis	Presentation
9	3T	Knowledge: Differentiate cloud vs. edge computing Skills: Explain their effect on latency and resource usage Values: Encourage optimal system design	Cloud and Edge Computing	Comparati Lecture + Discussion	Tests and Reports
10	3T	Knowledge: Identify common security risks Skills: Discuss protection strategies and best practices Values: Promote ethical responsibility	IoT Security and Privacy	Lecture + Risk Scena Analysis	Tests and Reports
11	3T	Knowledge: Learn about power management in IoT devices Skills: Identify ways to reduce energy consumption Values: Encourage eco-friendly design	Energy Efficiency in IoT	Concept-based Discussion	Tests and Reports
12	3T	Knowledge: Describe features of major IoT platforms Skills: Match platform features to application needs Values: Promote informed technology use	IoT Platforms and Frameworks	Lecture + Platform Compariso	Tests and Reports
13	3T	Knowledge: Understand domain-specific applications of IoT Skills: Analyze use case requirements and adaptations	Smart Applications of IoT	Case Study Review	Tests and Reports

		Values: Promote innovation and problem-solving			
14	3T	Knowledge: Review implemented IoT solutions Skills: Critique performance and challenges of real systems Values: Encourage critical evaluation	IoT Case Studies and Projects	Group Presentatio and Reflection	Tests and Reports
15	3T	Knowledge: Explore advancements like AIoT, 5G, digital twins Skills: Anticipate emerging tech in IoT space Values: Promote continuous learning and foresight	Future Trends in IoT	Seminar-st Session	Tests and Reports

11. Course Evaluation

The grades: 100%	
Midterm Exam	15
Presentation	15
Assignment & Quiz	10
Final Exam	60
Total	100

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• B. Raj Kamal, Internet of Things: Architecture and Design, McGraw-Hill Education, 2017. • Arshdeep Bahga and Vijay Madisetti, Internet Things: A Hands-on Approach, Universities Press, 2015.
Main references (sources)	• Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley 2016. • Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley, 2013. • Peter Waher, Learning Internet of Things, Pack Publishing, 2015.
Recommended books and references (scientific journals, reports...)	• IEEE Internet of Things Journal • ACM Transactions on Internet Technology • International Journal of Internet of Things and Cyber-Assurance • ITU Reports on IoT Standards and Trends • McKinsey Global Institute: The Internet of Things: Mapping the Value Beyond the Hype,

	2015
Electronic References, Websites	• https://www.iotforall.com – Tutorials and industry news • https://www.postscapes.com – IoT use cases ar trends • https://www.arduino.cc – Development platfor documentation • https://thingspeak.com – IoT cloud platform fo data collection • https://aws.amazon.com/iot/ – Amazon Web Services IoT Core documentation