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

Guide to the Academic Program and Course Description

2025-2024

Republic of Iraq
Ministry of higher education & scientific
research Supervision and scientific
evaluation directorate

Quality assurance and academic accreditation

Academic program specification form for the academic

University: Northern Technical University

College: Eng. Technical College/ Mosul

Department: Medical Instrumentation Techniques Engineering

Date of form completion: 15/10/2024

Dean's name	Dean's assistant for scientific affairs	Head of the Department
Majid Najim Khalel	**Mohammed S. Jarjees**	**Zaid Husham Dahham**
Date:	Date:	Date:
Signature:	Signature:	Signature

Quality Assurance and University performance manager

Name: Nour Kahtan

Date:

Signature

Introduction:

The educational program is considered a coordinated and organized package of academic courses that includes procedures and experiences structured into curriculum elements. Its primary purpose is to build and refine the skills of graduates, making them qualified to meet labor market demands. The program is reviewed and evaluated annually through internal or external auditing procedures and programs, such as the external examiner program.

The academic program description provides a brief summary of the main features of the program and its courses, highlighting the skills to be developed in students based on the academic program's objectives. This description is of significant importance as it serves as the cornerstone for obtaining program accreditation. It is written collaboratively by the teaching staff under the supervision of scientific committees within the academic departments.

This second edition of the guide includes an updated description of the academic program, reflecting revisions and changes made to the previous version in light of recent developments and advancements in the Iraqi educational system. It includes both the traditional formats (annual and semester-based systems) as well as the standardized program description adopted by the Directorate of Studies under letter number 2906/3م ت dated 3/5/2023, concerning programs that follow the Bologna Process as their framework.

In this regard, we emphasize the importance of preparing accurate academic program and course descriptions to ensure the smooth and effective operation of the educational process.

Concepts and Terminology:

- **Academic Program Description:**

  Provides a brief summary of the program's vision, mission, and objectives, including a precise description of the intended learning outcomes based on defined learning strategies.

- **Course Description:**

  Offers a concise summary of the key characteristics of the course and the expected learning outcomes that students are to achieve, demonstrating whether they have maximized the learning opportunities provided. It is derived from the academic program description.

- **Program Vision:**

  An aspirational image of the future of the academic program, aiming to be advanced, inspiring, motivating, realistic, and achievable.

- **Program Mission:**

  Clearly outlines the objectives and the activities required to achieve them in a brief manner, and defines the developmental pathways and directions of the program.

- **Program Objectives:**

  Statements describing what the academic program intends to achieve within a specific period. These objectives should be measurable and observable.

- **Curriculum Structure:**

  All academic courses/subjects included in the academic program based on the adopted learning system (semester-based, annual, or Bologna Process), including required courses (at the ministry, university, college, or departmental level) and the number of credit units.

- **Learning Outcomes:**

  A coherent set of knowledge, skills, and values acquired by the student upon successful completion of the academic program. Learning outcomes must be defined for each course in a way that supports the program's objectives.

- **Teaching and Learning Strategies:**

  Strategies used by faculty members to enhance student learning and development. These are planned methods followed to achieve learning goals, encompassing both in-class and extracurricular activities designed to attain the program’s learning outcomes.

Program Vision

To be a leading department in the field of Biomedical Equipment Engineering, specializing in the design and development of innovative, high-quality medical devices through a strong integration of engineering sciences and medical knowledge. We strive to achieve scientific and technological advancement to improve healthcare and facilitate the diagnosis and treatment of patients.

Program Mission

The Biomedical Equipment Engineering Technology program outlines the knowledge and skills required to work in the installation, calibration, and maintenance of medical devices. The program focuses on developing technical expertise in the medical equipment sector, emerging medical technologies, hospital management, and medical device maintenance. It typically consists of classroom lectures, hands-on training, and fieldwork.

In addition, the program emphasizes the development of technical skills such as electrical circuit design, computer-aided design, microcontroller programming, cost estimation, and medical project management. The program aims to equip graduates with the necessary skills to work as biomedical equipment engineers, leaders of biomedical engineering teams, medical device inspectors, cost estimators, and other technical roles within the biomedical engineering field.

Program Objectives

1. **Academic Excellence:**
   Provide distinguished educational programs in the field of Biomedical Equipment Engineering that cover fundamental concepts and practical applications, contributing to the development of students' skills and scientific knowledge.
2. **Research and Development:**
   Promote scientific research and technological development in biomedical equipment engineering by establishing specialized research teams focused on developing new technologies and devices, and exploring innovative techniques to improve healthcare.
3. **Collaborative Partnerships:**
   Strengthen collaboration and partnerships with medical institutions, technology companies, and the medical community by establishing strategic partnerships and knowledge-exchange programs aimed at enhancing practical applications and medical device technologies.
4. **Quality and Accreditation:**
   Commit to the highest standards of quality and safety in the design and manufacturing of medical devices, and strive to obtain internationally recognized accreditations and certifications in this field.

5. **Professional Development:**
   Provide continuous development opportunities for faculty and staff through training programs, workshops, and conferences to maintain a high level of expertise and academic aspiration.
6. **Community Service:**
   Contribute to community service and the improvement of healthcare by offering expertise and technical consultations in the field of biomedical equipment engineering, and participating in health- and treatment-related social initiatives.

2. Program Accreditation

N/A

Other External Influences

N/A

Program Structure

	Percentage	Credits	No. of Courses	Program structure
Secondary		40	16	**Institutional Requirements**
Basic		42	8	**College requirements**
Basic		144	24	**Dept. requirements**
basic		-	2	**Summer training**
			None	**Others**

1. وصف البرنامج

Hours		Name	Code	Year/ class
2+2	Th. + pr.	Diagnostic medical instruments	MIE301	**3rd**
2+2	Th. + pr.	Power electronics	MIE302	
2+2	Th. + pr.	Signal processing	MIE303	

2+2	Th. + pr.	Communication systems	MIE304	
2	Th.	English language	MIE305	
3+1	Th. + pr.	computer	MIE306	
2+2	Th. + pr.	Medical electronics	MIE307	
2+2	Th. + pr.	Medical communication	MIE308	
2+2	Th. + pr.	Microprocessors	MIE309	
2+2	Th. + pr.	Digital signal processing	MIE310	
2+2	Th. + pr.	Electrical technology	MIE311	
	pr.	Summer training	MIE312	
2+2	Th. + pr.	Medical Therapeutic instruments	MIE401	4^{th}
2+2	Th. + pr.	Medical laser system	MIE402	
2+2	Th. + pr.	Digital image processor	MIE403	
2	Th.	Research methodology	MIE404	
2	Th.	Engineering management	MIE405	
2+2	Th. + pr.	Microcontrollers	MIE406	
2+2	Th. + pr.	Radiation engineering	MIE407	
2	Th.	Computer application	MIE408	
2+2	Th. + pr.	Control system	MIE409	
2	Th.	English language	MIE410	
2	Pr.	project	MIE411	

Expected Learning Outcomes of the Program

- Understand the engineering fundamentals related to medical electronics, biophysics, and programming.
- Grasp basic medical principles such as anatomy, physiology, and biosignals.
- Acquire knowledge of methods for designing, developing, and maintaining various medical devices.

- Be familiar with international standards (FDA, ISO, IEC) related to medical device safety.
- Identify the latest technologies used in medical imaging, prosthetics, and medical artificial intelligence.
- Understand statistical analysis methods for medical data and apply biomedical and signal analysis techniques.

Skills

- bility to operate, adjust, and maintain modern medical devices.
- Analyze medical signals (ECG, EEG, MRI, CT Scan) and extract vital information.
- Design medical electronic circuits and use engineering software such as MATLAB, LabVIEW, and Proteus.
- Program and control medical devices using Arduino, Raspberry Pi, and PLCs.
- Apply artificial intelligence (AI) and Internet of Things (IoT) technologies in the medical field.
- Assess potential risks in medical devices and conduct quality and safety testing.
- Work within multidisciplinary teams to develop medical device projects and analyze healthcare sector needs.

- Adhere to professional ethics in handling medical devices and interacting with patients.
- Follow safety and quality standards in the operation and maintenance of medical equipment.
- Promote a culture of continuous learning and innovation to keep pace with advancements in medical technology.
- Commit to teamwork and collaboration with doctors, engineers, and technicians to improve healthcare services.
- Respect patient rights and maintain confidentiality of medical information.
- □ Apply sustainability principles in developing environmentally friendly engineering solutions.

2. Teaching and Learning Strategies

. Teaching and Learning Strategies

First: Teaching Strategies

1. **Interactive Lectures**

- Deliver theoretical concepts using presentations, educational videos, and illustrative tools.
- Engage students through questions, discussions, and practical applications.

2. **Problem-Based Learning (PBL)**

- Present students with real engineering problems related to medical devices and encourage them to analyze and develop innovative solutions.

- Promote critical thinking and teamwork in problem-solving.

3. **Project-Based Learning (PjBL)**

- Implement practical projects involving the design, development, or improvement of medical devices.
- Enhance research, development, and innovation skills.

4. **Laboratory and Hands-on Training**

- Provide a practical learning environment through medical and engineering laboratories.
- Use simulators and experimental systems for testing and maintaining medical equipment.

5. **E-Learning & Blended Learning**

- Utilize online learning platforms such as Moodle and Google Classroom to support self-learning.
- Integrate traditional education with e-learning to enhance the learning experience.

6. **Case-Based Learning (CBL)**

- Analyze real medical and engineering cases to understand how medical devices are applied in diagnosis and treatment.

Second: Learning Strategies

1. **Active Learning**

- Engage students in interactive activities such as experiments, discussions, and case studies.
- Encourage critical and creative thinking in problem-solving.

2. **Collaborative Learning**

- Work in multidisciplinary teams to solve real-world engineering problems.
- Foster communication and teamwork skills.

3. **Self-Directed Learning**

- Motivate students to research and stay updated with the latest developments in medical devices through scientific articles and specialized journals.
- Encourage participation in online training courses such as those offered by Coursera and edX.

4. **Research-Based Learning**

- Involve students in applied research and graduation projects to solve real medical challenges.
- Use data analysis tools to interpret results from engineering and medical experiments.

5. **Experiential Learning**

- Participate in field training at hospitals and medical device companies to gain practical experience.
- Implement simulation models to develop and test medical devices.

.2 طرائق التقييم

Assessment Methods in the Department of Biomedical Equipment Engineering

The student assessment process in the Department of Biomedical Equipment Engineering relies on a variety of methods to ensure that learning outcomes are achieved across cognitive, technical, and ethical domains. These methods are categorized into **Formative Assessments** conducted during the academic term and **Summative Assessments** carried out at the end of a course or program.

First: Formative Assessment

Formative assessment is conducted continuously throughout the learning process to enhance student performance and provide guidance. Key methods include:

1. **Quizzes & Short Tests**
   - Quick assessments to measure students' understanding of core concepts.
   - Can be paper-based or electronic via e-learning platforms.
2. **Peer Assessment**
   - Students evaluate their peers during presentations or projects.
   - Aims to enhance critical thinking and peer interaction.
3. **Assignments & Reports**
   - Submission of technical reports on lab experiments or scientific literature reviews.
   - Evaluation focuses on analytical accuracy, scientific documentation, and presentation quality.
4. **Classroom Participation & Discussions**
   - Evaluation of students' participation in lectures, their ability to ask questions, and analyze problems.
5. **Laboratory Assessment**
   - Assessment of students' performance in executing experiments, analyzing data, and operating medical devices.

- Based on accuracy, adherence to safety standards, and capability in maintaining equipment.

Second: Summative Assessment

These are conducted at the end of courses or academic programs to measure the achievement of learning outcomes. They include:

1. **Final Exams**
   - Comprehensive exams including essay questions, multiple choice, and applied problem-solving.
   - Measure students' analytical thinking, understanding, and application of engineering and medical concepts.
2. **Capstone Projects**
   - Involves designing and developing a medical device or engineering solution to a specific medical problem.
   - Evaluated by an academic and professional committee based on innovation and quality standards.
3. **Presentations**
   - Students present their graduation projects or research topics to a panel of professors and specialists.
   - Assessment is based on clarity, depth of analysis, and communication and persuasion skills.
4. **Internship Evaluation**
   - Evaluation of student performance during training in hospitals or medical device companies.
   - Based on:
     - Proficiency in operating and maintaining medical devices.
     - Commitment to professional ethics and interaction with the team.
5. **Research & Publications**
   - Encouraging students to write and publish research papers in conferences or scientific journals.
   - Evaluation based on scientific research standards: methodology, analysis, and originality of the idea

3. Academic staff

No. of staff		Requirements		Specialization		Scientific degree
Part time	Full time			Specific	General	
						Prof
	5			1	4	Assist. prof
	8			4	4	lecturer
	14			5	9	Assist. lwecturer

Professional Development

Orientation for New Faculty Members

First: Orientation Program for New Faculty Members

1. **Introduction to the Academic Environment**
   - Provide an overview of the university, college, and department, including academic regulations and organizational structure.
   - Introduce the department's vision, mission, and educational objectives.
2. **Training in Modern Teaching Strategies**
   - Workshops on effective teaching methods, curriculum design, and assessment techniques.
   - Training in e-learning and the use of platforms like Moodle and Google Classroom.
   - Application of active and interactive learning strategies to enhance student engagement.
3. **Academic Advising and Student Supervision**
   - Explain how to provide academic and professional guidance to students.
   - Present effective methods for supervising graduation projects and scientific research.
4. **Research Development and Scientific Publishing**
   - Workshops on preparing research papers, academic writing, and publishing in reputable scientific journals.
   - Introduce research funding sources and academic grant opportunities.
   - Encourage participation in scientific conferences and workshops.
5. **Training in Professional Ethics**
   - Emphasize academic responsibility, scientific integrity, and ethical interactions with students and colleagues.
   - Clarify standards for intellectual property rights in research and teaching.

Professional Development for Faculty Members

Continuous Professional Development Strategies

1. **Attending Workshops and Training Courses**
   - Organize regular workshops on the latest developments in medical devices and technology.
   - Encourage participation in specialized training programs to enhance teaching and research competencies.
2. **Collaboration with Industry and Hospitals**
   - Establish partnerships with medical device companies and hospitals to develop practical expertise.
   - Participate in applied research projects in collaboration with medical and engineering institutions.
3. **Self-Assessment and Performance Development**
   - Encourage faculty members to conduct self-assessments and analyze their strengths and weaknesses.
   - Provide feedback from students and colleagues to improve teaching skills.
4. **Supporting Innovation and Technology in Teaching**
   - Utilize modern technologies such as artificial intelligence and simulations in teaching.
   - Develop updated courses that keep pace with advancements in biomedical engineering

4. Admission Criteria

- Scientific Branch
- Evening Study
- GPA (Grade Point Average)

5. Main Sources of Information About the Program

- Textbooks
- Supplementary Sources (Internet)
- Scientific Research and Latest Updates

6. Program Development Plan

First: Current Situation Analysis (SWOT Analysis)

1. Strengths:

- Availability of integrated curricula combining engineering and medical sciences.
- Laboratories equipped with modern medical devices for practical training.
- Experienced faculty members in medical engineering and scientific research.
- Collaboration with hospitals and health institutions.

2. Weaknesses:

- Need to update curricula to keep pace with modern technologies.
- Weakness in using e-learning and smart technologies.
- Limited training and field opportunities for students.

3. Opportunities:

- Rapid developments in artificial intelligence and Internet of Things in medical devices.
- Increasing demand for biomedical engineers in the job market.
- Potential collaboration with international universities and medical companies.

4. Threats:

- Competition with other academic programs.
- Need for additional funding to develop laboratories and research projects.

Second: Strategic Goals for Program Development

1. **Updating Curricula**
    - Introducing new courses on artificial intelligence, Internet of Things, and 3D bioprinting technologies.
    - Enhancing practical training and applied research projects.
    - Designing courses focused on entrepreneurship in the field of medical devices.
2. **Developing Laboratories and Infrastructure**
    - Upgrading laboratories with modern devices such as medical imaging equipment and surgical robots.
    - Establishing a clinical simulation lab to train students on medical devices in a realistic environment.
3. **Enhancing Scientific Research and Innovation**
    - Encouraging research on implantable devices, medical robotics, and biomedical signal processing.
    - Supporting publication of research in reputable scientific journals and forming research partnerships.
    - Creating specialized research centers in cooperation with health and industrial entities.
4. **Expanding Training Opportunities and Industry Collaboration**
    - Signing agreements with hospitals, medical companies, and research centers to provide field training opportunities.

- Developing student and academic exchange programs with international universities.

5. **Promoting E-learning and Self-learning**
   - Applying e-learning technologies, virtual classrooms, and augmented reality in teaching.
   - Developing a digital platform with specialized courses in medical devices.
6. **Improving Faculty Competence**
   - Organizing workshops and training courses for faculty on the latest developments in medical engineering.
   - Encouraging obtaining international certifications in the field.
7. **Supporting Entrepreneurship and Innovation in Medical Devices**
   - Motivating students to design innovative medical products through business incubators.
   - Organizing competitions and conferences to showcase entrepreneurial projects in medical engineering.

Third: Implementation Mechanisms for the Development Plan

- Forming academic development committees to monitor implementation of updates.
- Conducting periodic surveys to gather feedback from students and employers about the program.
- Measuring development impact through performance indicators such as employment rates, number of published research papers, and quality of student projects.
- Obtaining academic accreditation from recognized bodies to ensure program quality.

Program Skills Map															
Expected Learning Outcomes of the Program															
Values				Skills				Knowledge				Type	Name	Code	Level
4C	3C	2C	1C	4B	3B	2B	1B	4A	3A	2A	1A				
*	*	*	*	*	*	*	*					basic	Medical diagnosing instruments	MIE301	3rd
				*	*	*	*	*	*	*	*	basic	Power electronics	MIE302	
*		*		*	*	*		*		*	*	basic	Signal processing	MIE303	
*	*	*	*		*	*		*	*	*	*	basic	Communication systems	MIE304	
				*	*	*	*	*	*	*	*	basic	English language	MIE305	
		*	*	*	*	*	*	*	*			basic	computer	MIE306	
*	*	*	*	*	*	*	*					basic	Medical electronics	MIE307	
				*	*	*	*	*	*	*	*	basic	Medical communications	MIE308	
*		*		*	*	*		*		*	*	basic	Micro processors	MIE309	
*		*		*	*	*		*		*	*	basic	Digital signal processing	MIE310	
				*	*	*	*	*	*	*	*	basic	Electrical technology	MIE311	

		*	*	*	*	*	*	*	*			basic	Summer training	MIE312	
*	*	*	*	*	*	*	*					basic	Medical therapeutic instruments	MIE401	
				*	*	*	*	*	*	*	*	basic	Medical laser system	MIE402	
*		*		*	*	*		*		*	*	basic	Digital image processing	MIE403	
		*	*	*	*	*	*	*	*			basic	Research methodology	MIE404	
				*	*	*	*	*	*	*	*	basic	Engineering management	MIE405	4th
*	*	*	*	*	*	*	*					basic	microcontrollers	MIE406	
*		*		*	*	*		*		*	*	basic	Radiation engineering	MIE407	
				*	*	*	*	*	*	*	*	basic	Computer application	MIE408	
*	*	*	*	*	*	*	*					basic	Control systems	MIE409	
				*	*	*	*	*	*	*	*	basic	English language	MIE410	
		*	*	*	*	*	*	*	*			basic	project	MIE411	

Course Description Form

1. Course Name: **Medical Communication System**	
2. Course Code:	
3. Semester / Year: Second Semester/ Third	
4. Description Preparation Date:27−6−2025	
5. Available Attendance Forms: In-person (On-campus) Attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
4 Hours/3 Units	
7. Course administrator's name (mention all, if more than one name)	
Name: Mohammed Talal Ghazal Email: mohammed.ghazal@ntu.edu.iq	
8. Course Objectives	
Course Objectives	**1− Understand the fundamental electromagnetic principles related to medical communication, including Maxwell's equations and electrostatic fields.** **2− Analyze the behavior of electromagnetic waves in various media, particularly within rectangular waveguides and biological tissue environments.**

	3- Identify the components of microwave communication systems such as passive devices, generators, and antennas used in medical applications. **4- Design and analyze simplified models of communication systems based on microwave technologies.** **5- Apply practical experiments related to electromagnetic signal measurement and simulation using specialized tools and software.** **6- Integrate theoretical knowledge with medical applications, such as MRI systems or biomedical signal detection devices.** **7- Evaluate challenges in designing medical communication systems in terms of precision, safety, and electromagnetic interference.**
9. Teaching and Learning Strategies	
Strategy	**Teaching Strategies** • **Interactive Lectures:** Explaining theoretical concepts using illustrations and presentations, while stimulating group discussions. • **Project-Based Learning:** Assigning students practical projects at the end of the semester that combine theoretical design with real-world implementation.

	• **Class Presentations:** Students present topics such as medical antennas or microwave systems to enhance their analytical and communication skills. • **Laboratory-Based Teaching:** Conducting hands-on experiments and simulations using measurement tools and engineering software such as MATLAB or CST Studio. • **Brainstorming & Case-Based Discussion:** Analyzing real-world scenarios involving medical communication systems, such as using an antenna in an MRI device. **Learning Strategies** • **Exploratory Learning:** Encouraging students to explore simulation tools and independently analyze electromagnetic data. • **Collaborative Learning:** Dividing students into teams to solve practical problems related to circuit design or wave analysis. • **Blended Learning:** Combining theoretical instruction with interactive digital content delivered online. • **Experiential Learning:** Applying hands-on experiments and linking them to real-world medical contexts. • **Problem-Based Learning:** Presenting technical scenarios (e.g., signal loss in a waveguide) for students to analyze and resolve using appropriate tools.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		Understand the fundamental concepts of static electric fields	eral Review in ctrostatics	ractive lecture + ussion	Pre-test + practical exercise

		Comprehend the relationship between electric and magnetic fields	xwell's ations – Part 1	Theoretical explanation + illustrations	Short assignment + group discussion
		Apply Maxwell's Equations to wave propagation concepts	xwell's ations – 2 & lications	Applied teaching + real-life examples	Practical exercise + case analysis
		Apply Gauss's Law to calculate electric fields in enclosed surfaces	ss's Law – ctric	Practical examples + discussion	Short quiz
		Differentiate magnetic field characteristics using Gauss's Law	ss's Law – gnetic	Theoretical explanation + applications	Lab report
		lyze tromagnetic ve propagation ree space	form Plane ve – Properties	Graphical presentation + lab activities	Applied assignment
		npare wave avior in free ce and lectric media	W in Dielectric lia	Interactive diagrams + practical task	Individual homework
		ine waveguides describe them in energy smission	tangular veguides – cepts	Theoretical lecture + diagrams	Theoretical test + lab report
		tify wave les and cut-off uencies in eguides	pagation Modes & -off Conditions	Comparative activities + lab experiment	Practical exam + data interpretation
		ssify and erstand power ders, couplers, isolators	sive Devices – inition & Types	Applied sessions + case study	Practical test

		ign basic filter matching vorks and ess system ormance	ching & Filters in sive Devices	Group activity + workshop	Mini project + group evaluation
		lain the tion of rowave erators	rowave erators ystron, gnetron)	Illustrative presentation + educational video	Applied assignment + theory test
		erentiate enna types and ne their iation ameters	ennas – es & ameters	Interactive lecture + diagram analysis	Diagram + oral evaluation
		k antenna cifications to lical systems h as MRI and G	ennas – lical plications	Comparative discussion + applied video	Short presentation
		wcase project rk integrating ry and ctical lications	l Project entation & iew	Review session + student presentations	Comprehensive evaluation + final feedback

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

quired textbooks (curricular books, if any)	**roduction to Communication Systems"** – Ferrel G. mler A foundational textbook covering analog and tal communication principles, ideal for derstanding signal transmission in medical systems. **crowave Engineering"** – David M. Pozar dely used in engineering programs, this book vides essential theory on waveguides, antennas, microwave devices relevant to medical communication.
Main references (sources)	**edical Instrumentation: Application and sign"** – John G. Webster Offers insight into the

	ign and function of medical devices, including communication interfaces. **omedical Signal Processing and Signal deling"** – Eugene N. Bruce Focuses on signal avior in biological systems, useful for lerstanding data transmission in medical contexts.
Recommended books and references (scientific journals, reports…)	**e Routledge Handbook of Language and alth Communication** – Edited by Heidi milton & Wen-ying Sylvia Chou A comprehensive erence on communication in healthcare settings, including patient-provider interaction. **fective Medical Communication: The A, B, C, E of It** – Subhash Chandra Parija & Balachandra dkoli A practical guide to communication skills in clinical and academic medical environments.
Electronic References, Websites	PubMed Central (PMC) – A free digital archive of biomedical and life sciences journal literature. OpenMD Directory of Medical References – Curated links to trusted medical information sites like MedlinePlus, Drugs.com, and Mayo Clinic.

13. Course Name: **Medical Instrumentation (II).**
14. Course Code: **MIE 301**
15. Semester / Year: first Semester/ third
16. Description Preparation Date:17−6−2025
17. Available Attendance Forms: In-person (On-campus) Attendance
tendance (on campus) means students' actual participation in educational tivities through direct presence in classrooms, laboratories, and other ademic facilities, allowing for direct interaction with faculty members and leagues, and active participation in lectures, practical exercises, discussion sessions, and field visits related to the course.
18. Number of Credit Hours (Total) / Number of Units (Total)
4 Hours/3 Units
19. Course administrator's name (mention all, if more than one name)
Waleed Name: Noor Abdullah Email: noor.waleed@ntu.edu.iq
20. Course Objectives

Course Objectives	• **To provide an in-depth understanding of the principles and practices of sanitary engineering**, including the design, operation, and maintenance of water supply, wastewater collection, treatment, and disposal systems. • **To develop the ability to apply scientific and engineering principles** for solving complex problems related to public health, environmental protection, and sustainable urban sanitation.

	• **To equip students with the skills necessary to design and evaluate sanitary infrastructure**, such as sewerage networks, wastewater treatment plants, and solid waste management systems, in compliance with national and international standards. • **To foster critical thinking and analytical capabilities** for assessing the environmental and societal impacts of sanitation projects, including risk assessment and mitigation strategies. • **To promote the integration of modern technologies and innovative solutions** in sanitary engineering practices to address emerging challenges in urbanization, climate change, and resource management. • **To enhance competencies in interdisciplinary collaboration, communication, and ethical decision-making**, essential for professional practice in the field of sanitary and environmental engineering.

21. Teaching and Learning Strategies

Strategy	he teaching and learning strategies employed in sanitary engineering are designed to foster deep understanding, critical thinking, and practical competence in addressing complex environmental and public health challenges. These strategies integrate theoretical foundations with applied engineering practices, and include: 1. **Lectures and Interactive Seminars** Delivery of core scientific and engineering concepts through structured lectures, complemented by interactive discussions that encourage analytical reasoning and problem-solving. 2. **Laboratory and Field Work** Hands-on experiments, field investigations, and site visits to wastewater treatment plants, water supply systems, and solid waste management facilities to bridge theory and practice.

	3. **Design Studios and Project-Based Learning** Collaborative design exercises and real-world projects where students conceptualize, model, and evaluate sanitary infrastructure systems, applying standards and innovative technologies. 4. **Case Study Analysis** Critical examination of national and international case studies related to sanitation, public health interventions, and environmental management to enhance decision-making skills. 5. **Simulation and Modelling Exercises** Use of advanced software tools for hydraulic modelling, treatment process simulation, and environmental impact assessments to develop technical proficiency. 6. **Blended and E-learning Approaches** Integration of online learning platforms and digital resources to provide flexible, self-paced study opportunities and to support continuous learning beyond the classroom. 7. **Interdisciplinary and Community-Based Learning** Engagement with professionals from public health, urban planning, and environmental science, as well as community stakeholders, to promote holistic and context-sensitive solutions. 8. **Assessment and Feedback Loops** Implementation of formative and summative assessments, including technical reports, design presentations, and oral examinations, with constructive feedback to support student growth and competence.

22. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		derstand the pe and nificance of ctrophysiology	roduction to ctrophysiology	cture, cussion	iz
		scribe ctrocardiogram d their nponents.	G Device	cture, Case Study	itten signment
		alyze sources d aracteristics of DC Shock.	Shock system	cture, Lab monstration	o Report

		ply principles Audiometer ocesses.	diometer chnologies	cture, Simulation	st
		sign basic of nitors .	nitors Systems	cture, Design dio	sign Exercise
		ntify nthalmic tem sources l aracteristics.	nthalmic System	cture, Discussion	iz
		Explain Pulmonary Anesthesia system design.	monary esthesia	cture, Field it	ld Report
		Evaluate Ventilator processes.	ntilator system	cture, Lab Work	o Report
		Discuss Rehabilitation Devices .	nabilitation Devices	cture, Case dy	signment
		Assess Surgical Scopes systems.	gical Scopes	cture, Design dio	sign omission
		Explain Ultrasound devices and their components.	rasound devices	cture, Discussion	itten Test
		Analyze X-ray Machine systems.	ay Machine	cture, Workshop	port
		Integrate CT Machine, and principles in design.	Machine	cture, Discussion	itten Test
		Apply computational tools in X-ray Imaging Techniques.	ay Imaging chniques	mputer Lab, mulation	oject omission
		Synthesize knowledge through case	egrated Sanitary stems Design	oupProject, minar	al Project esentation

		study analysis and project work.			

23. 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

24. Learning and Teaching Resources

quired textbooks (curricular books, if any)	• *Rapid Interpretation of EKG's* – Dale Dubin • *ACLS Provider Manual* – American Heart Association • *Introduction to Audiology* – Charles Katz • *Introduction to Audiology* – Charles Katz • *Introduction to Biomedical Equipment Technology* – Carr & Brown • *Clinical Ophthalmology: A Systematic Approach* – Jack Kanski • *Principles and Practice of Mechanical Ventilation* – Martin Tobin • *Physical Rehabilitation* – Susan O'Sullivan • *Atlas of Endoscopic Surgery* – Marvin L. Corman • *Diagnostic Ultrasound* – Carol M. Rumack • *Radiologic Science for Technologists* – Stewart C. Bushong • *Computed Tomography: Physical Principles, Clinical Applications, and Quality Control* – Euclid Seeram
Main references (sources)	• https://shop.elsevier.com/books/guyton-and-hall-textbook-of-medical-physiology/hall/978-0-323-59712-8 • https://www.amazon.com/Rapid-Interpretation-EKGs-Dubin-Dale/dp/0912912065 • https://shopcpr.heart.org/acls-provider-manual

	• https://www.vitalsource.com/products/introduction-to-audiology-martin-fred-h-v9780134410157 • https://www.vitalsource.com/products/introduction-to-audiology-martin-fred-h-v9780134410157 • https://www.pearson.com/en-us/subject-catalog/p/introduction-to-biomedical-equipment-technology/P200000003119/9780130104920 • https://www.elsevierhealth.com/clinical-ophthalmology-9780702077111.html • https://www.mhprofessional.com/principles-and-practice-of-mechanical-ventilation-9781260026108-usa • https://www.vitalsource.com/products/physical-rehabilitation-susan-b-39-o-sullivan-thomas-j-v9780803661148 • https://www.amazon.com/Atlas-Endoscopic-Surgery-Marvin-Corman/dp/0070131301 • https://www.elsevierhealth.com/diagnostic-ultrasound-2-volume-set-9780323401715.html • https://www.elsevier.com/books/radiologic-science-for-technologists/bushong/9780323661874 • https://www.elsevier.com/books/computed-tomography/seeram/978032379063
Recommended books and references (scientific journals, reports…)	• https://www.journals.elsevier.com/journal-of-electrocardiology • https://www.resuscitationjournal.com • https://www.audiology.org/publications/jaaa/

	• https://www.aami.org/news-publications/bio-medical-instrumentation-technology • https://bjo.bmj.com • https://pubs.asahq.org/anesthesiology
Electronic References, Websites	• https://www.archives-pmr.org • https://www.springer.com/journal/464 • https://www.ultrasoundjournal.org • https://pubs.rsna.org/journal/radiology

25. Course Name: Medical Therapeutic Devices/modul 1
26. Course Code: MIE400
27. Semester / Year: first Semester/ fourth
28. Description Preparation Date:27−6−2025
29. Available Attendance Forms: In-person (On-campus) Attendance
30. Number of Credit Hours (Total) / Number of Units (Total)
2 Hours/ 3 Units
31. Course administrator's name (mention all, if more than one name)
Name: sinan salim mohammed sheet Email: sinan_sm76@ntu.edu.iq
32. Course Objectives

Course Objectives	**rovide students with an in−depth understanding of advanced ciples and practices in biomedical engineering: Design and elopment of medical devices, analysis of their performance, and uring their safety and effectiveness.** **evelop students' ability to apply integrated scientific and engineering ciples to solve complex problems related to medical devices: Develop vative solutions to medical problems using advanced medical nology.** **quip students with the skills necessary to design and evaluate ical devices: Design medical devices, analyze their performance, and ure compliance with medical and engineering standards.**

	Enhance students' critical thinking and analytical skills: Evaluate dical devices, analyze risks, and develop strategies to mitigate them. **Encourage the integration of modern technologies and innovative utions in biomedical engineering practices: Apply modern technologies h as artificial intelligence and the Internet of Things to develop dical devices.** **Develop students' competencies in multidisciplinary collaboration, ctive professional communication, and ethical decision-making: mwork, effective communication, and ethical decision-making in medical engineering.** **se educational objectives will help students develop the skills and wledge necessary to design and develop medical devices with the hest levels of quality and safety.**

33. Teaching and Learning Strategies

Strategy	Here are the educational objectives for a Biomedical Engineering course: 1. Provide students with an in-depth understanding of advanced principles and practices in biomedical engineering: Design and development of medical devices, analysis of their performance, and ensuring their safety and effectiveness. 2. Develop students' ability to apply integrated scientific and engineering principles to solve complex problems related to medical devices: Develop innovative solutions to medical problems using advanced medical technology. 3. Equip students with the skills necessary to design and evaluate medical devices: Design medical devices, analyze their performance, and ensure compliance with medical and engineering standards. 4. Enhance students' critical thinking and analytical skills: Evaluate medical devices, analyze risks, and develop strategies to mitigate them. 5. Encourage the integration of modern technologies and innovative solutions in biomedical engineering practices: Apply modern technologies such as artificial intelligence and the Internet of Things to develop medical devices. 6. Develop students' competencies in multidisciplinary collaboration, effective professional communication, and ethical decision-making: Teamwork, effective communication, and ethical decision-making in biomedical engineering.

	7. Apply formative and summative assessment methods: Evaluate student performance through technical reports, design presentations, and oral exams, with constructive feedback. 8. Foster comprehensive and context-sensitive solutions: Engage students with professionals from medicine, engineering, science, and stakeholders in the community to develop innovative and effective solutions in biomedical engineering.

34. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		roduction in gery	dy and egration of chnology in gery	cture, Discussion, preparing the subject by students in pre-selected groups	iz, reports
		derstanding tion device ctionality, ety, and intenance to prove patient e.	tion devices	ture,	
		To understand design, functionality, safety, and application of dental equipment and systems(**Treatment section**)	ntal system t 1	cussion, preparing the ect by students in pre-cted groups	z, reports
		To understand design, functionality,	ntal system t2	ture,	

		safety, and application of dental equipment and systems(**Service unit)**			
		derstanding R monitoring uipment for urate fetal nitoring and ormed tetric care.	R system	cussion, preparing the ect by students in pre-cted groups	z, reports
		Understanding labor monitoring devices for optimal maternal and fetal care.	Labour monitoring Device	ture,	
		Understanding anesthesia machines for safe and effective anesthesia delivery.part1	esthesia chine-1	cussion, preparing the ect by students in pre-cted groups	z, reports
		Understanding anesthesia machines for safe and effective anesthesia delivery.part2	esthesia chine-2	ture,	
		derstanding ntilators for ective piratory pport and ient care.	oduction to tilators	cussion, preparing the ect by students in pre-cted groups	z, reports
		timizing ntilator therapy	tilators-Ventilation les	ture,	

		ough derstanding ntilation des.			
		Optimizing breath delivery control in ventilators for precise and safe ventilation support.	Ventilators- *Breathe Delivery Control*	cussion, preparing the ect by students in pre-cted groups	z, reports
		Understanding the basics of electricity for applications in medical equipment engineering.	Fundamentals of Electricity	ture,	z, reports
		Understanding Electrosurgical Units (ESUs) for safe and effective surgical procedures.	din roduction to J	cussion, preparing the ect by students in pre-cted groups	z, reports
		Understanding typical Electrosurgical Units (ESUs) for safe and effective surgical use.	din pical ctrosurgical ts	ture,	
		understand design, ctionality, and nical plication of	rdiac fibrillators	cussion, preparing the ect by students in pre-cted groups	z, reports

		diac ibrillators, luding:)efibrillation nciples Types (manual, omated, plantable))peration des nchronized, synchronized) Safety features l protocols Goal: Effective use of defibrillators for life-saving cardiac interventions.			

35. 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

36. Learning and Teaching Resources

Biomedical Instrumentation R Khandpur second Edition	ndbook of Second Edition medical Instrumentation 2003

37.	Course Name: engineering management
38.	Course Code: MEMO400
39.	Semester / Year: second Semester/ fourth
40.	Description Preparation Date:29−6−2025
41.	Available Attendance Forms: In-person (On-campus) Attendance
42.	Number of Credit Hours (Total) / Number of Units (Total)
	2 Hours/2 Units
43.	Course administrator's name (mention all, if more than one name)
	Name: Alaa Ibrahim Ahmed Email: alaa_ibrahim@ntu.edu.iq
44.	Course Objectives

Course Objectives	**dule Objectives:** 1. Develop problem-solving skills and an understanding of engineering management through the application of techniques. 2. • Understand transportation cost calculation methods. 3. • This course covers advanced project planning concepts. 4. • This course provides a foundation for the critical path. 5. • This course covers the study of time and time management.. **dule Learning Outcomes** Understand the introduction to 1. project management objectives and the trade-offs between them. Cost - Schedule - Performance • List the various terms associated with

	engineering management • Summarize project planning and control: • Planning, scheduling, and control • Discuss scheduling methods • Describe network methods • Solve the constant-time network method • Explain the critical path method nderstand the precedence diagram method.

45. Teaching and Learning Strategies

Strategy	Providing students with concepts related to the administrative activities carried out by the organization and their applications, and introducing students to the principles and elements of project management strategies in terms of planning, scheduling, and controlling activities. Emphasis is placed on quantitative methods for examining all administrative activities and functions of the project, in addition to examining modern Japanese management experiences compared to American (Western) management in general.

46. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		oduction to project nagement ectives and trade- s. Cost - Schedule - formance.	ntroduction to project anagement o.	Lecture, Discussion	Quiz
		ject Planning and ntrol: nning, Scheduling, l Control.	ject Planning l Control:	cture, se Study	itten Assignment
		eduling Methods.	eduling	cture, cussion	port
		work Methods	work Methods	cture, cussion	z
		tical Path	tical Path	cture, cussion	port
10		culation Methods ject Workforce nagement: Who nages It?	rkforce nagement	cture,	port

		nciples of Decision king for Workforce nagement			
		New Approach to formance aluation	rformance aluation	cture, cussion	signment
		pes of Work asurement	rk asurement	cture, cussion	itten Test
		ne Determination	ne	cture, rkshop	port
		ne Management	ne	ture	ject Submission

47. 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

48. Learning and Teaching Resources

quired textbooks (curricular books, if any)	Management" by Stephen P. Robbins & Mary Coulter
Main references (sources)	Management" by Stephen P. Robbins & Mary Coulter
Recommended books and references (scientific journals, reports…)	dara.com) "موقع "إدارة.كوم tps://www.edara.com
Electronic References, Websites	https://chatgpt.com

49. Course Name: Radiation Engineering
50. Course Code:
51. Semester / Year: first and second Semester/ Fourth
52. Description Preparation Date:27−6−2025
53. Available Attendance Forms: In-person (On-campus) Attendance
54. Number of Credit Hours (Total) / Number of Units (Total)
4 Hours/4 Units
55. Course administrator's name (mention all, if more than one name)
Name: Wameedh Baraq Edress Email: wameedh.adress@ntu.edu.iq
56. Course Objectives

Course Objectives	• **To provide an in-depth understanding of the principles and practices of radiation engineering** • **To develop the ability to apply scientific and engineering principles** for solving complex problems related to atomic and nuclear engineering and radiation devices. • **To equip students with the skills necessary to design and evaluate the medical radiation instruments.**

	• **To foster critical thinking and analytical capabilities** for assessing the maintenance of radiation medical devices. • **To promote the integration of modern technologies and innovative solutions** in **Therapeutic and diagnostic radiation devices.** • **To enhance competencies in interdisciplinary collaboration, communication, and ethical decision-making**, essential for professional practice in the field of sanitary and environmental engineering.
57. Teaching and Learning Strategies	
Strategy	he teaching and learning strategies employed in radiation engineering are designed to foster deep understanding, critical thinking, and practical competence in addressing the challenges. These strategies integrate theoretical foundations with applied engineering practices, and include: 9. **Lectures and Interactive Seminars** Delivery of core scientific and engineering concepts through structured lectures, complemented by interactive discussions that encourage analytical reasoning and problem-solving. 10. **Laboratory and Field Work** Hands-on experiments, field investigations, and site visits to medical radiation systems to bridge theory and practice. 11. **Design Studios and Project-Based Learning** Collaborative design exercises and real-world projects where students conceptualize, model, and evaluate radiation systems, applying standards and innovative technologies. 12. **Case Study Analysis** Critical examination of some radiation devices in used. 13. **Simulation and Modelling Exercises** Use of advanced software tools for radiation devices to develop technical proficiency. 14. **Blended and E-learning Approaches** Integration of online learning platforms and digital resources to provide flexible, self-paced study opportunities and to support continuous learning beyond the classroom.

	15. **Interdisciplinary and Community-Based Learning** Engagement with professionals from medical radiation engineering devices, to promote holistic and context-sensitive solutions. 16. **Assessment and Feedback Loops** Implementation of formative and summative assessments, including technical reports, design presentations, and oral examinations, with constructive feedback to support student growth and competence.

58. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		Atomic and Nuclear Structure	roduction to itary gineering	cture, cussion, mputer Lab, nulation	iz
		Atomic and Nuclear Structure	ter Supply gineering	cture, cussion, mputer Lab, nulation	itten signment
		Models of the atom	ter Sources l Quality	cture, cussion, mputer Lab, nulation	Report
		oduction to mic and clear Radiation	terTreatment chnologies	cture, cussion, mputer Lab, nulation	st
		eraction of iation with tter	ter tribution tems	cture, cussion, mputer Lab, nulation	iz
		Radioactivity	stewater gineering	cture, cussion, mputer Lab, nulation	itten signment
		Nuclear forces	verage Systems	cture,	Report

				cussion, nputer Lab, ulation	
		decay processes	stewater atment nts	ture, cussion, nputer Lab, ulation	st
		lpha, beta, gama	dge nagement	ture, cussion, nputer Lab, ulation	iz
		es of nuclear series	rmwater inage	ture, cussion, nputer Lab, ulation	itten signment
		Geiger Counter Scintillation detector	*tainable itary gineering*	ture, cussion, nputer Lab,
ulation	Report
		Radiation Dosimetry, simeters and Exposure	vironmental pact sessment	ture, cussion, nputer Lab, ulation	st
		system of dosimetric calculations	tainable itary gineering	ture, cussion, nputer Lab, ulation	iz
		Radiation protection	itary gineering delling	ture, cussion, nputer Lab, ulation	itten signment
		Revision	egrated itary Systems sign	ture, cussion, nputer Lab, ulation	st

59. 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

60. Learning and Teaching Resources

quired textbooks (curricular books, if any)	**المصادر الاساسية :**

	Physics for Scientists and Engineers with Modern Physics, Ninth Edition Raymond A. Serway and John W. Jewett, Jr. Physics of the Human Body Irving P. Herman Second Edition Medical Physics John R. Cameron and James G. Skofronick
Main references (sources)	Serge Marguet The Physics of Nuclear Reactor Springer
Recommended books and references (scientific journals, reports…)	Serge Marguet The Physics of Nuclear Reactor Springer extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.irsn.fr/sites/default/files/documents/professionnels_sante/documentation/syllabus_chapitre_1.pdf extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.govinfo.gov/content/pkg/GOVPUB-C13-1503f0c09fbefd5cef02350d85e32d7d/pdf/GOVPUB-C13-1503f0c09fbefd5cef02350d85e32d7d.pdf
Electronic References, Websites	https://phet.colorado.edu/ Teaching Resources, Activities, and Community

61.	Course Name: medical electronic systems1 , 2
62.	Course Code: MIE302, MIE303
63.	Semester / Year: first & second Semester/ third
64.	Description Preparation Date:27−6−2025
65.	Available Attendance Forms: In-person (On-campus) Attendance
66.	Number of Credit Hours (Total) / Number of Units (Total)
	4 Hours/3 Units
67.	Course administrator's name (mention all, if more than one name)
	Name: Khalil nawfal khalil Email: Khalil.nawfeal@ntu.edu.iq
68.	Course Objectives

Course Objectives	**dule Objectives:** 6. To develop problem solving skills and understanding of circuit theory through the application of techniques. 7. To understand voltage and current from a given circuit. 8. This course deals with the advance concept of electronic circuits. 9. This is the basic subject for all electronic circuits. 10. To understand Operational Amplifier, Active Filters, Voltage Regulator and Oscillator circuits. **11.** To perform Medical Electronic syste **dule Learning Outcomes** Recognize how electronics work in electronic circuits. 1. List the various terms associated with electronic circuits. 2.

	Summarize what is meant by a primary electronic circuit. 3. Discuss the reaction and involvement of atoms in electric circuits. 4. Describe electronic circuits, operation amplifiers, and oscillators. 5. Define gain law. 6. Identify the basic circuit elements and their applications. 7. Discuss the operational amplifier in an electronic circuit. 8. Discuss the various properties of resistors, capacitors, and inductors. 9. Explain the 555 timer in circuit analysis. 10. ntify the capacitor and inductor ationship with voltage regulators. 11.
69. Teaching and Learning Strategies	
Strategy	Training students to design advanced electronic circuits that are used in medical devices and basic circuits that connect electronic sensors in the design of electronic circuits, whether they are diagnostic or therapeutic, in addition to the method of getting and analyzing analog signals from the human body. Part A - Circuit Theory The Operational Amplifier (Introduction, Input Modes, and Parameters, Op-amp with negative feedback, Basic Op-Amp Circuits Active Filters, Voltage Regulator and Oscillator) Revision problem classes Part B - Analogue Electronics Fundamentals Comparators, Level Detection, Output Bounding, Comparators Applications Circuits, Summing Amplifiers, Op-Amp Integrator, and Differentiator Circuit, Analoge to Digital Converters (ADC), Digital to Analoge Converters (DAC), Active Low Pass Filters, Active High Pass Filters, Step Down Switching Regulators, Step Up Switching Regulators, Inverting Switching Regulators
70. Course Structure	

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		e Operational plifier (oduction, Input des and ameters, Op-amp h negative dback)	he Operational Amplifier	Lecture, Discussion	Quiz
		ects of negative dback on op-amp pedance, Close loop quency response op-amp	gative feedback	cture, se Study	itten Assignment
,5		sic Op-Amp cuits mparators, Level tection, Output nding, mparators plications Circuits, mming Amplifiers, -Amp Integrator l Differentiator cuit , Analoge To gital Converters DC) , Digital To aloge Converters AC))	sic Op-Amp cuits	cture, cussion	o Report
		tive Filters (Basic er Responses, er Response aracteristic)	tive Filters	cture, cussion	iz
		tive Low Pass ers, Active High s Filters	tive Filters	cture, cussion	ld Report
		tive Band Pass ers, Active Band p Filters	tive Filters	cture, b Work	o Report
0		ltage Regulator ne and Load gulators), Linear ies Regulators ,	ltage Regulator	cture, cussion	signment

		gulator With Fold ck Current niting, Linear unt Regulators.			
		p Down Switching gulators, Step Up itching Regulators, erting Switching gulators	ltage Regulator	cture, cussion	itten Test
13		cillator, Positive dback Oscillators, Feedback cillators (Wien-dge Oscillator), LC dback Oscillators lpitts Oscillator), Timer as an cillator	cillator	cture, rkshop	port
		dical Electronic tems	dical ctronic tems	mputer Lab, ulation	ject Submission
		dical Electronic tems	dical ctronic tems	upProject, minar	al Project sentation

71. 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

72. Learning and Teaching Resources

quired textbooks (curricular books, if any)	ECTRONIC DEVICES, Thomas L. Floyd, Pearson Education Limited·
Main references (sources)	ECTRONIC DEVICES, Thomas L. Floyd, Pearson Education Limited
Recommended books and references (scientific journals, reports…)	E ART OF ELECTRONICS, Paul Horowitz and Winfield Hill, Cambridge University Press.
Electronic References, Websites	https://chatgpt.com

73. Course Name: Power Electronic	
74. Course Code: MIE308	
75. Semester / Year: Second Semester/Third	
76. Description Preparation Date:27−6−2025	
77. Available Attendance Forms: In-person (On-campus) Attendance	
78. Number of Credit Hours (Total) / Number of Units (Total)	
4 Hours/4 Units	
79. Course administrator's name (mention all, if more than one name)	
Name: Osama Bashir Nori Email: usamaengeng@ntu.edu.iq	
80. Course Objectives	
Course Objectives	Upon successful completion of this course, students will be able to: 1. Demonstrate a comprehensive understanding of the fundamental principles of electrical energy conversion using power electronic systems, including AC/DC, DC/DC, and DC/AC conversion techniques. 2. Explain and evaluate the operating principles and modulation strategies of single-phase and three-phase diode rectifiers, switch-mode DC/DC converters, and DC/AC inverters. 3. Identify, classify, and analyze various types of power electronic converters used in modern energy conversion

	systems, and assess their performance in practical applications. 4. Apply analytical methods to examine the operation of single-phase and three-phase diode rectifiers, thyristor-controlled converters, and high-frequency switching converters, with emphasis on modulation techniques and control strategies. 5. Utilize laboratory instruments and power electronics equipment effectively and safely to design, build, and test converter circuits, and interpret experimental results accurately. 6. Design basic power electronic converter circuits and evaluate their efficiency, thermal performance, and suitability for applications such as renewable energy systems, motor drives, and uninterruptible power supplies (UPS). Interpret technical datasheets of power niconductor devices and apply this owledge to the selection and integration of nponents in power electronics circuit design.

81. Teaching and Learning Strategies

Strategy	**1. Active Learning Strategies** • **Problem-Based Learning (PBL):** ○ Present students with real-world problems, such as designin buck-boost converter for a renewable energy application. ○ Encourage critical thinking, collaboration, and solution-orien learning. • **Think-Pair-Share:** ○ Pose a question about circuit behavior or waveform analysis ○ Students first reflect individually, then discuss with a peer, finally share ideas with the class. • **Flipped Classroom:** ○ Deliver theoretical content (e.g., semiconductor devic switching theory) through pre-recorded videos.

	○ Reserve classroom time for solving numerical proble simulations, or group discussions. **2. Practical and Experimental Learning** • **Hands-On Lab Sessions:** ○ Use lab kits (like MATLAB/Simulink) to construct and anal circuits (e.g., inverters, rectifiers, choppers). ○ Reinforce theoretical learning with real-time measurement debugging. • **Simulation-Based Learning:** ○ Integrate software tools such as Multisim. ○ Assign tasks like simulating a PWM signal or analyz harmonic distortion in converters. • **Mini Projects:** ○ Assign semester-long projects like building a motor dr system or solar-powered inverter. ○ Foster creativity, teamwork, and practical application concepts. **3. Collaborative and Peer-Learning Strategies** • **Workshops and Seminars:** ○ Invite guest lecturers from industry or research to present current power electronics applications. ○ Engage students in organizing technical seminars or pos presentations. **4. Technology-Enhanced Learning** • **Use of Learning Management Systems (LMS):** ○ Upload lecture notes, quizzes, assignments, and video tutori ○ Provide immediate feedback and track progress. **5. Reflective and Metacognitive Strategies** • **Learning Journals and Logs:** ○ Encourage students to keep journals documenting what t learned each week. ○ Reflect on challenges faced during labs or simulations. **6. Formative and Summative Assessment Strategies** • **Formative Assessments:** ○ Use frequent short quizzes, in-class exercises, or low-sta assignments to monitor progress. • **Summative Assessments:** ○ Midterm and final exams with a mix of multiple-cho theoretical, and problem-solving questions. ○ Project evaluations and technical report submissions.
82. Course Structure	

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		roduction to wer electronics, itching devices, wer & control vice	roduction to wer electronics	cture, cussion	iz
		roduction to itching device	itching devices	cture, Case Study	itten signment
		roduction to wer & control vice	ntrol of Power ctronics vices	cture, Lab monstration	Report
		pes and aracteristic, ing (diode, nsistor …).	de and nsistor	cture, Simulation	st
		thods of ning – on	tural and rced ignition	cture, Design dio	sign Exercise
		thods of ning – off	tural and rced turning off	cture, Discussion	iz
		Protection of power devices	tection devices	cture, Field it	ld Report
		Triggering & base drive circuits	ggering nciples	cture, Lab Work	Report
		Controlled rectifiers, Single phase circuits	ntrolled tifier	cture, Case dy	signment
		Controlled rectifiers Three phase circuits	ree phase-trolled tifier	cture, Design dio	sign omission
		Half – wave & full – wave circuits	*igning of half l full wave cuits*	cture, Discussion	itten Test
		D.C choppers; step – up & step – down choppers	-DC converters	cture, Workshop	port
		A.C phase controllers	-AC converters	cture, Discussion	itten Test

		Invertors, 1 – phase & 3 – ph bridges	-AC converters	nputer Lab, nulation	oject omission
		Some applications: uninterruptible power supply (UPS), switching mode power supply (SMP)	S and it's plications	oup Project, minar	al Project esentation

83. 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

84. Learning and Teaching Resources

quired textbooks (curricular books, if any)	• Mohan, N., Undeland, T. M., & Robbins, W (2002). Power electronics: Convert applications, and design (3rd ed.). Wiley. • Rashid, M. H. (2013). Power electronics: Circu devices, and applications (4th ed.). Pearson.. • Hart, D. W. (2010). Power electronics (1st e McGraw-Hill Education. • Bose, B. K. (2002). Modern power electronics AC drives (1st ed.). Prentice Hall.
Main references (sources)	• Mohan, N., Undeland, T. M., & Robbins, W (2002). *Power electronics: Convert applications, and design* (3rd ed.). Wiley. • Rashid, M. H. (2013). *Power electronics: Circu devices, and applications* (4th ed.). Pearson. • Hart, D. W. (2010). *Power electronics* (1st e McGraw-Hill Education. • Erickson, R. W., & Maksimovic, D. (20 *Fundamentals of power electronics* (2nd e Springer. • Bose, B. K. (2002). *Modern power electronics AC drives*. Prentice Hall. • Sen, P. C. (1987). *Power electronics*. McGr Hill. • Krein, P. T. (1998). *Elements of power electron* Oxford University Press.

Recommended books and references (scientific journals, reports…)	Recommended Books 1. Mohan, N., Undeland, T. M., & Robbins, W. P. (2002). *Power electronics: Converters, applications, and design* (3rd ed.). Wiley. 2. Rashid, M. H. (2013). *Power electronics: Circuits, devices, and applications* (4th ed.). Pearson. 3. Hart, D. W. (2010). *Power electronics* (1st ed.). McGraw-Hill Education. 4. Erickson, R. W., & Maksimovic, D. (2001). *Fundamentals of power electronics* (2nd ed.). Springer. 5. Bose, B. K. (2002). *Modern power electronics and AC drives*. Prentice Hall. 6. Sen, P. C. (1987). *Power electronics*. McGraw-Hill. 7. Krein, P. T. (1998). *Elements of power electronics*. Oxford University Press. **Recommended Scientific Journals** 1. **IEEE Transactions on Power Electronics** Institute of Electrical and Electronics Engineers (IEEE). https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=63 2. **IEEE Transactions on Industrial Electronics** https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=41 3. **Renewable and Sustainable Energy Reviews** Elsevier. https://www.journals.elsevier.com/renewable-and-sustainable-energy-reviews 4. **Electric Power Systems Research** Elsevier. https://www.journals.elsevier.com/electric-power-systems-research **Recommended Technical Reports and Standards**

	1. **IEEE Standard 519-2014** IEEE. (2014). *IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems*. IEEE Standards Association. 2. **NREL Technical Reports** National Renewable Energy Laboratory (NREL). https://www.nrel.gov 3. **DOE Grid Modernization Reports** U.S. Department of Energy (DOE). https://www.energy.gov/oe/grid-modernization-initiative
Electronic References, Websites	**Educational Platforms & Online Courses** 1. **Coursera – Power Electronics Specialization** Erickson, R. W. (n.d.). *Power Electronics Specialization* [Online course]. Coursera. University of Colorado Boulder. https://www.coursera.org/specializations/power-electronics 2. **edX – Fundamentals of Power Electronics** MITx. (n.d.). *Fundamentals of Power Electronics* [MOOC]. edX. https://www.edx.org/course/fundamentals-of-power-electronics 3. **NPTEL – Power Electronics Lectures (India)** NPTEL. (n.d.). *Power Electronics* [Video lectures]. National Programme on Technology Enhanced Learning. https://nptel.ac.in/courses/108105066 **Technical Databases & Research Repositories** 4. **IEEE Xplore Digital Library** IEEE. (n.d.). *IEEE Xplore Digital Library*. https://ieeexplore.ieee.org 5. **ScienceDirect (Elsevier)** Elsevier. (n.d.). *ScienceDirect – Power Electronics*. https://www.sciencedirect.com 6. **SpringerLink** Springer. (n.d.). *SpringerLink – Power*

	Electronics Resources. https://link.springer.com **Simulation Tools & Design Resources** 7. **MATLAB & Simulink – Power Electronics Toolbox** MathWorks. (n.d.). *Simscape Electrical (formerly SimPowerSystems)*. https://www.mathworks.com/products/simscape-electrical.html **Datasheets & Component Libraries** 8. **Texas Instruments – Power Management & Converters** Texas Instruments. (n.d.). *TI Power Management Portal*. https://www.ti.com/power-management/overview.html 9. **Infineon Technologies – Power Semiconductors** Infineon. (n.d.). *Power Electronics Solutions*. https://www.infineon.com/cms/en/applications/industrial/power-supplies/ selection tools for IGBTs, MOSFETs, and drivers. 10. **ON Semiconductor (onsemi)** onsemi. (n.d.). *Power Electronics Products*. https://www.onsemi.com/products/power-management

Item	Description
1. Course Name	English Language
2. Course Code	MIE 410
3. Semester / Year	First Semester / Fourth Year
4. Date of Description Preparation	28-06-2025
5. Available Attendance Modes	On-campus attendance: Students participate directly in educational activities through physical presence in classrooms and other academic facilities, enabling direct interaction with faculty and peers, and active participation in lectures, oral exercises, and discussion sessions.
6. Total Credit Hours / Units	3 hours / 3 units
7. Course Coordinator(s)	Name: Rasha Dhyaa Mahdi Email: rasha.dhyaa@ntu.edu.iq
8. Course Objectives	**General Objectives** • Enhance grammatical knowledge: Provide students with an advanced understanding of essential and complex English grammar rules. • Develop writing skills: Enable students to write complex sentences using correct grammatical structures. • Improve reading comprehension: Help students better understand academic texts by improving their grasp of complex sentences. • Develop speaking skills: Strengthen students' ability to express ideas clearly and accurately in daily and academic conversations. • Enable critical thinking: Enhance students' ability to use linking tools and grammatical analysis to construct coherent and logical dialogues and essays. **Specific Objectives** • Master inverted sentences: Apply inverted sentences in formal writing and academic discussions, especially in contexts requiring emphasis on important concepts or ideas. • Understand and use time and cause connectors: Use connectors to clarify the chronological order of events and accurately link causes to results in texts and conversations. • Write complex sentences using noun and absolute clauses: Construct grammatically sound complex sentences using noun and absolute structures, enhancing their ability to write cohesive and multi-dimensional texts. • Master continuous verb tenses: Use continuous tenses to express ongoing events in academic texts and daily conversations. • Identify and correct common grammatical errors: Detect and correct grammatical mistakes such as parallelism issues and

	dangling modifiers through text analysis and applying learned rules. • Correctly use conditional sentences: Use all types of conditional sentences (first, second, third) to express hypotheses, future possibilities, and hypothetical scenarios. • Enhance linguistic analysis ability: Analyze academic texts and articles to identify linguistic errors and improve writing quality by focusing on grammatical accuracy. • Communicate clearly using connectors: Employ various connectors to build coherent and flowing paragraphs in writing and speaking, improving text cohesion and effective communication.
9. Teaching and Learning Strategies	**1. Interactive Lectures and Seminars**: Deliver core concepts through organized lectures enhanced by interactive discussions that encourage analytical thinking and problem-solving skills.**2. Assessment and Feedback Cycles**: Apply formative and summative assessments, including technical reports, design presentations, and oral exams, accompanied by constructive feedback to support student development and enhance competencies.
10. Course Structure	

Week	Hours	Learning Outcomes	Unit / Topic	Teaching Method	Assessment Method
1	3	Identify the function of appositives in a sentence and distinguish them from other grammatical components.	Appositives component of English grammar	Lecture, Discussion	Quiz
2	3	Correctly use appositives in writing sentences to provide additional information about nouns.	Appositives component of English grammar	Lecture, Discussion	Written Assignment
3	3	Rewrite simple sentences with more precision and clarity using appositives for clarification.	Appositives component of English grammar	Lecture, Discussion	Report
4	3	Identify forms of present participles and use them correctly in sentences.	Present Participles	Lecture, Discussion	Exam
5	3	Construct sentences using present participles to express ongoing actions.	Present Participles	Lecture, Discussion	Exercise
6	3	Differentiate between using present participles	Present Participles	Lecture, Discussion	Quiz

		as adjectives or parts of continuous tenses.			
7	3	Recognize common forms of past participles and use them correctly in sentences.	Past Participles	Lecture, Discussion	Report
8	3	Build sentences containing past participles to express completed actions.	Past Participles	Lecture, Discussion	Report
9	3	Distinguish between different uses of past participles in perfect tenses and as adjectives.	Past Participles	Lecture, Discussion	Written Task
10	3	Identify and use time and cause connectors correctly in writing and speaking.	Adverb Time and Cause Connectors	Lecture, Discussion	Discussion
11	3	Integrate time and cause connectors into complex sentences to express sequence or causality.	Adverb Time and Cause Connectors	Lecture, Discussion	Written Exam
12	3	Identify noun clause connectors and use them to form complex sentences.	Noun Clause Connectors	Lecture, Discussion	Report
13	3	Apply noun clause connectors in writing reports or answering complex questions.	Noun Clause Connectors	Lecture, Discussion	Written Exam
14	3	Identify adjective clause connectors and use them accurately to describe nouns.	Adjective Clause Connectors and Subject Usage	Lecture, Discussion	Discussion
15	3	Construct sentences with adjective clauses to describe people or things precisely.	Adjective Clause Connectors and Subject Usage	Lecture, Discussion	Presentation

11. Course Assessment	Grades out of 100 distributed according to student tasks such as daily preparation, oral daily tests, monthly or written exams, reports, etc.
12. Learning and Teaching Resources	**Textbooks and Grammar References** • *English Grammar in Use* by Raymond Murphy – A widely used book explaining English grammar in detail, including appositives and their uses.

	• *The Elements of Style* by William Strunk Jr. and E.B. White – A concise guide covering English writing fundamentals, including effective use of appositives to enhance texts. **Educational Websites** • Purdue OWL (Online Writing Lab): Comprehensive resource offering detailed lessons on English grammar, including appositives and correct punctuation. https://owl.purdue.edu • Grammarly Blog: Features detailed educational articles on improving writing and grammar, including how to use appositives in academic writing. https://www.grammarly.com/blog **Online Courses** • Coursera – Grammar and Punctuation Course by the University of California: Covers various grammar topics such as appositives, connectors, and punctuation usage. **Encyclopedias and Academic References** • Oxford English Grammar Course: Comprehensive reference covering advanced grammar structures, including appositives. **Academic Articles and Journals** • *Journal of English Linguistics*: Publishes academic studies on the evolution of the English language and grammar, including the use of appositives in academic writing

85. Course Name: Principles of Laser
86. Course Code: MIE 402
87. Semester / Year: first Semester/ Forth
88. Description Preparation Date:26−6−2025
89. Available Attendance Forms: In-person (On-campus) Attendance
90. Number of Credit Hours (Total) / Number of Units (Total)
4 Hours/3 Units
91. Course administrator's name (mention all, if more than one name)
Name: Bassam Tahseen Ahmad Email: Bassam_Raoof@ntu.edu.iq
92. Course Objectives

Course Objectives	• **Understand the basic physical principles of laser generation (Planck's equation, Einstein relations).** •Identify the main components and structure of laser systems •Analyze different types of lasers (solid-state, gas, ion, dye, semiconductor). •Distinguish between laser properties and their practical implications.

	•Understand the physical structure of optical fibers and total internal reflection. •Gain the ability to calculate mode numbers and losses in fibers. •Explore photonic crystal fibers and their modern applications.

93. Teaching and Learning Strategies

Strategy	17. Interactive Lecturing – to explain theoretical concepts like Planck's Law and laser construction 2-Multimedia Demonstrations – videos and animations showing laser generation and fiber optics 3-Collaborative Learning – student groups analyze and classify types of lasers. 4-Brainstorming – to deduce laser properties from physical principles. 5-Problem-Based Learning (PBL) – solving reflection and optical fiber-related calculations. 6-Simulation & Modeling – using software to model laser systems and wave propagation. 7-Concept Mapping – visualizing relationships between laser types and characteristics.

94. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		lain the basics of t, Planck's ation, and tein's relations	oduction - Light Planck's equation, tein relations tical Diffraction n one slit	ture, cussion	iz

		tify basic laser em components	er Systems ctical Diffraction n two slit	cture, Case Study	itten signment
		cribe laser struction and ration	er Construction Measure the Practical Distance Between Tracks of CD	cture, Lab monstration	Report
		lyze the physical perties of lasers	er Properties Measure the Practical Distance Between Tracks of DVD	cture, Simulation	st
		inguish between d-state lasers and r properties	d-State Lasers: y, Nd:YAG, YLF ctical Laser Beam ergence Angle	cture, Design dio	sign Exercise
		Understand the function and pplications of gas lasers	Lasers: He-Ne, , Excimer, N_2 ctical Polarization aser Light	cture, Discussion nducting an periment in the oratory	iz, Report
		Explain ion and dye lasers and their uses	Lasers, Dye Lasers iew and Midterm m	cture, Field it , Conducting an periment in the oratory	ld Report
		Understand how semiconductor lasers work	iconductor Lasers ctical The racteristic of laser le	cture, Lab Work	Report
		Conduct a comprehensive review and preparatory exercises	iew and Midterm m ctical The struction and work Helium-neon laser	cture, Case dy, Conducting experiment in the oratory	signment, port
		Describe the structure and key properties of optical fibers	cture of Optical er ctical Refractive ex and Snell's Law	cture, Design dio, Conducting experiment in the oratory	sign omission, port
		Distinguish types of optical fibers and their uses	es of Optical Fiber ctical Numerical ture and ptance angle of an cal fiber	cture, Discussion	itten Test, port
		Solve problems related to total internal reflection	l Internal ection Calculations ctical The ersion in optical r part1	cture, Workshop	port

		Analyze mode propagation and loss in fibers	le Numbers and ses in Fiber ctical The ersion in optical r part2	cture, Discussion nducting an periment in the oratory	itten Test, port
		Explain the concept of photonic crystal fibers	tonic Crystal Fiber ctical Bending ses in Optical fiber	mputer Lab, nulation	ject omission
		Conduct a comprehensive review and conclude the semester	iew and End of nester ctical Review and of Semester	upProject, minar	al Project sentation

95. Course Evaluation

Theoretical Degree (Midterm exam + quizzes + homework assignments + attendance) = 30

Practical Degree (Lab reports + quizzes + lab discussions + attendance + midterm exam) = 20

Coursework Total (Effort Grade) (Theoretical Grade + Practical Grade) = 50

Final Theoretical Exam = 40

Final Practical Exam = 10

Final Degree (Coursework + Final Exams) = 100

96. Learning and Teaching Resources

quired textbooks (curricular books, if any)	Vlison , J.F.B.Hawkes , Optoelectronics An Introduction ,1983 azio Sevlto , Principles of Laser, Fourth Edition, 1998
Main references (sources)	
Recommended books and references (scientific journals, reports…)	chael Bass, Eric W. Van Stryland,(FIBER OPTICS HANDBOOK),2002
Electronic References, Websites	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ele.uva.es/~ivasan/DO/%5BBook%20-%20Opto%5D%20Optoelectronics.%20An%20introduction%20-%20Wilson,%20Hawkes%20(Prentice-Hall,%201998).pdf

	https://libgen.is/book/index.php?md5=5BED40E149A2F0E6973AEBC7D9EC421E

97. Course Name: Medical Laser System
98. Course Code: MIE 403
99. Semester / Year: second Semester/ Forth
100. Description Preparation Date:26−6−2025
101. Available Attendance Forms: In-person (On-campus) Attendance
102. Number of Credit Hours (Total) / Number of Units (Total)
4 Hours/3 Units
103. Course administrator's name (mention all, if more than one name)
Name: Bassam Tahseen Ahmad Email: Bassam_Raoof@ntu.edu.iq
104. Course Objectives

Course Objectives	1. Identify the types of detectors used with lasers (quantum, thermal, photoconductive) 2. Study photo-detectors such as photomultiplier tubes and solar cells. 3. Understand the biological effects of laser on human tissue. 4. Analyze various medical applications of lasers (surgery, therapy, cosmetic). 5. Assess potential hazards of laser use in medical and industrial environments. 6. Classify lasers according to hazard classes. 7. Learn key safety procedures and protocols in laser environments.

105. Teaching and Learning Strategies

Strategy	• **Case-Based Learning** – analyzing real-world medical laser applications (e.g., surgery, dermatology) • **Student Presentations** – students present on detectors or laser safety systems. • **Project-Based Learning (PjBL)** – designing safe laser application models. • **Inquiry-Based Learning** – exploring how laser characteristics affect biological tissues. • **Virtual or Field Visits** – to laser clinics or labs (virtual platforms or real visits). • **Classroom Discussions** – debating safety, ethics, and effectiveness of laser use. • **Role-Playing Activities** – enacting emergency laser situations or safety drill

106. Course Structure

Week	Hours Th.2 Pra.2	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		oduction to ctors and their types	oduction to ectors	cture, cussion	iz, Lab Report
		lain the working ciple of quantum detectors	ntum Detectors tical Light endent Resistors Rs) part 1	cture, Case Study nducting an periment in the	itten signment, Lab port
		lyze the role of notomultiplier tubes	Photomultiplier Tube Detector Practical Light Dependent Resistors (LDRs) part 2	cture, Lab monstration	Report

		Distinguish toelectric detectors d their applications	Photoelectric Detector Practical Photovoltaic detectors part 1	cture, Simulation	st, Lab Report
		lain the difference veen solar cells and photodiodes	r Cells and todiode Junctions actical hotovoltaic ctors part2	cture, Design dio	sign Exercise
		npare thermal and toconductive ctors	rmal & toconductive ectors ctical The acteristics of otransistor part 1	cture, Discussion nducting an periment in the oratory	iz, Report
		Review and midterm assessment	iew and Midterm m ctical Review and term Exam	cture, Field it , Conducting an periment in the oratory	ld Report
		Explain biological effects of lasers on tissue	er Action on Tissue ctical The acteristics of otransistor part 2	cture, Lab Work	Report
		Analyze laser effects on cells and tissues	er Effects on Cells Tissue ctical Calculate the time and full time DR	cture, Case dy, Conducting experiment in the .	signment, port
		Identify various medical applications of lasers	es of Medical Laser lications ctical Calculate the time and full time hototransistor	cture, Design dio, Conducting experiment in the .	sign mission, port
		Present and discuss practical case studies	e Studies on Laser lications ctical Photoelectric ct	cture, Discussion nducting an periment in the .	itten Test, port
		Identify laser usage hazards in medical environments	npare Thermal and ctical toconductive ectors	cture, Workshop	port
		Classify lasers based on hazard levels	er Hazard Classes ctical Laser osure on Tissue del (Egg/Synthetic n)	cture, Discussion nducting an periment in the oratory	itten Test, port
		Apply laser safety protocols	er Safety cedures	mputer Lab, mulation	ject mission

			ctical Laser Safety ocol and Hazard ssification		
		Final comprehensive review of the semester	iew and End of nester ctical Review and of Semester	oupProject, minar	al Project esentation

107. Course Evaluation

Theoretical Degree (Midterm exam + quizzes + homework assignments + attendance) = 30

Practical Degree (Lab reports + quizzes + lab discussions + attendance + midterm exam) = 20

Coursework Total (Effort Grade) (Theoretical Grade + Practical Grade) = 50

Final Theoretical Exam = 40

Final Practical Exam = 10

Final Degree (Coursework + Final Exams) = 100

108. Learning and Teaching Resources

quired textbooks (curricular books, if any)	.Wlison , J.F.B.Hawkes ,)ptoelectronics An Introduction ,1983 Leon Goldman, M.D.,(Applications of the Laser), 2018
Main references (sources)	
Recommended books and references (scientific journals, reports…)	chael R. Hamblin,Marcelo Victor Pires Sousa,Tanupriya Agrawal(Handbook Low-Level Laser Therapy),2017
Electronic References, Websites	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ele.uva.es/~ivasan/DO/%5BBook%20-%20Opto%5D%20Optoelectronics.%20An%20introduction%20-%20Wilson,%20Hawkes%20(Prentice-Hall,%201998).pdf

109. Course Name: Electrical Technology	
110. Course Code: MIE309	
111. Semester / Year: First Semester/Third	
112. Description Preparation Date:28−6−2025	
113. Available Attendance Forms: In-person (On-campus) Attendance	
114. Number of Credit Hours (Total) / Number of Units (Total)	
4 Hours/6 Units	
115. Course administrator's name (mention all, if more than one name)	
Name: Osama Bashir Nori Email: usamaengeng@ntu.edu.iq	
116. Course Objectives	
Course Objectives	Upon successful completion of this course, students will be able to: • Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. • Ability to apply engineering design to produce solutions that meet specified needs while considering public health, safety, welfare, as well as global, cultural, social, environmental, and economic factors. • Ability to develop and conduct appropriate experiments, analyze and interpret data, and use engineering judgment to draw conclusions.

	• Ability to acquire and apply new knowledge as needed, using appropriate learning strategies. • Graduates studying electrical technology will possess strong theoretical and practical knowledge in fields such as power generation, electrical machines, power distribution design, industrial electrical systems, and power quality measurement issues. • Students studying electrical engineering may pursue successful careers in electrical power engineering technology and related fields, continue lifelong learning opportunities such as graduate degrees or professional studies to adapt to evolving technological changes, and contribute to society in professional and leadership roles with commitment to the highest ethical standards. • Deliver and present some presentations related to clarifying and explaining certain concepts pertaining to the course vocabulary.

117. Teaching and Learning Strategies

Strategy

1. Active Learning Strategies

- **Problem-Based Learning (PBL):**

Present real-world scenarios such as diagnosing an electrical transformer failure. This encourages analytical thinking and team collaboration.

- **Think-Pair-Share:**

Use conceptual or troubleshooting questions related to circuit behavior, where students think individually, discuss with peers, then share their insights with the class.

- **Interactive Demonstrations:**

Incorporate live circuit demonstrations (e.g., voltage drop in electrical transformers) to visualize abstract electrical concepts.

2. Hands-On and Experimental Learning

- **Lab-Based Instruction:**

Conduct structured lab sessions where students perform wiring, circuit assembly, Transformer testing, and measurements using real equipment (e.g., multimeters, oscilloscopes, control panels).

- **Simulation Tools:**

Use software like **Multisim**, **MATLAB** for circuit design and fault analysis when real hardware is unavailable.

- **Capstone Projects:**

Engage students in end-of-course projects such as building a small-scale power distribution board or control system for an elevator or industrial conveyor.

3. Collaborative and Peer-Learning Strategies

- **Group Assignments:**

Assign group tasks such as designing a residential wiring system or analyzing transformer losses, promoting cooperation and task-sharing.

- **Peer Instruction:**

Encourage students to explain circuit concepts or fault-finding techniques to each other under the instructor's guidance.

- **Student Seminars:**

Have students research and present topics like smart grid technology, renewable energy integration, or safety standards in electrical installations.

4. Technology-Enhanced Learning

- **Learning Management Systems (LMS):**

Use platforms like **Google Classroom** to share lecture notes, upload quizzes, conduct forums, and assign virtual labs.

- **Multimedia Integration:**

Enhance learning through instructional videos, animated simulations, and virtual tours of substations or manufacturing plants.

5. Reflective and Metacognitive Strategies

- **Learning Journals:**

Encourage students to maintain weekly logs summarizing what they learned and reflecting on challenges faced during labs or discussions.

- **Self and Peer Assessment:**

After group activities or presentations, students evaluate their own performance and that of their peers, fostering self-awareness and accountability.

6. Formative and Summative Assessment Strategies

- **Formative Assessment:**

Includes regular quizzes, in-class questioning, short written reflections, and feedback on lab performance.

	• **Summative Assessment:** Consists of midterm and final exams, practical tests (e.g., circuit construction and measurement), project reports, and oral presentations.

118. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	ctrical transformer ling	Theory of operation, no load and short circuit test	cture, cussion	iz
2	4	nponents of single-se transformer	Transformers: single phase transformer and construction	cture, Case Study	itten Assignment
3	4	hematical esentation of trical transformer	Equivalent circuit, auto–transformers, instrument transformers	cture, Lab monstration	o Report
4	4	nponents of three-se transformer	Three phase transformers, constructions methods of connection	cture, Simulation	st
5	4	ctrical Motors	Electromechanical energy conversion principles, relay operation	cture, Design dio	sign Exercise
6	4	machines	D.C machines: e.m.f and torque equation,	cture, Discussion	iz
7	4	hods of operations	equivalent circuit, methods of excitation, generator characteristics	cture, Field it	ld Report
8	4	ing and losses ulation for motors	Motor characteristics, testing, calculation of	cture, Lab Work	o Report

			losses and efficiency		
9	4	uction motors	Induction machines: equivalent circuit, basic equation, simple analysis testing	cture, Case dy	signment
10	4	hods of starting of uction machines	Single phase induction motor, methods of starting, split phase	cture, Design dio	sign omission
11	4	ting of induction ors	Capacitor short, capacitor run and shaded pole motors	cture, Discussion	itten Test
12	4	crical analytics of chronous machines	chronous machines, erators and motors, valent circuit, basic ation	cture, Workshop	port
13	4	es of Special hines:	Special machines: Reluctance motor, hysteresis motor, linear motor, stepper motor, drag cup type motor, servo .motor	cture, Discussion	itten Test
14	4	tches	tches, float ches , Contactors , sure switches, High age circuits	mputer Lab, nulation	oject Submission
15	4	trolled Switches	trol switches : pilot ches , push buttons hit switch	oup Project, minar	al Project esentation

119. 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

120. Learning and Teaching Resources

quired textbooks (curricular books, if any)	• Hughes, E. (2016). Hughes Electrical and Electro Technology (12th ed.). Pearson Education. • Del Toro, V. (1986). *Principles of Electr Engineering*. Prentice Hall.

	• Theraja, B. L., & Theraja, A. K. (2005). *A Textbook Electrical Technology* (Vol. 1–2). S. Chand Publishin • Boylestad, R. L., & Nashelsky, L. (2016). *Electro Devices and Circuit Theory* (11th ed.). Pearson. • Chapman, S. J. (2011). *Electric Machinery Fundamen* (5th ed.). McGraw-Hill Education. • Fitzgerald, A. E., Kingsley, C., & Umans, S. D. (20 *Electric Machinery* (6th ed.). McGraw-Hill.
Main references (sources)	• Hughes, E. (2016). Hughes Electrical and Electro Technology (12th ed.). Pearson Education. • Theraja, B. L., & Theraja, A. K. (2005). A Textbook Electrical Technology (Vols. 1 & 2). S. Ch Publishing. • Del Toro, V. (1986). Principles of Electrical Engineer Prentice Hall. • Chapman, S. J. (2011). Electric Machinery Fundamen (5th ed.). McGraw-Hill Education. • Boylestad, R. L., & Nashelsky, L. (2016). Electro Devices and Circuit Theory (11th ed.). Pearson. • Fitzgerald, A. E., Kingsley, C., & Umans, S. D. (20 *Electric Machinery* (6th ed.). McGraw-Hill. • Hambley, A. R. (2011). *Electrical Engineeri Principles and Applications* (5th ed.). Pearson Educat • Grewal, B. S. (2005). *Higher Engineering Mathema* (43rd ed.). Khanna Publishers.
Recommended books and references (scientific journals, reports…)	Recommended Books 11. Hughes, E. (2016). Hughes Electrical and Electronic Technology (12th ed.). Pearson Education. 12. Theraja, B. L., & Theraja, A. K. (2005). A Textbook of Electrical Technology (Vols. 1–2). S. Chand Publishing. 13. Del Toro, V. (1986). Principles of Electrical Engineering. Prentice Hall. 14. Chapman, S. J. (2011). Electric Machinery Fundamentals (5th ed.). McGraw-Hill Education. 15. Boylestad, R. L., & Nashelsky, L. (2016). Electronic Devices and Circuit Theory (11th ed.). Pearson. **Recommended Scientific Journals**

	5. **IEEE Transactions on Industrial Electronics** **IEEE Industrial Electronics Society. (n.d.).** *IEEE Transactions on Industrial Electronics*. **https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=41** 6. **IEEE Transactions on Power Delivery** **IEEE Power & Energy Society. (n.d.).** *IEEE Transactions on Power Delivery*. **https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=61** 7. **Electric Power Systems Research** Elsevier. (n.d.). Electric Power Systems Research. **https://www.journals.elsevier.com/electric-power-systems-research** 8. **Journal of Electrical Engineering & Technology (JEET)** The Korean Institute of Electrical Engineers (KIEE). **https://www.springer.com/journal/42835** **Recommended Technical Reports and Standards** 4. **National Electrical Code (NEC)** National Fire Protection Association. (Latest Edition). NFPA 70: National Electrical Code. **https://www.nfpa.org** 5. **IEC Standards (International Electrotechnical Commission)** IEC. (n.d.). *International Standards for Electrical and Electronic Technologies*. https://www.iec.ch/standards 6. **NREL Technical Reports** National Renewable Energy Laboratory. (n.d.). *Technical Reports on Grid and Renewable Systems*. https://www.nrel.gov 7. **IEEE Std 141™-1993 (Red Book)** IEEE. (1993). *IEEE Recommended Practice for Electric Power Distribution for Industrial Plants*.
Electronic References, Websites	**Educational Platforms & Online Courses**

	4. **MIT OpenCourseWare – Electrical Engineering and Computer Science** Massachusetts Institute of Technology. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/ 5. **Coursera – Electrical Engineering Courses** https://www.coursera.org/browse/engineering/electrical-engineering ➤ University-led online courses in electrical circuits, machines, power systems, and electronics. 6. **NPTEL – Electrical Engineering Lectures** National Programme on Technology Enhanced Learning (India). https://nptel.ac.in/course.html 7. **edX – Electrical Engineering and Power Systems Courses** https://www.edx.org/learn/electrical-engineering **Simulation Tools & Design Resources** 1. **Multisim by NI (National Instruments)** https://www.ni.com/en-us/shop/multisim.html 2. **Tinkercad Circuits (by Autodesk)** https://www.tinkercad.com/circuits 3. **Falstad Circuit Simulator** https://www.falstad.com/circuit/ 4. **MATLAB & Simulink – Simscape Electrical** https://www.mathworks.com/products/simscape-electrical.html **Professional Resources & Standards** 1. **IEEE Xplore Digital Library** https://ieeexplore.ieee.org 2. **National Fire Protection Association (NFPA)** https://www.nfpa.org 3. **International Electrotechnical Commission (IEC)** https://www.iec.ch 4. **ETAP Learning Portal** https://etap.com/solutions/education **Component Data and Manufacturer Resources**

	1. **Texas Instruments – Electrical Engineering Resources** https://www.ti.com 2. **Digi-Key Electronics** https://www.digikey.com 3. **All About Circuits** https://www.allaboutcircuits.com

121. Course Name: computer application 3
122. Course Code: MIE310
123. Semester / Year: first Semester/ third
124. Description Preparation Date:27−6−2025
125. Available Attendance Forms: In-person (On-campus) Attendance
student's actual presence within classrooms, laboratories, and academic facilities, actively engaging in lectures, practical sessions, class discussions, and field visits
126. Number of Credit Hours (Total) / Number of Units (Total)
3 Hours/2 Units
127. Course administrator's name (mention all, if more than one name)
Name: AZZA KAYS Email: azzakays@ntu.edu.iq
128. Course Objectives

Course Objectives	1. Develop fundamental programming and data analysis skills using MATLAB. 2. Enhance students' computational thinking for solving engineering and mathematical problems. 3. Apply engineering theories through practical simulations using MATLAB. 4. Foster research and innovation in problem-solving using MATLAB tools. 5. Equip students with essential technical competencies for the engineering job market

129. Teaching and Learning Strategies

Strategy

The teaching strategies for the *MATLAB Applications* course should balance theoretical understanding with practical application, as the course demands analytical and applied skills in programming, modeling, and simulation. The following strategies are most suitable:

1. **Theoretical Explanation with Immediate Practical Application**
    - Begin the lesson by explaining a concept (e.g., arrays or functions).
    - Follow with immediate implementation in the MATLAB environment.
    - Emphasize the connection between theory and practice.
2. **Computer-Assisted Instruction**
    - Utilize computers during class sessions to allow students to practice programming directly.
    - Reinforces hands-on experience in a controlled environment.
3. **Learning by Doing**
    - Students write and test their own code.
    - Essential for practical understanding of the MATLAB environment.
4. **Exploratory Learning**
    - Provide students with a goal or expected output and ask them to discover the best way to achieve it using MATLAB.
    - Enhances critical thinking and problem-solving abilities.
5. **Interactive Lecture Method**
    - Combines explanations with brainstorming and questioning.
    - Incorporates whiteboard use, presentations, and live coding demonstrations.
6. **Cooperative Learning**
    - Divide students into small groups to solve problems or complete projects using MATLAB.
    - Encourages teamwork and communication skills.
7. **Problem-Solving Approach**
    - Present practical problems that require algorithmic thinking and application of MATLAB tools.
    - Develops students' ability to apply programming skills to real-world engineering scenarios.

130. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		starting matlab with types of matlab windows using matlab as calculator	Overview of TLAB vironment	cture and lab	cussion
	3	• Creating matlab variables • Overwrit g variable	Overview of TLAB vironment	cture and lab	tten assignment
	3	trix generation tering a vector tering a matrix trix indexing on operator ating a sub-trix	trices	cture and lab	tical report
	3	eting row or umn nension of trix nsposing a trix ncatenating trices ecial matrices	trices	cture and lab	m
		trix arithmetic eration ray arithmetic eration ving linear uation	ray operation l linear uation	cture and lab	cussion
		n,sub,multiply l division olr,flipud	trix function	cture and lab	z

		Shift and Sort Functions ecking truction	 fting and ting Matrices	cture and lab	ort
			d-term exam		mprehensive exam
		ipt file ut and Output tement	 tlab ogramming	cture and lab	cute
		ational erator gical operator	gical and ational erator	cture and lab	signment
		tatement	w control	cture and lab	cute
		Switch control	w control	cture and lab	ort
		-loops and plied it on ogram	 w control	cture and lab	
		While- tement break tement ontinue tement	 w control	cture and lab	ignment
			omprehensive iew of all ogram	cture and lab	l report

131. 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

132. Learning and Teaching Resources

quired textbooks (curricular books, if any)	.
Main references (sources)	• Introduction to matlab for engineering student ,David Houcque, Northwestern Universty ,version 1.2,August 2005 • Matrix Theory and Applications with MATLAB Darald J. Hartfiel, Texas A&M University CRC Press,

	Inc., 2001 ISBN: 1-58488-108-9; Language: English
Recommended books and references (scientific journals, reports…)	• A MATLAB Exercise Bo Paperback – June 18, 2014, by Ludm Kuncheva (Author), Cameron Gr (Author)\ lving Applied Mathematical • oblems with MATLAB ngyü Xue, Northeastern University ina; YangQuan Chen, University of lifornia CRC Press, Inc., 2009 ISBN: 8-1-4200-8250-0; Language: English
Electronic References, Websites	**Matlab Matrix - Reviewed (tutorialspoint.com)** **https://www.mathworks.com/help/matlab/getting-started-with-matlab.html** **https://www.tutorialspoint.com/matlab/index.htm**

133. Course Name: computer application 4	
134. Course Code: MIE311	
135. Semester / Year: 2nd Semester/ third	
136. Description Preparation Date:27−6−2025	
137. Available Attendance Forms: In-person (On-campus) Attendance	
student's actual presence within classrooms, laboratories, and academic facilities, actively engaging in lectures, practical sessions, class discussions, and field visits	
138. Number of Credit Hours (Total) / Number of Units (Total)	
3 Hours/2 Units	
139. Course administrator's name (mention all, if more than one name)	
Name: AZZA KAYS Email: azzakays@ntu.edu.iq	
140. Course Objectives	
Course Objectives	his course aims to equip students with both theoretical knowledge and practical skills in the **MATLAB environment**, focusing on the **modeling and simulation of dynamic systems using Simulink**, as well as the design of **graphical user interfaces (GUI)** to develop interactive and engineering-oriented applications. By the end of the course, students will be able to: 1. **Understand the fundamentals of MATLAB and Simulink** and use them for mathematical modeling and simulation of dynamic systems. 2. **Build simulation models** of physical and engineering systems using Simulink blocks. 3. **Recognize key concepts of graphical user interfaces (GUI)** and develop interactive applications using MATLAB tools such as GUIDE or App Designer.

	4. **Integrate GUI components with MATLAB functions or Simulink models** to create complete and functional applications. 5. **Develop technical problem-solving skills** through both graphical and script-based programming in MATLAB. 6. **Analyze and interpret simulation results** to enhance system design and support data-driven decision-making

141. Teaching and Learning Strategies

Strategy	The instructional strategy for this course is designed to promote both **conceptual understanding** and **hands-on proficiency** in MATLAB, Simulink, and GUI development. The strategy combines **interactive lectures**, **practical labs**, **project-based learning**, and **formative assessments** to reinforce theoretical concepts through application. 1. **Lecture-Based Learning** • **Purpose:** Introduce theoretical foundations and key concepts. • **Method:** Use visual presentations, live demonstrations in MATLAB/Simulink, and class discussions. • **Tools:** PowerPoint, MATLAB live scripts, short quizzes. 2. **Hands-on Laboratory Sessions** • **Purpose:** Develop practical skills in modeling, simulation, and GUI development. • **Method:** Guided exercises, simulation tasks, and real-time coding in supervised labs. • **Tools:** MATLAB, Simulink, App Designer, GUIDE. 3. **Project-Based Learning** • **Purpose:** Encourage creative thinking and real-world application. • **Method:** Students complete a term project combining system modeling and GUI integration. • **Assessment:** Project proposal, midterm progress check, final report, and presentation.

	4. **Collaborative and Problem-Solving Activities** • **Purpose:** Promote teamwork, critical thinking, and problem-solving. • **Method:** Group assignments, design challenges, peer code reviews

142. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		Introduction to the Use of Simulation Software and Its Importance in Engineering Applications	roduction ulink in talb	cture and	cussion
	3	Getting to know the Simulin windows, how to access the Simulink library, designing a model, learning how to run t model, and building a simulation model.	ulink	cture and	tten assignment
	3	inition of types of Simulink aries: sources, sinks, math rations, logic operations, and anced libraries.	ulink	cture and	ctical report
	3	igning simulation models to orm mathematical operations g math operation blocks such qrt, sum, product, math ction, trigonometric functions,	ulink	cture and	m
		Practical Examples of the Math Operation Toolbox	ulink	o.	ort
		roduction to power ctronic circuit with ulink and define all nponent	ulink with wer ctronic cuit	cture and	z
		sign half wave and full ve rectifier with power ctronic library	ulink with wer	cture and	ort

			ctronic cuit		
			d-term m		nprehensive exam
		sign op-amp circuits by nulink	nulink with ctronic cuit	cture and	cute
		roduction to GUI system matlab and starting action h a GUI element	phical user erface UI)	cture and	signment
		rting action with GUI ment	phical user erface UI)	cture and	cute
		Communicating with GUI element and design a program by using GUI	phical user erface UI)	cture and	ort
		ating GUI tools step by p	phical user erface UI)	cture and	
		sign gui program to drw signal e axes ,toggle and mor	phical user erface UI)	cture and	ignment
		sign more program by ng GUI	phical user erface UI)		l report

143. 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

144. Learning and Teaching Resources

quired textbooks (curricular books, if any)	.
Main references (sources)	• Quan, L. (2020). *Simulink: Dynamic System Simulation for MATLAB*. Independently publishe • Matrix Theory and Applications with MATLAB Darald J. Hartfiel, Texas A&M University

	CRC Press, Inc., 2001 ISBN: 1-58488-108-9; Language: English
Recommended books and references (scientific journals, reports…)	• A MATLAB Exercise Book Paperbac June 18, 2014, by Ludmila Kunche (Author), Cameron Gray (Author) • *MATLAB Graphical User Interface Design* – M.A. Mazidi, Naimul Hasan, Rolin Dmello, 2015, **MicroDigitalEd**
Electronic References, Websites	https://www.mathworks.com/products/simulink.html /https://www.geeksforgeeks.org/matlab-gui

145. Course Name: Microcontroller
146. Course Code:
147. Semester / Year: second Semester/ Fourth
148. Description Preparation Date:28-6-2025
149. Available Attendance Forms: (main campus) Attendance
150. Number of Credit Hours (Total) / Number of Units (Total)
4 Hours/3 Units
151. Course administrator's name (mention all, if more than one name)
Name: Dr.Ahmed Sabeeh Yousif Email: Ahmedsabeeh123@ntu.edu.iq
152. Course Objectives

Course Objectives	**Remember** **Identify the components of the 8051 microcontroller and understand the function of each part.** **Recall different memory types within the microcontroller (RAM, ROM, SFR).** **Recognize assembly language instructions for the 8051 such as MOV, ADD, SJMP, etc.** **Understand the various addressing modes (e.g., direct, indirect, immediate).** **Understand**

	Explain how instructions are executed within the 8051's CPU. **Describe the operation and different modes of timers (Timers 0/1).** **Differentiate between the various addressing modes used in 8051.** **Apply** **Write assembly programs to perform tasks such as addition, looping, or using timers.** **Implement and test programs using simulators or real development tools such as Debug or MIDE.** **Design delay routines using timers or loop-based programming.** **Analyze** **Analyze memory contents before and after program execution to understand the effect of instructions.** **Infer how different timer values affect the resulting delay time.** **Evaluate** **Evaluate the efficiency of written programs in terms of execution speed and memory usage.** **Select the most appropriate timer mode or addressing mode for a specific task.** **Create** **Design a mini embedded system (mini project) such as a motor control or display system using the 8051 microcontroller.** **Integrate multiple features (e.g., timer + display + input switches) to develop a complete practical application.**

153. Teaching and Learning Strategies	
Strategy	The teaching and learning strategies in the "Control Systems" course are designed to prepare students to analyze and design intelligent and digital control systems within engineering and medical contexts. The focus is on developing a deep understanding of control principles, practical application of embedded systems, and strengthening technical skills in complex and dynamic environments. **Teaching and Learning Strategies** The teaching and learning strategies in the "Control Systems" course are designed to prepare students to analyze and design intelligent and digital control systems within engineering and medical contexts. Emphasis is placed on deep understanding of control principles, practical implementation of embedded systems, and the enhancement of technical skills in complex and dynamic environments. These strategies include: **Theoretical Lectures and In-Class Discussions** Delivery of core concepts in control theory such as system stability, time response analysis, and controller design using PID, Root Locus, and Bode techniques in an interactive classroom setting that encourages questions and critical system analysis. **Practical Laboratory Work** Implementation of hands-on experiments using real control systems (e.g., temperature, motor, and pressure control) to apply theoretical models through software tools such as MATLAB/Simulink or LabVIEW, strengthening practical skills and bridging theory with engineering reality. **Group Design Projects** Assigning students to design analog or digital control models for medical or industrial systems using microcontrollers (e.g., Arduino, 8051, or PLC), with a focus on component selection, performance analysis, and documentation. **Real-World Case Study Analysis** Analysis of existing control systems in hospitals or vital medical equipment (e.g., infusion pumps, ventilators) to reinforce applied

	understanding of control principles and decision-making in system design. **Simulation and Digital Modeling** Use of simulation software such as EIDSIM to model the behavior of dynamic systems and evaluate the impact of modifications on system performance, fostering student capability in exploring innovative solutions without costly field implementation. **E-Learning and Digital Instruction** Provision of interactive digital content (recorded lectures, Moodle activities, training videos) that supports self-paced learning, reinforcement of fundamental concepts, and monitoring of individual progress in a flexible learning environment. **Interdisciplinary and Community-Oriented Learning** Integration of control concepts with public health and environmental challenges, through applications such as intelligent ventilation systems, air quality control, and optimizing performance of medical devices used in local communities. **Continuous Assessment and Constructive Feedback** Use of quizzes, lab reports, project presentations, and oral discussions to assess not only theoretical knowledge but also applied engineering thinking, supported by professional feedback to continuously improve student performance.

154. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		derstands the ncept of the crocontroller l the difference ween it and croprocessor.	roduction to croprocessors l the 8051 crocontroller	cture, cussion	iz

		plains the hitecture of 8051 and the damental ctions of its ernal memory.	niliarization h the training ard and using ulation tware.	cture, Case Study	itten signment
		plies the use of stack in grammingand ces the data w.	ntrolling an O using MOV l SETB tructions.	cture, Lab monstration	Report
		tinguishes ween different dressing modes l selects the st appropriate e.	plying SH/POP tructions and cing the stack.	cture, Simulation	LINE SIGNMENT
		ecutes basic thmetic and ical tructions using embly guage.	grammingng different dressing modes.	cture, Design dio	sign Exercise
		ecutes simple thmetic and ical tructions using embly guage.	ecuting thmetic and ical operations ng the crocontroller	cture, Discussion	iz
		Designs loops using jump and repeat instructions.	grammingnters using ps.	cture, Field it	LINE SIGNMENT
		Executes bit-le instructions an applies basic control operations.	ntrolling puts using TB/CLR tructions.	cture, Lab Work	Report

		Explains the structure of timers and use them in delay-based applications.	ner nagement	cture, Case dy	signment
		Programs time in different mo for time contro	nerating Delay ng Timer Mode	cture, Design dio	sign omission
		Implements a pulse generato using timers.	*gramming ner Mode 2 to-Reload)*	cture, Discussion	itten Test
		Analyzes PWM	nerating a PWM veform with cise timing.	cture, Workshop	LINE SIGNMENT
		Interacts with input/output units and reads real-time data.	ading buttons l controlling ernal nponents.	cture, Discussion	itten Test
		Performs interfacing wit external memo and analyzes th results.	gramming a transfer ween internal l external RAM.	mputer Lab, mulation	ject omission
		Develops an integrated proj that utilizes the skills acquired.	egrated Design Engineering tems.	upProject, minar	al Project sentation

155. 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

156. Learning and Teaching Resources

quired textbooks (curricular books, if any)	The 8051 Microcontroller: Architecture, Programming, and Applications. 3rd Edition, Cengage Learning, 2004

	• The 8051 Microcontroller and Embedded Systems: Using Assembly and C. 2nd Edition, Pearson Education, 2006
Main references (sources)	• The 8051 Microcontroller: Architecture, Programming, and Applications. 3rd Edition, Cengage Learning, 2004. ISBN: 9781401861582 • The 8051 Microcontroller. Pearson Education, 1995. ISBN: 9780028006018
Recommended books and references (scientific journals, reports…)	• **IEEE Transactions on Industrial Electronics** Publishes advanced research on intelligent control systems and microcontroller applications in the medical and industrial sectors. • **Biomedical Engineering Online (BMC)** Focuses on control applications in biomedical devices such as drug infusion systems and ventilators.
Electronic References, Websites	https://www.tutorialspoint.com/8051_microcontroller **https://www.electronics-tutorials.ws**

157. Course Name: Signal Processing
158. Course Code: MIE 307
159. Semester / Year: Second Semester/ third
160. Description Preparation Date: 29−6−2025
161. Available Attendance Forms:
In University: According to academic culture between halls and laboratory. E-Learning: By Google Meet on Google Class, for assignments, times, marks, _ _ _ _ _.
162. Number of Credit Hours (Total) / Number of Units (Total)
4 Hours/3 Units
163. Course administrator's name (mention all, if more than one name)
Name: Eanass Usama Taha Email: eshabkhoontc@ntu.edu.iq
164. Course Objectives

Course Objectives	• **Support to understanding in-depth** signal description and responses of linear time invariant systems. • **Solving the mathematical problems with the possibility of time variation**. • **Enhancement LTE Concepts by examples**. • **Trained to extract output signal** according to a specified engineering concept.

	• **Trained to analyze signals and the related system.** • **Encourage to** explore medical signal and its' complexion. • **Encouraging to** engage in interdisciplinary collaboration, effective professional communication, and taking ethical decision to ensure qualification for outstanding professional practice in the field of medical device engineering.

165. Teaching and Learning Strategies

Strategy	The educational strategy followed aims primarily to build a solid knowledge base that can be relied upon and referred to at all times. Such objective is achieved gradually through description and enriching it with experience, conducting quick tests to assess the students' status, and opening the field for proposing ideas while considering the students' ability and the real opportunities to complete it appropriately. 18. **Interactive lectures and seminars**: Presenting basic scientific and engineering concepts through regular lectures, enhanced by interactive dialogues that encourage analytical thinking and the development of problem-solving skills. 19. **Laboratory and analytical work:** Conducting practical experiments corresponding to the scientific foundation of the material in high-capacity scientific laboratories**.** 20. **Design workshops and project-based learning:** Proposing scientific projects related to the scientific foundation and research reality. 21. **Case study analysis:** Conducting analytical studies based on real and substantiated data. 22. **Simulation and modeling exercises:** Using technical software (MATLAB-Simulink) is a relevant issue. 23. **Blended and electronic learning methods:** Integrating online learning platforms and digital resources to provide flexible and self-paced study opportunities, and to support continuous learning outside the classroom. 24. **Multidisciplinary and community-based learning:** Engaging students to interact with the reality of healthcare.

	25. **Student assessment:** Statistical distribution and reasons for any degree occurring outside the curve is the only way to reach logical causes.

166. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		Convert Signal to Data	Sampling Theory	cture, mputer chniques	o Report mework
		Z-Transform Fundamentals	Z-Transform	cture, mputer chniques	o Report
		Z-Transform Properties	Z-Transform	cture, mputer chniques	o Report
		Problem Solved	Z-Transform	cture, mputer chniques	o Report mework
		rk ndamentals	Digital Filters	cture, mputer chniques	o Report
		FIR Design Procedure	Digital Filters	cture, mputer chniques	o Report
		IIR Design Method	Digital Filters	cture, mputer chniques	o Report
		Producing IIR Model by transfer s to z.	Digital Filters	cture, mputer chniques	o Report mework
		Producing Circuit Diagram-1	Realization of Digital Filter	cture, mputer chniques	o Report

		Producing Circuit Diagram-2	Realization of Digital Filter	cture, mputer chniques	o Report mework
		Discrete Fourier Transform Fundamenta	Analysis of Digital Signal	cture, mputer chniques	o Report
		Fast Fourier Transform Method	Analysis of Digital Signal	cture, mputer chniques	o Report mework
		Analysis of Sound	Analysis of Sound	minar, mputer chniques	o Report
		Analysis of EMG	Analysis of EMG	minar, mputer chniques	o Report
		Analysis of ECG	Analysis of ECG	minar, mputer chniques	o Report

167. Course Evaluation

Total 100% =(Resultant 50%: HW. 10%+Rep. 10%+ 20% mid-Theory+10%mid-practical) + (Final 50%: Theory 40%+Practical 10%)

168. Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Emiliano R. Martins (2024). Essentials of Signals and Systems. 1st Edition, Wiley.
Main references (sources)	• Monson H. Hayes (1999), Digital Signals and Systems, Schaum's Outline Series, 2nd Edition, McGraw-Hill. • D. Sundararajan (2024), Digital Signal Processing - An Introduction. 2nd Edition, Springer Nature Switzerland.
Recommended books and references (scientific journals, reports…)	• Kayvan Najarian, Robert Splinter (2012), Biomedical Signal and Image Processing, 2nd Edition, **CRC** Press.

	• Parker S. Ruth, Christopher M. Neils (2020), Bio signal Processing: Foundations for Biomedical Engineers, 1st Edition, independently published
Electronic References, Websites	• https://www.scribd.com/docs/Science-Mathematics

169. Course Name: Signal Processing	
170. Course Code: MIE 306	
171. Semester / Year: first Semester/ third	
172. Description Preparation Date:28−6−2025	
173. Available Attendance Forms:	
In University: According to academic culture between halls and laboratory. E-Learning: By Google Meet on Google Class, for assignments, times, marks, _ _ _ _ _.	
174. Number of Credit Hours (Total) / Number of Units (Total)	
4 Hours/3 Units	
175. Course administrator's name (mention all, if more than one name)	
Name: Eanass Usama Taha Email: eshabkhoontc@ntu.edu.iq	
176. Course Objectives	
Course Objectives	• **Support to understanding in-depth** signal description and responses of linear time invariant systems. • **Solving the mathematical problems with the possibility of time variation**. • **Enhancement LTE Concepts by examples**. • **Trained to extract output signal** according to a specified engineering concept.

	• **Trained to analyze signals and the related system.** • **Encourage to** explore medical signal and its' complexion. • **Encouraging to** engage in interdisciplinary collaboration, effective professional communication, and taking ethical decision to ensure qualification for outstanding professional practice in the field of medical device engineering.

177. Teaching and Learning Strategies

Strategy	The educational strategy followed aims primarily to build a solid knowledge base that can be relied upon and referred to at all times. Such objective is achieved gradually through description and enriching it with experience, conducting quick tests to assess the students' status, and opening the field for proposing ideas while considering the students' ability and the real opportunities to complete it appropriately. 26. **Interactive lectures and seminars**: Presenting basic scientific and engineering concepts through regular lectures, enhanced by interactive dialogues that encourage analytical thinking and the development of problem-solving skills. 27. **Laboratory and analytical work:** Conducting practical experiments corresponding to the scientific foundation of the material in high-capacity scientific laboratories**.** 28. **Design workshops and project-based learning:** Proposing scientific projects related to the scientific foundation and research reality. 29. **Case study analysis:** Conducting analytical studies based on real and substantiated data. 30. **Simulation and modeling exercises:** Using technical software (MATLAB-Simulink) is a relevant issue. 31. **Blended and electronic learning methods:** Integrating online learning platforms and digital resources to provide flexible and self-paced study opportunities, and to support continuous learning outside the classroom. 32. **Multidisciplinary and community-based learning:** Engaging students to interact with the reality of healthcare.

	33. **Student assessment:** Statistical distribution and reasons for any degree occurring outside the curve is the only way to reach logical causes.

178. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
		ıcking	History of Signal Processing	ture, mputer chniques	ort a say
		Signal Description	Standard signal	ture, mputer chniques	Report mework
		Describing Frequency Response of LTI.	Analog Systems	ture, mputer chniques	Report
		Examine Impulse Response of LTI.	Analog Systems	ture, mputer chniques	Report mework
		tterworth ter	Filters	ture, mputer chniques	Report
		Chebyshev Filter	Filters	ture, mputer chniques	Report
		Fundamenta	Convolution	ture, mputer chniques	Report
		Processing input signal output	Convolution	ture, mputer chniques	Report mework

		Fourier Series Fundamentals	Signal Analysis	cture, mputer chniques	o Report
		Analyzing Periodic Signal	Signal Analysis	cture, mputer chniques	o Report
		Complex Fourier Serie Fundamentals	Signal Analysis	cture, mputer chniques	o Report mework
		Fourier Transform Fundamentals	Signal Analysis	cture, mputer chniques	o Report
		Analyzing Energy Signal	Signal Analysis	cture, mputer chniques	o Report
		Fourier Transform Properties	Signal Analysis	cture, mputer chniques	o Report
		Transform Energy signal based on properties	Signal Analysis	cture, mputer chniques	o Report mework

179. Course Evaluation

Total 100% =(Resultant 50%: HW. 10%+Rep. 10%+ 20% mid-Theory+10%mid-practical) + (Final 50%: Theory 40%+Practical 10%)

180. Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Emiliano R. Martins (2024). Essentials of Signals and Systems. 1st Edition, Wiley.
Main references (sources)	• Hwei P. Hsu (2011), Signals and Systems, Schaum's Outline Series, 2nd Edition, McGraw-Hill. • D. Sundararajan (2024), Digital Signal Processing - An Introduction. 2nd Edition, Springer Nature Switzerland.

Recommended books and references (scientific journals, reports…)	• Kayvan Najarian, Robert Splinter (2012), Biomedical Signal and Image Processing, 2nd Edition, **CRC** Press. • Parker S. Ruth, Christopher M. Neils (2020), Bio signal Processing: Foundations for Biomedical Engineers, 1st Edition, independently published
Electronic References, Websites	• https://www.scribd.com/docs/Science-Mathematics

Module Title: Microprocessors .1	
Module Code: MIE309 .2	
Module Level Third / Semester of Delivery Second .3	
4. Date of preparation of the description :17-6-2025	
5. Available forms of attendance	
Attendance (on campus): This means students' actual participation in educational activities through direct presence in classrooms, laboratories, and other academic facilities. This allows for direct interaction with faculty members and colleagues, and active participation in lectures, practical exercises, discussion sessions, and field visits related to the course.	
6. Number of credit hours (total) / Number of units (total)	
2 hours theory / 3 hours practical / 5 units	
7. Course supervisor name	
Name: Dr. Aseel Thamer Ibrahim Email: aseelthamer@ntu.edu.iq	
8. Course objectives	
● Provide students with a deep understanding of advanced principles and practices in computer engineering, electronics, and low-level programming through the study of the Intel 8086 microprocessor and assembly language, which aims to achieve a set of important educational and technical objectives, as well as low-level programming. **● Understand the internal architecture of a computer by learning how a central processing unit (CPU) works in terms of architecture, registers, buses, arithmetic logic unit (ALU), and more.** **● Be able to program a microprocessor to perform a specific task using assembly language.** **● Be able to identify microprocessor versions and the differences between them.**	**Goals**

● **Implement practical programming projects to apply what has been learned by writing real programs and solving programming problems.** ● **Be able to interact with hardware by understanding how to communicate with peripheral devices such as memory, displays, and switches via ports and input/output technologies.** ● **Learn low-level design principles: the ability to build microprocessor-based electronic systems.** ● **Gain analytical and problem-solving skills: by understanding how commands are executed within the processor and troubleshooting at the component level.** ● **Understand memory organization and address handling: learn how to partition memory, address commands and data, and use the stack.**	
9. Teaching and learning strategies	
To teach the 8086 Microprocessor and Assembly Language course, a range of teaching and learning strategies are used that are appropriate to the technical and applied nature of the subject. This course requires a deep theoretical understanding along with practical skills. These strategies include: 1. Interactive Lectures and Seminars Introducing basic scientific and engineering concepts through structured lectures, reinforced by interactive discussions that encourage analytical thinking and the development of problem-solving skills. 2. Project-Based Learning: Encourages students to apply theoretical concepts practically, such as designing a circuit using the 8086 or writing an assembly language program, which helps develop problem-solving and critical thinking skills. 3. Simulation-Based Learning Using simulators such as the EMU8086, students experience executing commands and monitoring results without the need for a physical device.	**Strategy**

4. Demonstrations: Live demonstrations of how to write and run assembly language programs. This helps connect theory with practice. 5. Collaborative Learning: Divide students into small groups to solve exercises or complete projects that develop teamwork and technical discussion skills. 6. Interactive Lectures: Incorporate short questions, visual presentations, and short videos to explain the processor's architecture or addressing methods. 7. Use of visual learning aids: such as 8086 architecture diagrams, instruction tables, and addressing maps, to facilitate understanding of complex structures. 8. Short tests and continuous assessment: Help reinforce understanding and measure student progress, such as instruction decoding exercises, short tests on register structures, and assembly instructions. 9. Blended and e-Learning Methods Integrate online learning platforms and digital resources to provide flexible, self-paced learning opportunities and support continuous learning outside of the classroom. 10. System Design: Explain how microprocessors interact with memory, input/output devices, and peripheral components. 11. Programming Skills: Develop effective assembly code to solve computational problems. Implementing microprocessor-based solutions for controlling devices. 12. Assessment and Feedback Cycles Applying formative and summative assessment methods, including technical reports, design presentations, and oral tests, while providing constructive feedback to support student development and enhance their competencies. 13. Delivering presentations to clarify and explain concepts related to the course content.	

14. Working as a team through discussion groups related to the course content. 15. Preparing reports: This method is used to increase students' access to more information about the subject, whether from academic books or the internet.	

11. Course structure

الأسبوع	الساعات	مخرجات التعلم المطلوبة	اسم الوحدة / أو الموضوع	طريقة التعليم	طريقة التقييم
1	5	Understanding of microprocessor chitecture, and ability program and execute assembly language instructions to manipulate hardware d embedded systems.	Introduction to microprocessor	Lecture, discussion, video presentation explaining the evolution of the processor	Short test
2	5	Be able to analyze the architecture of the 8086 processor and program in assembly language to perform operations and control its associated devices.	**8086 MICROPROCESSORS**	lecture, discussion	Written assignment
3	5	lerstand the function of the control bus in the 8086 cessor and its role in coordinating data transfer between the processor and other components.	8086 Control Bus	Lecture, presentation	practical report
4	5	The ability to distinguish and use the different addressing modes in the 8086 to access data and xecute instructions efficiently.	8086 Addressing Modes	Lecture, application lab programs	a test
5	5	lerstand how to locate data using the 8086 addressing modes and distinguish the impact of each mode on the execution of instructions.	Data of addressing modes	Lecture, application lab programs	Design exercise

Short test	Lecture, application lab programs	Program-Memory Addressing Modes in Microprocessor 8086/8088	nderstand the mechanisms and methods of addressing programmatic memory in the 8086/8088 processor and use them to determine instruction locations during program execution.	5	6
practical report	Lecture, application lab programs	Compare instruction, Arithmetic Instructions in Microprocessor 8086/8088(part 2) Div & mult (unsigned -signed).	able to use and understand the comparison and calculation (addition, raction, multiplication, and division) instructions for signed and unsigned data in 8086/8088 processors.	5	7
practical report	Lecture, application lab programs	**Logic Instructions in Microprocessor 8086/8088 and Shift and rotate instructions**	Understand and implement c instructions (AND, OR, XOR, NOT) and shift and rotation instructions in 8086/8088 processors to process data at the bit level.	5	8
Written assignment	Lecture, application lab programs	Program Control Instructions in Microprocessor 8086/8088 and Jump, loop, and call instructions. Program Control Instructions in Microprocessor 8086/8088 and Jump, loop, and call instructions	ability to use program control ructions (jump, loop, and back) in 8086/8088 processors rganize instruction execution and control program flow.	5	9
Written test	Lecture, application lab programs	Hardware Specifications of 8086/8088 microprocessor Hardware Specifications of 8086/8088 microprocessor	sical Understanding the specifications of the 8086/8088 processors, including pin count, nals, operating modes, and interface architecture.	10	10, 11

Written test	Lecture, discussion, giving practical examples	**Memory Interface of 8086/8088 microprocessor**	Be able to design and understand the memory interface for 8086/8088 processors to ensure proper nmunication between the processor and external memory.	15	12, 13 , 14
		review		5	15

Delivery Plan (Weekly Lab. Syllabus)

Week	Material Covered
Week 1	Emu8086 program
Week 2,3,4	Move instructions, Addition and Subtraction, Multiplication and division
Week 5	Other transfer instructions
Week 6,7	Other Arithmetic Instructions
Week 8	Logic Instructions
Week 9,10,11,12	Shift and rotate instructions
Week 13,14	Jumps instructions and loops
Week 15	CALL and RETURN instructions, IN/OUT and other control instructions

Module Evaluation

توزيع الدرجات من **100** وفقًا للمهام الموكلة إلى الطالب مثل التحضير اليومي، الاختبارات الشفوية اليومية، الاختبارات الشهرية أو الكتابية، التقارير **...** إلخ.

Module Evaluation

تقييم المادة الدراسية

As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	3,5,7,9	LO #1, 4,10, 12
	Assignments	2	10% (10)	2 ,9	LO # 4 ,10
	Projects / Lab.	6	10% (10)	Continuous	All
	Report	6	10% (10)	Continuous	All

Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Learning and Teaching Resources

▪ Brey Barry B., (1997), Intel microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium.	
.1 Walter A. Triebel, Avtar Singh, (2002), The Lab Manual for 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications, 4th edition [4th ed.] .2 A. Nagoor Kani, (2013), 8086 Microprocessors and its Applications.	المراجع الرئيسية (المصادر)
Brey, Barry B, (2019), The Intel microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit extensions: architecture, programming, and interfacing [8th ed].	الكتب والمراجع الموصى بها (المجلات العلمية والتقارير...)
.1 https://www.tutorialspoint.com/microprocessor/index.htm. .2 https://www.geeksforgeeks.org/intel-8086-microprocessor. .3 https://www.youtube.com/playlist?list=PLBlnK6fEyqRhX6r2uhhlubuF5QextdCSM .4 https://www.allaboutcircuits.com/textbook/digital/chpt-11/the-intel-8086-microprocessor/ .5 https://www.8051projects.net/8086-microprocessor-tutorial.php	المراجع الإلكترونية والمواقع الإلكترونية

181. Course Name: Medical Image Processing	
182. Course Code: MIE403	
183. Semester / Year: 2nd Semester/ forth	
184. Description Preparation Date:26−6−2025	
185. Available Attendance Forms: In-person (On-campus) Attendance	
186. Number of Credit Hours (Total) / Number of Units (Total)	
4 Hours/3 Units	
187. Course administrator's name (mention all, if more than one name)	
Name: Marwa Mawfaq Mohamedsheet Email: nabeelismail@ntu.edu.iq	
188. Course Objectives	
Course Objectives	• **Introduce the fundamentals of digital image processing**, including image representation, formats, and characteristics relevant to medical and engineering applications. • **Develop students' understanding of spatial domain techniques**, such as intensity transformations and histogram processing, to enhance image quality and extract relevant features. • **Train students in pixel-wise operations** and basic filtering methods for noise reduction, smoothing, and image enhancement using linear and nonlinear techniques. • **Familiarize students with advanced spatial filtering** techniques for edge

	detection, image sharpening, and enhancement, essential in medical diagnostics. • **Enable students to implement image segmentation methods**, such as thresholding, region growing, and edge-based techniques to isolate areas of interest in medical images. • **Introduce fundamental concepts of image restoration**, including noise modeling and filter-based correction to recover degraded images. • **Provide a foundational understanding of Discrete Wavelet Transform (DWT)** and its role in multiresolution analysis of medical images. • **Teach core principles of digital image compression**, focusing on medical image storage and transmission using algorithms like EZW, SPIHT, and No List SPIHT. • **Equip students with practical skills using MATLAB** or equivalent tools to implement and analyze image processing algorithms on real-world biomedical images. • **Promote critical thinking and problem-solving** through lab-based projects and assignments simulating real challenges in medical image analysis.
189. Teaching and Learning Strategies	
Strategy	The course employs a diverse set of instructional strategies to ensure both theoretical understanding and practical competence in digital image processing. These strategies include: 1. **Lectures (Theory Sessions):** Structured presentations covering foundational and advanced topics in digital

image processing, including mathematical concepts and algorithmic approaches, with emphasis on applications in medical imaging.

2. **Laboratory Sessions (Hands-on Practice):**
Supervised practical labs using MATLAB or equivalent tools to reinforce theoretical knowledge through implementation and experimentation on real or simulated medical image datasets.

3. **Seminars and Interactive Discussions:**
Facilitated discussions and student-led presentations on recent developments, challenges, and innovations in image processing, particularly in the biomedical field.

4. **Problem-Based Learning (PBL):**
Students are presented with real-world image processing problems and encouraged to investigate, design, and implement effective solutions using appropriate techniques.

5. **Case Studies and Applied Projects:**
Medical imaging case studies are analyzed to illustrate the role of digital image processing in diagnosis, segmentation, enhancement, and compression.

6. **Assignments and Homework:**
Regular problem-solving exercises and coding assignments to deepen students' analytical and technical skills.

7. **Self-Directed Learning:**
Encouragement of individual exploration through academic resources, online tools, and datasets to develop independent learning and research capabilities.

8. **Continuous Feedback and Assessment:**
Ongoing formative assessment through quizzes, lab reports, and in-class exercises to monitor student progress and provide timely support.

190. Course Structure

Week	Hours	Required Learning Outcomes	Unit or Subject Name	Learning Method	Evaluation Method
		erstand the fundamentals igital image processing and the an visual system.	oduction to ital Image cessing and HVS	ture, Discussion	z
		cribe image representation, lution, and sampling niques.	ital Image resentation Resolution	ture, Visual nonstration	tten ignment
		tify pixel relationships their importance in spatial ain processing.	el Neighbors Spatial ationships	ture, Lab Activity	Report
		ly intensity transformation niques.	ic Gray Level nsformations	ture, MATLAB Lab	
		lyze and equalize image ograms.	ogram cessing and ancement	ture, Hands-on Practice	ignment
		orm arithmetic and logical rations on images.	el-wise	ture, MATLAB rcises	z

			rations and Image raging		
		ly linear and non-linear tial filters.	tial Filtering hniques	ture, Lab Session	Report
		Laplacian and gradient filters mage sharpening.	ge Sharpening Edge ancement	ture, Practical Lab	
		luate and implement edge ction techniques.	dient Filters Edge Detection bel, Roberts)	ture, Lab Demo	ort
		ment images using various niques.	ge Segmentation in Spatial Domain	ture, Practical Coding	ignment
		tore images affected by noise g spatial techniques.	ge Restoration and se Models	ture, Lab Work	z
		erstand and apply Discrete velet Transform.	oduction to DWT Multiresolution lysis	ture, MATLAB Lab	ort
		cribe principles of embedded ng using EZW.	ge Compression EZW	ture, Coding Activity	ignment
		lyze and apply SPIHT image pression.	HT Compression orithm	ture, Simulation	tten Test
		lement and evaluate No List HT technique.	anced Image pression: NLS HT	up Project, Seminar	l Project entation

191. 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

192. Learning and Teaching Resources

quired textbooks (curricular books, if any)	• Gonzalez, R. C., & Woods, R. E. (2002). *Digital Image Processing* (Hall. • Gonzalez, R. C., Woods, R. E., & Eddins, S. L. (2004). *Digital Imag Using MATLAB*. Prentice Hall. • Jayaraman, S., Esakkirajan, S., & Veerakumar, T. (2009). *Digital Im* McGraw-Hill .
Main references (sources)	Burger, W., & Burge, M. J. (2016). *Digital Image Processing: An Algorithmic Introduction Using Java* (2nd ed.). Springer. • Jahne, B. *Digital Image Processing* (6th ed.). Springer. • Jain, A. K. *Fundamentals of Digital Image Processing*. Prentice-Hal
Recommended books and references (scientific journals, reports…)	• Bankman, I, *Handbook of Medical Image Processing and Analysis* Academic Press. • Suetens, P. (2017). *Fundamentals of Medical Imaging* (3rd ed.). Ca University Press. • Journals:

	• *IEEE Transactions on Medical Imaging* • *Computerized Medical Imaging and Graphics* • *Journal of Digital Imaging (Springer)* *Medical Image Analysis (Elsevier)* |
Electronic References, Websites	he MathWorks (MATLAB Image Processing Toolbox): https://www.mathworks.com/discovery/digital-image-processing.html Radiopaedia (Medical imaging knowledge base): https://radiopaedia.org lational Institutes of Health (NIH) Imaging Resources: https://www.nih.gov sight Toolkit (ITK – Open-source medical image processing): https://itk.org OpenCV (Open-source computer vision library): https://opencv.org IT OpenCourseWare – Image Processing & Computer Vision: https://ocw.mit.edu Kaggle Medical Datasets (for projects and research): https://www.kaggle.com