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

Academic Program and Course Description Guide

2025−2026

Introduction:

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

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

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

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

Concepts and terminology:

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

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

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

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

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

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

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

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

Academic Program Description Form

University Name: Ninevah University
Faculty/Institute: College of Electronics Engineering
Scientific Department: Systems and Control Engineering Department
Academic or Professional Program Name: Bachelor of Systems and Control Engineering
Final Certificate Name: Bachelor of Systems and Control Engineering
Academic System: Courses & Bologna System
Description Preparation Date: 19/11/2025
File Completion Date: 16/03/2026

Signature:
Head of Department:
Assist. Prof. Abdullah Ibrahim Abdulah
Date: 17/3/2026

Signature:
Scientific Associate:
Assist. Prof. Dr. Bilal A. Jaber
Date: 17/3/2026

The file is checked by:
Department of Quality Assurance and University Performance
Director of the Quality Assurance and University Performance Department: Yaser Mohmmed Hussen
Date: 17/3/2026
Signature:

Approval of the Dean
30/3/2026

1. **Program Vision**
To attain leadership, excellence and creativity in the field of systems and control engineering and employing capabilities towards modern teaching, scientific research and community service.

2. **Program Mission**
To provide outstanding education in systems and control engineering topics, preparing students to excel in control, automation and intelligent systems. The department foster industry partnerships, engage in cutting-edge research and develop solutions for society challenges aligning with technological advancements and labor market needs.

3. **Program Objectives**
1. To graduate specialized engineers in the field of Systems and Control Engineering who possess a strong ethical commitment, are capable of working in both the public and private sectors, and are dedicated to lifelong learning and the pursuit of postgraduate studies. 2. To establish modern engineering practices that meet the needs of society, guided by professional responsibility and ethical standards. 3. To prepare graduates with creative knowledge that enables them to develop problem-solving skills and adapt rapidly to evolving technologies.

4. To develop the self-learning capacities of graduates to ensure continuous educational and professional development.

Objectives of the Systems and Control Engineering Department:

1. To graduate specialized engineers in the field of Systems and Control Engineering who are capable of working in both the public and private sectors.
2. To embrace continuous learning and career growth for students and graduates.
3. To support scientific research and collaboration with industrial partners and key entities.
4. To enhance the leadership aspect among staff and students, and to instill a spirit of collaboration among them.
5. To continuously update the curriculum to meet labor market requirements and achieve accreditation standards.

4. **Program Accreditation**
Does the program have program accreditation? And from which agency? NO

5. **Other external influences**
Is there a sponsor for the program? Yes, the Ministry of Higher Education and Scientific Research is the sponsoring body of the program.

6. **Program Structure**				
Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	6	15	9.32%	Basic course
College Requirements	15	38	23.60%	Basic course
Department Requirements	41	108	67.08%	Core course
Summer Training	Compulsory at 3rd stage			
Other				

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

7.**Program Description**				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
			theoretical	**practical**
1st Stage / 1st Semester	NVEE206	Mathematics I	4	
1st Stage / 1st Semester	NVEE215	DC Circuits Analysis	3	2
1st Stage / 1st Semester	NVEESC301	Physics of Semiconductors	3	2
1st Stage / 1st Semester	NVU10	Computer Skills and AI I	2	2
1st Stage / 1st Semester	NVEESC302	Engineering Mechanics (Statics)	3	
1st Stage / 1st Semester	NVU12	Democracy and Human Rights	2	
1st Stage / 2nd Semester	NVEE207	Mathematics II	4	
1st Stage / 2nd Semester	NVEE216	AC Circuits Analysis	3	2

1st Stage / 2nd Semester	NVEESC303	Engineering Mechanics (Dynamics)	3	
1st Stage / 2nd Semester	NVEESC304	Computer Programming	3	2
1st Stage / 2nd Semester	NVEESC307	Digital Design	3	2
1st Stage / 2nd Semester	NVU11	English I	2	
2nd Stage / 1st Semester	NVEE208	Engineering Analysis I	3	
2nd Stage / 1st Semester	NVEE210	Signals & Systems I	2	2
2nd Stage / 1st Semester	NVEESC305	Control I	3	2
2nd Stage / 1st Semester	NVEESC306	MATLAB Programming	2	2
2nd Stage / 1st Semester	NVEE212	Analog Electronics I	2	2
2nd Stage / 1st Semester	NVU13	Crimes of the Baath regime in Iraq	3	
2nd Stage / 2nd Semester	NVEE209	Engineering Analysis II	3	
2nd Stage / 2nd Semester	NVEESC309	Control II	2	2
2nd Stage / 2nd Semester	NVEE213	Analog Electronics II	2	2
2nd Stage / 2nd Semester	NVEESC311	Measurement and Sensors	2	
2nd Stage / 2nd Semester	NVEESC312	Machines	2	2
2nd Stage / 2nd Semester	NVEE201	Engineering Drawing	2	
2nd Stage / 2nd Semester	NVU16	Arabic I	2	
2nd Stage / 2nd Semester	NVU15	English II	2	
3rd Stage / 1st Semester	NVEESC314	Digital Control	2	2
3rd Stage / 1st Semester	NVEESC315	Mathematical Modelling	3	
3rd Stage / 1st Semester	NVEE204	Digital Signal Processing I	2	2
3rd Stage / 1st Semester	NVEESC316	Thermodynamics	2	
3rd Stage / 1st Semester	NVEESC317	Power Electronics	2	2
3rd Stage / 1st Semester	NVEE202	Industrial Management and Ethics	2	
3rd Stage / 1st Semester	NVU18	Computer Skills and AI II	2	2
3rd Stage / 2nd Semester	NVEE	Numerical Analysis	3	
3rd Stage / 2nd Semester	NVEESC319	PLC	3	2
3rd Stage / 2nd Semester	NVEESC320	Control Systems Design	3	2
3rd Stage / 2nd Semester	NVEE	Statistics and Probability	3	

3rd Stage / 2nd Semester	NVEESC321	Communications	2	
3rd Stage / 2nd Semester	NVEESC322	Microprocessors	2	2
3rd Stage / 2nd Semester	NVU17	Arabic II	2	
4th Stage / 1st Semester	NVEESC324	Robotics I	2	2
4th Stage / 1st Semester	NVEESC325	Optimal Control I	2	2
4th Stage / 1st Semester	NVEESC326	Linear Algebra	4	
4th Stage / 1st Semester	NVEESC327	Process Control	2	2
4th Stage / 1st Semester	NVEESC328	Industrial Networks	2	
4th Stage / 1st Semester	NVEESC329	Embedded Systems	2	2
4th Stage / 1st Semester	NVEESC337	Project Design		2
4th Stage / 2nd Semester	NVEESC331	Robotics II	2	2
4th Stage / 2nd Semester	NVEESC332	Optimal Control II	2	2
4th Stage / 2nd Semester	NVEESC333	Adaptive Control	2	
4th Stage / 2nd Semester	NVEESC334	Soft Computing	2	
4th Stage / 2nd Semester	NVEESC335	Computer Control	2	
4th Stage / 2nd Semester	NVEESC336	Modern Control Systems	2	2
4th Stage / 2nd Semester	NVEESC338	Project Implementation		2

8. Expected Program Learning Outcomes	
Knowledge	
Learning Outcomes 1	**Learning Outcomes Statement 1**
• Understanding the fundamental principles of feedback control systems, including mathematical modeling using differential equations, transfer functions, and state-space representations. • Explaining the stability criteria of control systems and analyzing the factors that affect system performance. • Describing the role of feedback mechanisms in	Upon successful completion of this course, the student will be able to: 1. Model Dynamic Systems: Construct mathematical models of physical systems (electrical, mechanical, chemical) using various techniques such as differential equations, transfer functions, and state-space representations.

various engineering disciplines, including electrical, mechanical, and chemical systems. • Demonstrating proficiency in using MATLAB and Simulink for the analysis and design of control systems.	2. Analyze System Stability and Performance: Evaluate the stability of control systems using theoretical criteria (such as Routh-Hurwitz) and analyze system performance through its transient and steady-state responses to identify influencing factors. 3. Assess the Impact of Feedback: Explain the principle, types, and vital applications of feedback in improving the accuracy, stability, and performance of systems across a wide range of engineering applications. 4. Utilize Computer Simulation Tools: Apply practical skills using software like MATLAB and Simulink to simulate, analyze, and design effective control systems that meet required specifications.
Skills	
Learning Outcomes 2	**Learning Outcomes Statement 2**
The aim of this course is to develop the following practical and personal skills in students: • Skills in design, experimentation, and analysis. • Effective communication skills. • Teamwork skills.	Upon successful completion of this course, the student will be able to: 1. **Design, Conduct, and Interpret Experiments:** Design appropriate engineering experiments, conduct them practically, collect data, and analyze and interpret it using suitable statistical tools and quality assurance measures to reach sound conclusions. 2. **Communicate with Clarity and Effectiveness:** Present and defend technical ideas and reports confidently in written and oral forms, using clear and structured language for diverse audiences (peers, supervisors, clients) and different management levels. 3. **Collaborate Effectively in Teams:** Actively engage as a productive

	member or leader in a work team, participating in setting goals, planning tasks, managing time, and adhering to schedules to achieve shared objectives.
Learning Outcomes 3	**Learning Outcomes Statement 3**
The aim of this course is to develop the student's capabilities in practical and communicative aspects, including: 1. The ability to design and conduct appropriate experiments, analyze and interpret data, and apply quality assurance principles. 2. The ability to communicate effectively with diverse audiences and across various organizational and managerial levels.	Of course. Here is the professional translation of the provided learning outcomes into English: Upon successful completion of this course, the student will be able to: **1. Design, Conduct Experiments, and Analyze Results:** • Design systematic engineering experiments that meet specific objectives. • Apply data collection tools and statistical analysis techniques to accurately interpret results. • Evaluate the quality of outcomes and apply quality assurance standards in technical reports. **2. Communicate Effectively Orally and in Writing:** • Formulate clear, well-structured technical reports suitable for diverse audiences (e.g., technical teams, management, clients). • Present ideas and projects orally using persuasive and interactive language, supported by visual aids. • Adapt communication styles according to the organizational level and cultural background of the target audience.
Ethics	
Learning Outcomes 4	**Learning Outcomes Statement 4**
This course aims to enhance the following professional and social values in students: 1. Commitment to ethical and professional responsibility in engineering practice.	Upon successful completion of this course, the student will be able to: 1. **Evaluate the ethical and social implications of engineering projects:**

2. Analytical thinking based on scientific and logical foundations. 3. Respect for diverse viewpoints and the promotion of constructive dialogue. 4. Teamwork with a collaborative spirit.	○ Analyze the economic, environmental, and societal consequences of engineering solutions and make balanced decisions. ○ Apply standards of professional and ethical responsibility in practical situations. 2. **Adopt critical and analytical thinking**: ○ Analyze complex problems using scientific and logical methodologies. ○ Evaluate proposed solutions based on evidence and objective data. 3. **Engage in constructive dialogue and respect diversity**: ○ Discuss technical ideas objectively while respecting different viewpoints. ○ Support teamwork by expressing opinions confidently and valuing the opinions of others. 4. **Collaborate effectively within teams**: ○ Contribute to achieving team goals through active participation in group tasks. ○ Adhere to deadlines and assume individual and collective responsibility.

Learning Outcomes 5	Learning Outcomes Statement 5
This course aims to enhance the student's values related to continuous development and leadership, including: • Commitment to continuous professional development and identifying relevant knowledge. • The ability to work effectively as a team member or leader. • Commitment to meeting deadlines and managing risks and uncertainty.	Upon successful completion of this course, the student will be able to: **1. Engage in Continuous Professional Development:** • Identify knowledge gaps and seek out appropriate learning resources to address them. • Effectively and systematically apply new knowledge to engineering projects. **2. Demonstrate Leadership and Teamwork:** • Guide a team towards specific and clear goals. • Delegate tasks fairly according to team members' capabilities. • Manage conflicts and foster collaboration among members. **3. Manage Time and Risks:** • Develop realistic, actionable plans and adhere to deadlines. • Identify potential risks and formulate strategies to mitigate their impact. • Make quick and effective decisions under conditions of uncertainty.

9.Teaching and Learning Strategies

Teaching strategy

The systems and control engineering department has an educational strategy that can be summarized as follow:

• Presenting the curriculum syllabus to the students at the beginning of the academic year, specifying the study hours that are appropriate for each topic that will be addressed during the semester.

• Assigning the dates for submitting homework and asking for it in an orderly manner.

• Specifying the dates of the quizzes mid and final exams according to the university's calendar

• Provide students with a detailed explanation of the grade they will obtain during the semester.

• Allocating textbook and supporting books that the student can use.

Learning strategy

One of the duties of the department is to follow up on the development of students' learning ability through:

• Motivating the student and highlighting the students' own abilities.

• Using modern means and presenting the lecture in an interesting way to draw the student's attention to the scientific material through illustrations and linking it to practical applications that can be understood by students.

• Involve all students in continuous discussions to make all students engaged in the lecture atmosphere.

• Non-discrimination between male and female students when they are involved in the different education sections.

• Make laboratories working groups of both sexes.

• Using modern means of illustration to enable the student to see things that may be difficult to convey verbally.

• The use of direct speech by the instructor of the lecture, while allowing the students to discuss the subject matter of the lecture. • Follow up the students' grades through their performance of the various exams to find out the failures that some students suffer from and try to overcome them. • Strengthening the relationship between the student and the lecturer so that it is not limited to the lecture, as well as providing ample time for students to review the teacher at other times to clarify any problems that students may encounter from not understanding some of the things that may appear during his studies. • Work to avoid using the method of memorization and indoctrination, but rather focus on stimulating the mental capacity of students by the appropriate method of presentation of the lecture and practical examples that increase the student's focus and expand his perceptions.

10.Evaluation methods
• Participation in physical or online classrooms. • Submission of laboratory reports. • Evaluation of practical implementation of experiments. • Submission of various activities. • Daily, midterm, and final exams, both in-person and online

11. Faculty						
Faculty members						
No.	**Name/Academic Rank**	**Specialization**		**Special Requirements /Skills (if applicable)**	**Number of the teaching staff**	
		General	**Special**		**Staff**	**Lecture**
1	Abdullah Ibrahim Abdullah/Asst. Prof.	Electrical Engineering	Control Engineering		1	

2	Jaafar Ramadan Mohamed/Prof.	Electrical Engineering	Digital Communication Engineering		1	
3	Ibrahim Khalaf Mohammad/Asst. Prof.	Electrical Engineering	Control Engineering		1	
4	Mohammed Abdul Jalil/Asst. Prof.	Electrical Engineering	Control Engineering		1	
5	Ahmed Jamil Abdel Qader/Lecturer	Electrical Engineering	Communicatio n Engineering		1	
6	Hussain Mohammed Hussain/Lecturer	Electronics Engineering	Electronics Engineering		1	
7	Nashwan Zior Hero/Asst. Lec	Electrical Engineering	Communicatio n Engineering		1	
8	Yazen Hudhiafa Shakir/Lecturer	Mechatronics and Robotics Engineering	Mechatronics Engineering		1	
9	Ali Khalil Mahmoud/Lecturer	Mechatronics and Robotics Engineering	Mechatronics Engineering		1	
10	Omar Yaseen Ismael/Asst. Prof.	Mechatronics Engineering	Control systems		1	
11	Muhammad Nusrat Younes/Asst. Prof.	Mechatronics Engineering	Control systems		1	
12	Muhannad Nihad Nouman/Lecturer	Mechatronics and Robotics Engineering	Mechatronics Engineering		1	
13	Salam Ibrahim Khader/Lecturer	Electrical Engineering	Control Engineering		1	
14	Muhammad Abdul	Computer	Computer		1	

	Razzaq Thanoon/Asst. Lec	Engineering artificial intelligent	Engineering			
15	Abdel Hamid Nabil Hamid/Lecturer	Communications Engineering	Computer networks		1	
16	Thakwan Akram Jawad/Asst. Lec	Computer Engineering	Computer Engineering		1	
17	Awan Nahil Mahmood/Asst. Lec	Computer Engineering	Computer Engineering		1	
18	Ismail Khudair Abdallah/Asst. Lec	Mechanical Engineering	Mechanical Engineering		1	
19	Muhammad Salem Qassem/Lecturer	Mechatronics and Robotics Engineering	Mechatronics Engineering		1	
20	Rafal Raed Mahmood/Asst. Lec	Electronics Engineering	Electronics Engineering		1	
21	Ahmed Mohammed Basheer Ibrahim Al-Hattab	Computer Engineering	Computer Engineering		1	
22	Omar Abdullah Khalaf Ahmed Al-Sabawi	Mechanical Engineering	Mechanical Engineering		1	
23	Ziyad Tareq Shareef Younis Al-Alloush	Communication and Computer Engineering	Communication and Computer Engineering		1	
24	Saif Saad Mahmoud Mohammed Nader Al-Taie	Electrical Engineering	Power Electronics Engineering		1	
25	Abdulrahman Basel Ayoub Rajab Agha	Mechatronics Engineering	Mechatronics Engineering		1	
26	Mariam Abbas Mohammed Saeed Khudair	Physics Science	Physics Science		1	
27	Bahauddin Khudair	History	History		1	

	Atiyah					
28	Saady Al-Sadoon	Electronics Engineering	Electronics Engineering		1	

Professional Development
Mentoring new faculty members
The educational institution offers services and trainings (teaching methods and techniques training) that are suitable for new faculty members, together with a suitable supportive atmosphere and setting for faculty members.
Professional development of faculty members
-The academic institution provides resources for the faculty member to attend conferences, workshops for professional development, and workshops for local, regional, and worldwide training. -As there is an instruction manual that contains contemporary teaching and learning techniques, there are clear and precise instructions that cover the teaching and methods. -Scientific prizes are awarded to renowned teachers as one component of faculty member evaluation, and the educational institution operates by implementing guidelines and standards for scientific research, scientific prize awards, and faculty member performance evaluation. -The department of Systems and Control Engineering maintains connections with most of ministries, in Iraq. Under its direction, several seminars have been held throughout the department's history to benefit the ministries. These relationships give faculty members access to real-world experience. -Regarding the lecture topic, the department's members arranged numerous workshops covering various aspects of knowledge, which ultimately led to the

acquisition of significant experience. Nearly every member of the department has received training in a variety of pedagogical approaches.

-Since 2014, about seven department members have studied for master's and doctorate degrees inside Iraq and abroad in countries including Malaysia, and Iran. The University and College Continuing Education Center assisted in the department's growth and arranged a number of workshops in various science disciplines.

12.Acceptance Criterion

The conditions for admission to Iraqi universities are subject to the instructions of the Ministry of Higher Education and Scientific Research in accordance with the first chapter of the Guide to Student Affairs Procedures and Admission Controls issued by the Deanship of Studies, Planning, and Education, Monitoring Department. To view the guide, please visit the website below for the any written policies that apply:

https://www.dirasat-gate.org/assets/documents/daleel-process

13.The most important sources of information about the program

Comprehensive information about the department's programs can be obtained by visiting the official website of the University of Nineveh and browsing the website of the College of Electronic Engineering:

www.uoninevah.edu.iq

Additional information can be found in the self-evaluation report

14.Program Development Plan

Assessment Methods for Achieving Learning Outcomes in Systems and Control Engineering

1. Introduction to Assessment in Engineering Education

Assessment in **Systems and Control Engineering** is crucial to ensure that students achieve the expected learning outcomes, including **technical proficiency, problem-solving skills, system modeling capabilities, and practical control implementation expertise**. Various assessment methods are used to evaluate different levels of student learning, from foundational knowledge to advanced system design and analysis.

The selection of assessment methods should align with **Bloom's Taxonomy**, covering:

- **Lower-order thinking skills** (knowledge, understanding)
- **Higher-order thinking skills** (application, analysis, synthesis, and evaluation)
- **Professional and practical skills** (design, teamwork, communication, and real-world implementation)

2. Types of Assessment in Systems and Control Engineering

To ensure comprehensive evaluation, diverse assessment strategies are used, including **formative and summative assessments**.

A. Formative Assessment (Continuous Feedback-Oriented)

These methods provide real-time feedback, guiding students toward better understanding and skill development.

1. **Quizzes and Short Tests**
    - Evaluate basic concepts of control theory, system modeling, and stability analysis.
    - Can be conducted online or in-class using multiple-choice questions (MCQs), short-answer questions, or problem-solving exercises.
2. **Homework Assignments**
    - Reinforce learning by applying theoretical concepts to solve real-world control problems.
    - Can include MATLAB simulations, coding exercises, and derivations of system equations.
3. **Classroom Discussions & Peer Assessment**
    - Engages students in problem-solving discussions on control system challenges.
    - Encourages peer feedback on design projects and reports.
4. **Laboratory Experiments & Simulation-Based Exercises**
    - Hands-on assessments using MATLAB/Simulink, LabVIEW, or hardware platforms (Arduino, DSP, FPGA).
    - Evaluate students' ability to implement controllers (e.g., PID, fuzzy logic, adaptive control).
5. **Project-Based Learning (PBL)**
    - Assign real-world engineering problems where students must **design, model, and implement** control systems.
    - Encourages teamwork, critical thinking, and innovation.

B. Summative Assessment (Final Evaluation-Oriented)

Summative assessments are used to measure students' overall achievements at the end of a course or program.

1. **Midterm and Final Examinations**
    - Assess theoretical understanding and problem-solving skills in linear control systems, nonlinear dynamics, and modern control techniques.
    - May include analytical problems, system stability proofs, and controller design questions.

2. **Design Projects & Capstone Courses**
   - Students design, analyze, and optimize control systems for real-world applications (e.g., robotic arms, UAV control, industrial automation).
   - Assessed based on **technical correctness, innovation, and implementation success**.
3. **Case Studies & Research Reports**
   - Encourage students to analyze existing control systems in industries like aerospace, automotive, and biomedical engineering.
   - Develops technical writing and critical analysis skills.
4. **Oral Examinations & Presentations**
   - Evaluate students' ability to communicate complex engineering solutions effectively.
   - Can be used for final-year projects, conference-style presentations, or thesis defenses.
5. **Industry-Based Internships & Work-Based Learning**
   - Real-world experience through internships in industries such as automation, robotics, and process control.
   - Evaluated through employer feedback, reports, and practical skill demonstrations.

3. Mapping Assessment Methods to Learning Outcomes

Effective assessment ensures alignment with **ABET (Accreditation Board for Engineering and Technology) criteria** and program-specific learning outcomes. The table below illustrates how different assessments align with specific learning outcomes:

Learning Outcome	Assessment Methods
Knowledge of system modeling & analysis	Exams, quizzes, homework assignments
Ability to design and simulate controllers	Lab exercises, MATLAB projects, capstone projects
Problem-solving in real-world applications	Project-based learning, case studies, design reports
Practical implementation skills	Lab experiments, hardware-based assessments
Communication & teamwork	Oral presentations, peer reviews, collaborative projects

Program Skills Outline															
				Required program Learning outcomes											
Year/ Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Values			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
One	NVEE206	Mathematics I	Basic	*	*	*	*	*	*		*	*	*	*	
	NVEE215	DC Circuits Analysis	Basic	*	*	*		*	*	*	*	*		*	*
	NVEESC301	Physics of Semiconductors	Basic	*		*	*	*	*	*	*	*	*	*	*
	NVU10	Computer Skills and AI I	Basic	*	*	*	*	*	*	*	*		*	*	*
	NVEESC302	Engineering Mechanics (Statics)	Basic	*	*	*	*	*	*	*	*	*	*	*	
	NVU12	Democracy and Human Rights	Basic	*	*	*	*		*	*	*	*	*	*	*

	NVEE207	Mathematics II	Basic	*	*	*		*	*	*	*		*	*	*
	NVEE216	AC Circuits Analysis	Basic		*	*	*	*	*	*	*	*		*	*
	NVEESC303	Engineering Mechanics (Dynamics)	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC304	Computer Programming	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC307	Digital Design	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVU11	English I	Basic	*	*	*	*	*	*	*	*	*	*	*	*
Two	NVEE208	Engineering Analysis I	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEE210	Signals & Systems I	Basic	*	*	*		*	*	*	*	*	*	*	*

	NVEESC305	Control I	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC306	MATLAB Programming	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEE212	Analog Electronics I	Basic	*	*	*	*	*		*	*	*	*	*	*
	NVU13	Crimes of the Baath regime in Iraq	Basic	*	*	*	*	*	*	*	*		*	*	*
	NVEE209	Engineering Analysis II	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC309	Control II	Basic	*	*	*	*	*	*	*	*		*	*	*
	NVEE213	Analog Electronics II	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC311	Measurement and Sensors	Basic	*	*	*	*	*	*	*	*	*	*	*	*

	NVEESC312	Machines	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEE201	Engineering Drawing	Basic	*		*	*	*	*	*	*	*		*	*
	NVU16	Arabic I	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVU15	English II	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC314	Digital Control	Basic	*	*	*	*	*	*	*	*	*	*	*	
Third	NVEESC315	Mathematical Modelling	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEE204	Digital Signal Processing I	Basic	*		*	*	*	*	*	*	*	*	*	*
	NVEESC316	Thermodynamics	Basic	*	*	*	*	*	*	*	*	*	*	*	*

	NVEESC317	Power Electronics	Basic	*	*	*	*	*	*	*	*	*		*	*
	NVEE202	Industrial Management and Ethics	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVU18	Computer Skills and AI II	Basic	*	*	*	*	*		*	*	*	*	*	*
	NVEE	Numerical Analysis	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC319	PLC	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC320	Control Systems Design	Basic	*	*		*	*	*	*	*	*	*	*	*
	NVEE	Statistics and Probability	Basic	*	*	*		*	*	*	*		*	*	*
	NVEESC321	Communications	Basic	*	*	*		*	*	*	*	*	*	*	*

	NVEESC322	Microprocessors	Basic	*	*	*	*	*	*	*	*	*		*	*
	NVU17	Arabic II	Basic	*	*	*	*	*		*	*	*	*	*	*
Fourth	NVEESC324	Robotics I	Basic	*	*	*		*		*	*	*	*	*	
	NVEESC325	Optimal Control I	Basic	*	*	*	*	*		*	*		*	*	*
	NVEESC326	Linear Algebra	Basic	*	*	*	*	*	*	*	*	*	*	*	*
	NVEESC327	Process Control	Basic	*	*	*	*		*	*		*	*	*	*
	NVEESC328	Industrial Networks	Basic		*	*		*		*	*	*	*		*
	NVEESC329	Embedded Systems	Basic	*	*	*		*	*	*		*	*		*

	NVEESC337	Project Design	Basic	*	*	*	*	*		*	*	*	*	*	*
	NVEESC331	Robotics II	Basic	*	*	*		*	*	*		*	*	*	*
	NVEESC332	Optimal Control II	Basic	*	*	*	*	*	*	*		*	*	*	*
	NVEESC333	Adaptive Control	Basic	*	*	*		*	*	*	*		*	*	*
	NVEESC334	Soft Computing	Basic		*	*	*	*	*	*	*	*	*	*	*
	NVEESC335	Computer Control	Basic	*	*	*	*	*	*	*	*	*	*	*	*

	NVEESC336	Modern Control Systems	Basic	*	*		*	*	*	*	*	*		*	*
	NVEESC338	Project Implementation	Basic	*	*	*	*	*	*			*	*	*	*

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Descriptions for the Academic Year 2025 – 2026

University of Nineveh

College of Electronics Engineering

Department of Systems and Control Engineering

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Mathematics I</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td colspan="3" rowspan="4">☒ Theory
☐ Lecture
☐ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEE206</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">6</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">150</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>1</td></tr>
<tr><td colspan="2">Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td colspan="2">Hussein M. Hussein</td><td>e-mail</td><td colspan="2">Hussein.hussein@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Shaiemma Kadder Ismaile</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Ismael Khudhair Abdullah</td><td>e-mail</td><td colspan="2">ismael.abdullah@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td>1.0</td></tr>
</table>

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Develop a strong foundation in calculus, including a solid understanding of vector operations, complex numbers, matrices, and determinants. 2. Master differentiation techniques, including the chain rule, implicit differentiation, and higher-order differentiation, for various types of functions. 3. Apply differentiation skills to solve engineering problems, such as finding maxima and minima and curve plotting. 4. Gain proficiency in differentiating trigonometric, exponential, logarithmic, and inverse trigonometric functions. 5. Understand the concept of definite integration and its applications, including finding volumes of revolution, lengths of curves, and surface areas of revolution. 6. Apply calculus principles to solve real-world engineering problems, developing problem-solving skills and the ability to apply calculus concepts to practical situations.
Module Learning Outcomes	1. Demonstrate a solid understanding of vector operations, complex numbers, matrices, and determinants. 2. Apply differentiation techniques, including the chain rule, implicit differentiation, and higher-order differentiation, to various functions and engineering problems. Also, apply definite integration to find areas, volumes, and lengths in engineering applications 3. Solve optimization problems, including finding maxima and minima, using differentiation. Also, solve engineering problems involving differential equations, including first-order linear equations. 4. Differentiate trigonometric, exponential, logarithmic, and inverse trigonometric functions accurately and efficiently. 5. Analyze functions and curves using differentiation and integration, including determining concavity, points of inflection, and intervals of increase and decrease. 6. Develop critical thinking and problem-solving skills by applying calculus principles to practical engineering scenarios. Moreover, Communicate mathematical ideas and solutions clearly and effectively, both orally and in written form. Finally, apply calculus concepts and techniques to model and solve real-world engineering problems.

Indicative Contents	Indicative content includes the following. Review of Vectors: i) Representation of vectors in space (i;j;k) unit vectors. ii) Scalar product iii) Vector product. [4 hrs] Review of Complex Numbers: i) The Argand diagram. ii) Addition; Subtraction; Product; Quotient; power and roots. Iv) Demoiver's Theorem. [4hrs] MATRICES AND DETERMINANTS: i) Definitions ii) Properties. iii) Inverse of a matrix iv) Solution of Equations (Cramer's rule) and Elementary Row Operation. [12hrs] DIFFERENTIATION: Techniques of differentiation; Chain rule; Implicit differentiation; Higher order differentiation; Applications of differentiation; maxima and minima; Curve plotting; Differentiation of trigonometric functions. [12hrs] TRANSCENDENTAL FUNCTIONS: Inverse trigonometric: i) Definitions ii) properties iii) graphs iv) derivatives and integrals, Natural logarithmic: i) Definitions ii) properties iii) graphs iv) derivatives and integrals, Exponential and power: i) Definitions ii) properties iii) graphs iv) derivatives and integrals. [12hrs] Review and Applications of Integral: i) Volumes of revolution. ii) Length of the curve. iii) Surface area of revolution. [12hrs]

Learning and Teaching Strategies	
Strategies	The main strategy for delivering this module in calculus is to promote active student participation and cultivate critical thinking skills. This will be accomplished through a combination of interactive classes, tutorials, and hands-on experiments. The classes will cover key concepts through lectures and visual aids, encouraging students to engage in discussions and ask questions. Interactive tutorials will provide opportunities for problem-solving and practical application of calculus principles. Additionally, incorporating simple experiments and sampling activities will help students connect theory to real-world scenarios in control engineering. By implementing these strategies, the module aims to create an engaging learning environment that enhances students' understanding of calculus while refining their critical thinking abilities.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	87	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 11	LO #1, 2, 4 and 6
	Assignments	2	10% (10)	2, 13	LO # 3, 5 and 6
	Report	1	10% (10)	13	LO # 4, 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1, 2, 3, and 6
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Review of Vectors.
Week 2	Review of Complex Numbers.
Week 3	Matrices And Determinants: Definitions, Properties.
Week 4	Inverse of a matrix.
Week 5	Solution of Equations (Cramer's rule) and Elementary Row Operation.
Week 6	Differentiation: Techniques of differentiation; Chain rule; Implicit differentiation.
Week 7	Higher order differentiation; Applications of differentiation; maxima and minima; Curve plotting.
Week 8	**Mid-term Exam**
Week 9	Differentiation of trigonometric functions.
Week 10	Transcendental Functions: Inverse trigonometric: Definitions, properties, graphs, derivatives and integrals.
Week 11	Natural logarithmic: Definitions, properties, graphs, derivatives and integrals.
Week 12	Exponential and power: Definitions, properties, graphs, derivatives and integrals.
Week 13	Review and Applications of Integral: Volumes of revolution.
Week 14	Length of the curve.
Week 15	Surface area of revolution
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	G. B. Thomas Jr., M. D. Weir, J. Hass, and F. R. Giordano, "Thomas' Calculus," 12th ed., Pearson, 2019.	Yes
Recommended Texts	Zill, D. G., Wright, W. S., & Cullen, M. R. (2011). Advanced Engineering Mathematics. Jones & Bartlett Publishers.	Yes
Websites	https://www.coursera.org/learn/introduction-to-calculus	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C - Good	70 – 79	Sound work with notable errors
	D - Satisfactory	60 – 69	Fair but with major shortcomings
	E - Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">DC Circuits Analysis</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEE215</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">7</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">175</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>1</td></tr>
<tr><td colspan="2">Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td colspan="2">Nashwan Z. Hero</td><td>e-mail</td><td colspan="2">Nashwan.hero@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader's Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader's Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Name (if available)</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Thakwan Akram jawad</td><td>e-mail</td><td colspan="2">thakwan.jawad@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	7. To develop problem solving skills and understanding of circuit theory through the application of techniques. 8. To understand voltage, current and power from a given circuit. 9. This course deals with the basic concept of electrical circuits. 10. To understand Kirchhoff's current and voltage Laws problems. 11. To perform mesh and Nodal analysis. 12. To perform Thevenin's and Norton theorems).
Module Learning Outcomes	7. Recognize how electricity works in electrical circuits and list the various terms associated with electrical circuits. Then, summarize what is meant by a basic electric circuit. 8. Discuss the reaction and involvement of atoms in electric circuits. 9. Describe electrical power, charge, and current. 10. Define Ohm's law. 11. Identify the basic circuit elements and their applications. 12. Explain the two Kirchoff's laws used in circuit analysis
Indicative Contents	Indicative content includes the following. Basic Component and Electric Circuits System of units, Charge, current, Voltage, power, Voltage and Current Sources. DC circuits – Current and voltage definitions, Passive sign convention and circuit elements. [15 hrs] Combining resistive elements in series and parallel. Kirchhoff's laws and Ohm's law. Anatomy of a circuit, Network reduction, Introduction to mesh and nodal analysis. [15 hrs] Fundamentals Resistive networks, voltage and current sources, Thevenin and Norton equivalent circuits. [19 hrs] current and voltage division, input resistance, output resistance, maximum power transfer, power dissipation, current limiting and over voltage protection. [19 hrs] Revision problem classes [6 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	92	**Structured SWL (h/w)**	6
Unstructured SWL (h/sem)	83	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	175		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 4 and 6
	Assignments	2	10% (10)	2, 12	LO # 2, 4 and 6
	Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 3, 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-4
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction - Difference between Circuit Theory and system of units
Week 2	Basics of Network Elements (voltage and current sources)
Week 3	Resistance and Resistivity, Ohm's Law
Week 4	Series and Parallel connection
Week 5	Voltage and Current division
Week 6	Resistors in series, parallel and Delta-Star conversion
Week 7	Kirchhoff's current law
Week 8	Kirchhoff's voltage law
Week 9	**Mid-term Exam**
Week 10	Methods of Analysis:(Mesh Circuit analysis and super mesh)
Week 11	Methods of Analysis:(Nodal Circuit analysis and super node)
Week 12	D.C. Circuit Theorems (Linearity and Superposition)
Week 13	D.C. Circuit Theorems (Thevenin's theorems)
Week 14	D.C. Circuit Theorems source transformation
Week 15	Maximum power transfer
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to Agilent VEE and PSPICE
Week 2	Lab 2: Ohm's law
Week 3	Lab 3: Voltage and current division
Week 4	Lab 4: Series and parallel connection
Week 5	Lab 5: Kirchhoff's Laws D.C. Circuit Theorems
Week 6	Lab 6: Kirchhoff's Laws D.C. Circuit Theorems
Week 7	Lab 7: Mesh D.C. Circuit Theorem
Week 8	Lab 8: Mesh D.C. Circuit Theorem
Week 9	**Mid-term Exam**
Week 10	Lab10: Nodal D.C. Circuit Theorem
Week 11	Lab 11: Nodal D.C. Circuit Theorem
Week 12	Lab 12: Linearity and Superposition
Week 13	Lab 13: Linearity and Superposition
Week 14	Lab 14: Maximum power transfer D.C. Circuit Theorems
Week 15	Lab 15: Maximum power transfer D.C. Circuit Theorems

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education	Yes
Recommended Texts	DC Electrical Circuit Analysis: A Practical Approach Copyright Year: 2020, dissidents.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information					
Module Title	**Physics of Semiconductors**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVEESC301**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	1		**Semester of Delivery**		1
Administering Department	SCE		**College**	EE	
Module Leader	Awan Nahil Mahmood		**e-mail**		
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**		Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Maryam Abbas Mohammed		**e-mail**		
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Understanding Semiconductor Physics: The module aims to familiarize students with the physics of semiconductors, including concepts such as energy band theory, carrier generation, recombination, and transport. Students will gain a deep understanding of how electrons and holes behave in semiconductors and how these principles are applied in electronic devices. 2. Analysis of Electronic Devices: The module aims to introduce students to the operation and characteristics of various electronic devices, such as diodes, transistors, and integrated circuits. Students will learn about the working principles, fabrication techniques, and applications of these devices. They will also gain an understanding of the basic device models and how to analyze and design circuits using these devices. 3. Circuit Analysis and Design: The module aims to develop students' skills in analyzing and designing electronic circuits. Students will learn fundamental circuit analysis techniques, including Kirchhoff's laws, nodal analysis, and mesh analysis. They will also explore different circuit configurations, such as amplifiers, filters, and oscillators, and understand how to design and analyze these circuits using the principles of electronics physics. 4. Introduction to Digital Electronics: The module aims to provide an introduction to digital electronics and the principles of digital logic. Students will learn about binary number systems, Boolean algebra, logic gates, and sequential logic circuits. They will understand the operation of digital devices, such as logic gates and how to design and analyze digital circuits. 5. Practical Skills: The module aims to develop students' practical skills in electronics. Students will have hands-on experience with laboratory experiments, where they will learn to measure and analyze electronic circuits using instruments such as oscilloscopes, function generators, and multimeters. They will also learn basic soldering techniques and circuit construction.
Module Learning Outcomes	1. Knowledge of Semiconductor Physics: Students will demonstrate a comprehensive understanding of semiconductor physics, including concepts such as energy band theory, carrier generation, recombination, and transport in semiconductors. They will be able to explain the behavior of electrons and holes in different semiconductor materials. 2. Understanding of Electronic Devices: Students will be familiar with various electronic devices, such as diodes, transistors, and integrated circuits. They will understand the principles of operation, characteristics, and applications of these devices. Students will be able to analyze and predict the behavior of electronic devices in different circuit configurations. 3. Circuit Analysis and Design Skills: Students will possess the skills to analyze and design electronic circuits. They will be able to apply circuit analysis techniques, such as Kirchhoff's laws and nodal analysis, to solve complex electronic circuits. Students will demonstrate the ability to design basic

	electronic circuits, such as rectifier, clipping, clamping, regulator, amplifiers, filters, using the principles learned in the module. 4. Knowledge of Digital Electronics: Students will have a solid understanding of digital electronics principles, including binary number systems, Boolean algebra and logic gates circuits. They will be able to analyze and design digital circuits using logic gates. Students will be capable of designing combinational logic circuits for various applications. 5. Practical Skills in Electronics: Students will have acquired practical skills in electronics through laboratory experiments and hands-on activities. They will be able to use electronic instruments, such as oscilloscopes, function generators, and multimeters, to measure and analyze electronic circuits. Students will demonstrate proficiency in basic soldering techniques and circuit construction. 6. Problem-Solving and Critical Thinking: Students will develop problem-solving and critical thinking skills in the context of electronics physics. They will be able to apply their knowledge and analytical skills to identify and solve complex electronic circuit problems. Students will also demonstrate the ability to evaluate different design options and make informed decisions based on their understanding of electronics physics principles.
Indicative Contents	1. Introduction to Semiconductor Physics: • Atomic structure and energy bands • Intrinsic and extrinsic semiconductors • Carrier generation, recombination, and transport • PN junction and its characteristics 2. Diodes: • Diode operation and characteristics • Diode models and equivalent circuits • Diode applications: rectifiers, clippers, clamping and limiters • Special types of diodes: Zener diodes, and LEDs 3. Bipolar Junction Transistors (BJTs): • BJT structure and operation • BJT modes: active, cutoff, and saturation • BJT models and amplification principles • Common emitter, common base, and common collector configurations 4. Electronic Circuits Analysis: • Circuit analysis techniques: Kirchhoff's laws and nodal analysis • Amplifier circuits: common emitter, common collector, and common base configurations 5. Laboratory Exercises and Practical Skills:

	• Measurement and characterization of electronic components • Breadboarding and soldering techniques • Oscilloscope operation and waveform analysis • Circuit simulation using software tools

Learning and Teaching Strategies	
Strategies	1. Lectures: Conduct interactive lectures to introduce and explain the theoretical concepts of electronics physics. Use multimedia presentations, visual aids, and real-life examples to enhance understanding. 2. Demonstrations: Perform live demonstrations of electronic circuits and devices to illustrate their operation and behavior. This can help students visualize abstract concepts and enhance their understanding of practical applications. 3. Problem-solving sessions: Organize regular problem-solving sessions where students can practice solving numerical problems related to electronics physics. Encourage group discussions and provide guidance to help students develop problem-solving skills. 4. Laboratory experiments: Conduct hands-on laboratory experiments to allow students to apply theoretical concepts and gain practical experience. Provide well-equipped lab facilities and clear instructions for conducting experiments safely. 5. Simulations and virtual experiments: Utilize simulation software and virtual lab platforms to supplement practical learning. This allows students to experiment with different circuit configurations and observe the effects in a controlled virtual environment. 6. Group projects and presentations: Assign group projects where students can collaborate to design and build electronic circuits or systems. This promotes teamwork, problem-solving, and communication skills. Encourage students to present their projects to the class, sharing their design process and findings. 7. Case studies and real-world examples: Discuss case studies and real-world examples that demonstrate the applications of electronics physics in various industries and technologies. This helps students understand the relevance and practical implications of the subject. 8. Online resources and self-study materials: Provide access to online resources, such as interactive tutorials, video lectures, and e-books, to facilitate self-study and independent learning. Encourage students to explore additional resources to deepen their understanding. 9. Assessments and feedback: Regularly assess students' understanding through quizzes, tests, and assignments. Provide constructive feedback to help students identify areas for improvement and encourage active engagement with the subject matter. 10. Guest lectures and industry visits: Invite guest speakers from the industry or academia to share their expertise and experiences in the field of electronics physics. Organize visits to relevant industries or research centers to expose students to real-world applications and emerging technologies.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, and 6
	Assignments	2	10% (10)	2, 12	LO # 3, 4, and 6
	Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-6
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	• Introduction to Semiconductor Physics. • Atomic structure and energy bands. • Field effect intensity and potential energy .
Week 2	• The ev units of energy . • Nature of atom and Electronic of structure of elements. • Electronic structure of elements .
Week 3	• Transport Phenomena in semiconductor • Mobility conductivity • Intrinsic and extrinsic semiconductors.
Week 4	• Conductivity modulation. • Generation and recombination of charge and Diffusion current.
Week 5	• PN junction in equilibrium • Volt Ampere characteristic • PN Junction characteristics
Week 6	• Basic theory and analysis of simple diode circuit • Diode operation and characteristics

	• Diode models and equivalent circuits • Types of diodes
Week 7	• Diode applications • Circuit analysis of half wave and full wave rectifiers • Bridge rectifier
Week 8	• Ripple and form factor calculations • Types of filters :C filters, L filter,L.C. filter,PIE filter • Analysis of filter and calculation of ripple and regulation .
Week 9	• Mid-term Exam
Week 10	• Clippers and clamping circuits analysis and applications • limiters circuits analysis and applications • Diode logic gates
Week 11	• Special Diodes • Zener diodes: characteristics and applications • Light-emitting diodes (LEDs): working principles and applications
Week 12	• Bipolar Junction Transistors (BJTs) • BJT structure and operation • Current and voltage analysis
Week 13	• Collector characteristic curves • BJT modes: active, cutoff, and saturation • DC load line
Week 14	• BJT models and amplification principles • Linear Operation.
Week 15	• Voltage Divider Bais • Diode transistor logic gate (DTL).
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	• Lab safety guidelines and equipment familiarization • Introduction to basic electronic components: resistors, capacitors, and inductors • Measurement of resistance using multimeters

Week 2	• Breadboarding and soldering techniques
Week 3	• Oscilloscope operation and signal generator
Week 4	• Diode characterization and measurements: forward and reverse bias • Verification of diode IV characteristics
Week 5	• Half wave and full wave rectifiers
Week 6	• Half wave and full wave rectifiers filters
Week 7	• Design power supply
Week 8	• **Review for mid-term Exam**
Week 9	• **Mid-term Exam**
Week 10	• Clipping and Clamping circuits
Week 11	• Zener diode characterization and measurements: breakdown voltage and regulation
Week 12	• Photo diode characterization and measurements.
Week 13	• (BJT) Transistor characterization and measurements
Week 14	**Review for Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Integrated Electronics: Analog and Digital Circuits and Systems, By Jacob Millman	
Recommended Texts	2. Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky - This book provides a thorough introduction to electronic devices and circuit theory, covering topics such as diodes, transistors, amplifiers, and digital circuits. 3. "Electronic Principles" by Albert Malvino and David Bates - This textbook offers a practical approach to understanding electronic principles and their applications, covering topics such as semiconductor devices, amplifiers, oscillators, and digital circuits. 4. "Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith - This widely-used textbook covers the analysis and design of microelectronic circuits, including analog and digital integrated circuits and bipolar junction transistors. 5. "Electronics for Dummies" by Cathleen Shamieh - This beginner-friendly book provides an easy-to-understand introduction to electronics, covering topics such as circuits, components, and basic electronic principles.	
Websites	1. Electronics Tutorials (www.electronics-tutorials.ws) - This website offers a wide range of tutorials and resources on electronics, including circuit analysis, components, and practical applications. 2. All About Circuits (www.allaboutcircuits.com) - This online platform provides comprehensive resources, including tutorials, articles, and interactive tools, covering various topics in electronics and circuit design. 3. Khan Academy (www.khanacademy.org) - Khan Academy offers free online courses and tutorials on electronics and electrical engineering, covering topics such as circuit analysis, semiconductors, and digital electronics.	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Computer I**	**Module Delivery**
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVU10**	
ECTS Credits	**3**	
SWL (hr/sem)	**75**	

Module Level	1	**Semester of Delivery**	1
Administering Department	SCE	**College**	EE
Module Leader	Abdulameed Nabeel Hameed	**e-mail**	abdulhamed.hameed@uoninevah.edu.iq
Module Leader's Acad. Title	Ass. Lecturer	**Module Leader's Qualification**	M.Sc.
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Mohammed A. Thanon	**e-mail**	mohammed.alsayed@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. **Build Fundamental Digital Literacy** ○ Equip students with essential computer skills for academic and professional tasks (e.g., document creation, data organization). ○ Familiarize learners with hardware/software components and basic troubleshooting. 2. **Develop Proficiency in Productivity Tools**

	o Enable students to use word processors, spreadsheets, and presentation software effectively. o Teach file management and cloud collaboration tools (e.g., Google Workspace). 3. **Introduce Internet and Cybersecurity Basics** o Explain how the internet functions (IP addresses, domains, browsers). o Promote safe online practices (email etiquette, data privacy). 4. **Provide a Foundational Understanding of AI** o Define AI and its everyday applications (e.g., virtual assistants, recommendation systems). o Highlight ethical implications (bias, privacy) in simple terms.
Module Learning Outcomes	1. **Operate Basic Computer Systems** o Identify hardware/software components and their functions. o Perform file management tasks (create, organize, and save documents). 2. **Use Productivity Software** o Create formatted documents (reports, tables) using word processors. o Develop simple spreadsheets with formulas and charts. o Design multimedia presentations with transitions and templates. 3. **Navigate Digital Environments Safely** o Explain how the internet works (IP addresses, domains, browsers). o Demonstrate email etiquette and cloud collaboration (e.g., Google Drive). 4. **Understand AI Basics** o Define artificial intelligence and its everyday applications. o Recognize ethical concerns (e.g., data privacy, algorithmic bia
Indicative Contents	**1. Computer Basics** • **Hardware: CPU, memory, storage, input/output devices** • **Software: Operating systems (Windows, macOS, Linux), applications** • **File management: Folders, directories, shortcuts** **2. Productivity Tools** • **Word Processing:**

	o Document creation, formatting, tables, templates **o Headers/footers, spell check, collaboration features** • **Spreadsheets:** **o Basic formulas (SUM, AVERAGE), charts, sorting/filtering** • **Presentations:** **o Slide design, animations, transitions, multimedia insertion** **3. Internet & Digital Literacy** • **How the internet works (IP addresses, DNS, browsers)** • **Safe browsing, email etiquette, cloud tools (Google Drive, OneDrive)** • **Basic cybersecurity (passwords, phishing awareness)** **4. Introduction to AI** • **What is AI? History and key concepts (machine learning, NLP)** • **Everyday AI: Virtual assistants (Siri, Alexa), recommendation systems** • **Ethical considerations: Bias, privacy, societal impact**

Learning and Teaching Strategies	
Strategies	1. **Guided Hands-On Learning** ○ Step-by-step hardware/software labs ○ Template-based tasks → Original work progression 2. **Gamification** ○ Digital badges for completed modules ○ Quick interactive quizzes (e.g., Kahoot!) 3. **Peer Mentoring** ○ "Tech Buddy" system for troubleshooting 4. **Micro-Assessments** ○ Weekly 10-minute practical tests

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	13	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	75		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 12	LO #1-2
	Assignments	1	10% (10)	14	LO # 1, and 3
	Lab	14	15% (15)	Continuous	
	Report	1	5% (5)	13	LO # 4
Summative assessment	**Midterm Exam**	4 hr	10% (10)	8	LO # 1-3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Computer Hardware (CPU, RAM, Storage)
Week 2	Operating Systems Basics (Windows/Linux)
Week 3	File Management (Folders, Directories)
Week 4	Word Processing Fundamentals

Week 5	Spreadsheet Basics (Formulas, Functions)
Week 6	Presentation Software (Slides, Transitions)
Week 7	Internet Concepts (IP, DNS, Browsers)
Week 8	Email & Cloud Storage
Week 9	Introduction to AI (Definition, History)
Week 10	AI in Daily Life (Recommendation Systems)
Week 11	Computer Maintenance (Updates, Troubleshooting)
Week 12	Digital Security Basics (Passwords, Privacy)
Week 13	Review & Case Studies
Week 14	Final Project Guidance
Week 15	Portfolio Compilation
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Identifying Hardware Components
Week 2	GUI Navigation & File Creation
Week 3	Creating Nested Folder Structures
Week 4	Formatting Documents & Inserting Tables
Week 5	Using SUM, AVERAGE Functions
Week 6	Designing a 5-Slide Presentation
Week 7	Browser Settings & Safe Search
Week 8	Email Composition & Attachments
Week 9	Identifying AI-Powered Products
Week 10	Analyzing Recommendation Algorithms
Week 11	Disk Cleanup & Software Updates
Week 12	Password Manager Setup
Week 13	Mock Exam & Skill Reinforcement
Week 14	Group Case Study Analysis
Week 15	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. **"Computer Basics Absolute Beginner's Guide"** – Michael Miller (8th Edition) o Covers hardware, software, and basic troubleshooting. 2. **"Microsoft Office 365 for Beginners"** – Joan lamber Step-by-step guide for Word, Excel,powerpoint	No

	3. **"Artificial Intelligence: A Guide for Thinking Humans"** – Melanie Mitchell (Ch. 1-3) o Simplified introduction to AI concepts.	
Recommended Texts	1. **"But How Do It Know?"** – J. Clark Scott o Explains how computers work in an easy-to-understand way. 2. **"The Internet for Dummies"** – John R. Levine & Margaret Levine Young o Practical guide to internet basics and online safety.	No
Websites	1. **GCFGlobal (edu.gcfglobal.org)** – Free tutorials on Office tools and basic computing. 2. **Code.org (AI for Oceans)** – Interactive intro to AI concepts. 3. **Google's "Be Internet Awesome"** – Digital literacy and safety lessons.	

Grading Schem

Group	Grade	Marks (%)	Definition
Success Group (50 - 100)	**A -** Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C – Good	70 – 79	Sound work with notable errors
	D - Satisfactory	60 – 69	Fair but with major shortcomings
	E - Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Engineering Mechanics (Statics)</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="5">☒ Theory
☐ Lecture
☐ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC302</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">6</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">150</td></tr>
<tr></tr>
<tr><td>Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td colspan="2">1</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="3">EE</td></tr>
<tr><td>Module Leader</td><td>Ismael Khudhair Abdullah Al-Jobury</td><td>e-mail</td><td colspan="3">ismael.abdullah@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader's Acad. Title</td><td>Lecturer Assistant</td><td colspan="2">Module Leader's Qualification</td><td colspan="2">M.Sc.</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td colspan="3"></td></tr>
<tr><td>Peer Reviewer Name</td><td>Mohanad Nihad Noaman</td><td>e-mail</td><td colspan="3">mohanad.noaman@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Understanding and comprehending the laws, theories, and basic concepts related to forces and moments applied on bodies, analyzing them, finding the resultant, and the principles of transferring forces on the line of their action and outside their line of action, and developing the skills of solving problems related to them. 2. Knowing of Newton's laws of motion and gravitation and their universal applications and their applications in public life and industrial life. 3. Knowing of coordinate systems and how to use them in force analysis. 4. Knowing of unit systems used globally and how to convert from one system to another. 5. Detailed knowledge of equilibrium, its conditions, mathematical laws and applications, how to model the effect of forces and construction of free-body diagrams. Know how to derive reaction forces. 6. Learn in detail how to analyze engineering structures in all its branches and learn how to analyze them. 7. Learn about the principles of friction between contacting surfaces, the resulting forces, its importance, applications, types, properties, mathematical laws, and how to find the friction coefficient and apply it in friction equations. 8. Learn how to find the centers of bodies (masses, weights, lengths, areas and volumes), know its importance and applications. 9. Learn how to find the moment of inertia of areas and masses in detail and know the moment of inertia of some planer and solid shapes and some homogeneous masses. 10. The study of static is considered a basic introduction to the study of dynamics, which in turn is a major course in the Department of Systems and Control Engineering, as well as it is a basic introduction to the study of strength of materials.
Module Learning Outcomes	1. Knowing of Newton's laws of motion and gravitation and their universal applications and their applications in public life and industrial life. Learning the coordinate systems and how to use them in force analysis. Also, used globally unit systems and how to convert from one system to another. 2. Understanding and comprehending the laws, theories, and basic concepts related to forces applied on bodies, analyzing them, finding the resultant, and the principles of transferring forces on the line of their action and outside their line of action, and developing the skills of solving problems related to them, and solve some of the related problems to it to enable understanding of the subject. 3. Knowing of moments and their applications, methods and theories specialized in deducing them, finding the resultant of several moments, finding the resultant of moments and forces together, the resultant of non-convergent forces, knowing the couple moment and its general applications, and solve some of the related problems to it to enable understanding of the subject. 4. Detailed knowledge of equilibrium in its two branches (equilibrium of particles and equilibrium of rigid bodies), the conditions of each of them, their mathematical laws and applications, how to model the effect of forces and construction of free-body diagrams. Know how to derive reaction forces, and solve some of the related problems to it to enable understanding of the subject. 5. Learn about the principles of friction between contacting surfaces, the resulting forces, its importance, applications, types, properties, mathematical laws, and how to find the friction coefficient and apply it in friction equations, and solve some of the related problems to it to enable understanding of the subject.

	6. Understanding the centers of bodies and the moment of inertia is essential for analyzing stability, balance, and rotational motion in engineering and physics. This involves calculating the centroids of common geometric shapes and solving related problems to grasp their importance and applications. Additionally, learning about the moment of inertia, its properties, types, units, and methods for transferring it between axes, along with the radius of gyration, enables deeper insights into the behavior of planar and solid shapes, as well as homogeneous masses.
Indicative Contents	- **Statics Fundamentals:** Engineering mechanics definition and basic concepts, Newton's Fundamental Laws, Coordinates system, System of Units. [4 hrs] - **Force Analysis:** Scalars and Vectors, Trigonometric relations, Types of Force systems. [4 hrs] - **Force Analysis:** Principle of Transmissibility, Resultant Forces. [4 hrs] - **The Moments:** The moment definition and methods of solution, Resultant Moment. [4 hrs] - **The Moments:** Moment of a couple. [4 hrs] - **The Moments:** Resultant of nonconcurrent force (Force and Moment). [4 hrs] - **Equilibrium:** Principle of Equilibrium, Free body diagram construction. [4 hrs] - **Equilibrium:** Equilibrium of a Particle. [4 hrs] - **Equilibrium:** Equilibrium of a rigid bodies. [4 hrs] - **Friction:** Principle of Friction, Applications of Friction. [4 hrs] - **Friction:** Types of Friction, Characteristics of Friction. [4 hrs] - **Centers of Mass and Centroids:** Centroids of lines, areas, and volumes. [4 hrs] - **The Moment of Inertia:** Area Moment of Inertia. [4 hrs] - **The Moment of Inertia:** Mass Moment of Inertia. [4 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in introducing this unit is: - Sending the lecture to the students electronically three days before its scheduled date in the form of a (pdf) file with video clips (YouTube) showing the lecture with solutions to a number of related problems. - Giving the lecture and involving the students so that the lecture becomes a discussion to improve the students' skills and increase their understanding of the subject. - Conducting short exams in each lecture to urge students to follow up and increase their interest in the topic of the lecture. - - Conducting an electronic meeting after each lecture if necessary to solve more problems related to the subject of the lecture to increase students' understanding of the subject.

Student Workload (SWL)			
Structured SWL (h/sem)ل	63	**Structured SWL (h/w)اا**	4
Unstructured SWL (h/sem)	87	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	10% (20)	3, 6, 9,12 ,13	LO #2,3,4 and 5
	Assignments	2	10% (10)	1, 9	LO # 1 and 6
	Projects / Lab.				
	Report	1	10% (10)	15	LO # 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	10	LO # 1-4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Statics Fundamentals:** Engineering mechanics definition and basic concepts, Newton's Fundamental Laws, Coordinates system, System of Units.
Week 2	**Force Analysis:** Scalars and Vectors, Trigonometric relations, Types of Force systems.
Week 3	**Force Analysis:** Principle of Transmissibility, Resultant Forces.
Week 4	**The Moments:** The moment definition and methods of solution, Resultant Moment.
Week 5	**The Moments:** Moment of a couple.
Week 6	**The Moments:** Resultant of nonconcurrent force (Force and Moment).
Week 7	**Equilibrium:** Principle of Equilibrium, Free body diagram construction.
Week 8	**Equilibrium:** Equilibrium of a Particle.
Week 9	**Equilibrium:** Equilibrium of a rigid bodies.
Week 10	**Mid-term Exam.**
Week 11	**Friction:** Principle of Friction, Applications of Friction.
Week 12	**Friction:** Types of Friction, Characteristics of Friction.
Week 13	**Centers of Mass and Centroids:** Centroids of lines, areas, and volumes.
Week 14	**The Moment of Inertia:** Area Moment of Inertia.
Week 15	**The Moment of Inertia:** Mass Moment of Inertia.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Engineering Mechanics – Statics / R. C. Hibbeler.	Yes
Recommended Texts	Engineering Mechanics – Statics / J. L. Meriam , L. G. Kraige.	No
Websites	https://youtube.com/@ismaelal-jobury6914	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information				
Module Title	**Democracy and Human Rights**		**Module Delivery**	
Module Type	**Basic**		☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVU12**			
ECTS Credits	**2**			
SWL (hr/sem)	**50**			
Module Level	1		**Semester of Delivery**	1
Administering Department	SCE		**College**	EE
Module Leader	Husham swadi hashim		**e-mail**	Husham.hashim@uoninevah.edu.iq
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	PHD
Module Tutor			**e-mail**	
Peer Reviewer Name			**e-mail**	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1 – شرح مفهومي حقوق الانسان والديمقراطية 2 – بيان اهمية حقوق الانسان في حياتنا العامة وعلى جميع الصعد (الدراسية و الوظيفية و الاجتماعية ..الخ) 3 – بيان اهمية ايجاد مفهوم واعي لمصطلح الديمقراطية ضمن انظمة الحكم وتاثيرها على الاستقرار السياسي 4 – ضرورة فهم الترابط الوثيق مابين حقوق وبناء مجتمع ديمقراطي يضمن حرية افرادة وضمان مصالحهم 5- ضرورة التركيز على ان بناء مفهوم حفيفي لحقوق الانسان ومجتمع ديمقراطي لا يكون الا من خلال ين قوانين تضمن ذلك واهمية هذه القوانين في بناء مجتمع مستقر يضمن لجميع افرادة حقوقهم ضمن نظام سياسي ديمقراطي
Module Learning Outcomes	1 – ترسيخ قيم الحرية والمساواة في اسس المشاركة الفعلية في بناء المجتمع 2 – العمل على بناء بيءة حقيية مستقرة من خلال تطبيق القوانين ضمن مجتمع ديمقراطي 3 – والسعي لتوفير اسس لحماية الافراد ضمن المجتمعات الديمقراطية
Indicative Contents	-القسم الأول:- التطور التاريخي لحقوق الإنسان أولا:- المجتمعات البدائية - مرحلة ما قبل التاريخ - الحضارات الشرقية (بلاد وادي الرافدين والحضارة الفرعونية نموذجاً) (نموذجاً - الحضارات الغربية (اليونانية والرومانية ثانيا:- الشرائع السماوية - الديانة اليهودية - الديانة المسيحية - الديانة الإسلامية(بصوره أكثر تفصيلاً) ثالثاً:- تطور حقوق الانسان في القوانين الوضعية نظرية العقد الاجتماعي - -الحروب العالمية وأثرها في حقوق الانسان - التنظيم الدولي القسم الثاني :- حقوق الإنسان التعريف بها وأنواعها أولا- التحديد والتعريف - الحق في الفقه الإسلامي - الحق في الفقه القانوني -تعريف حقوق الإنسان ثانياً- تقسيمات حقوق الإنسان (وتتم بدراسة مفصلة ومقارنة بين القانون والشريعة الإسلامية) الحقوق الجماعية(حق تقرير المصير, حق التنمية, الحق في بيئة مناسبة, حق الإنسان في العيش بسلام)- الحقوق الفردية (الحقوق الاقتصادية والثقافية, الحقوق المدنية والسياسية الحقوق الصيغة بالشخصية)- القسم الثالث:- ضمانات احترام وحماية حقوق الإنسان أولا – الضمانات في الشريعة الإسلامية ثانياً:- الضمانات على الصعيد الوطني ثالثا:- الضمانات على الصعيد الدولي مفردات ماده الديمقراطية الكورس الأول:- يتضمن ماده الحريات العامة بين الشريعة والقانون الكورس الثاني:- يتضمن ماده نظم إدارة الدولة بين الشريعة والقانون

	الحريات العامة (بين الشريعة والقانون) أولا:- المقدمة ثانياً:- التعريف بالحريات العامة - الأصل اللغوي - الأصل التاريخي - الأساس القانوني - الأساس الشرعي ثالثا:- أسس الحريات العامة - العدالة - المساواة - الحرية رابعاً:- الحريات العامة الو صفية - حرية الرأي - حرية الفكر - حرية الأعلام - المسا واه خامساً:- الشريعة الإسلامية والحريات العامة - موقف الإسلام من المرأة (الميراث, الزواج, تولي الوظائف) - موقف الإسلام من حرية العقيدة نظم إدارة الدولة أولا:- في تحديد النظم السياسية - فكره النظام السياسي - شرعية النظم السياسية - أنواع النظم السياسية ثانياً:- في النظام الديمقراطي - مقدمة تأصيلية - تعريف الديمقراطية -أركان ومرتكزات النظام الديمقراطي ثالثاً:- نماذج الديمقراطية - الديمقراطية المباشرة

Learning and Teaching Strategies	
Strategies	اتباع طريقة التعليم المباشر من خلال عرض المادة وشرحها والاستعانة بالادوات التعليمية لشرحها من خلال توضيح اليات المفهوم العلمي لمصطلحي الديمقراطية و حقوق الانسان

Student Workload (SWL)			
Structured SWL (h/sem)ل	33	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)**ا	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	التطور التاريخي لحقوق الانسان
Week 2	الشرائع السماوية
Week 3	تطور حقوق الانسان في القوانين الوضعية
Week 4	حقوق الانسان التعريف بها وانواعها
Week 5	ضمانات احترام وحماية حقوق الانسان
Week 6	الضمانات في الشريعة وعلى الصعيدين الوطني والدولي
Week 7	Mid-term Exam
Week 8	مفهوم الديمقراطية
Week 9	الحريات العامة بين الشريعة و القانون
Week 10	التعريف بالحريات العامة و اسس الحريات
Week 11	الشريعة الاسلامية والحريات العامة
Week 12	نظم ادارة الدولة
Week 13	الديمقراطية مقدمة تأصيلية
Week 14	اركان ومرتكزات النظام الديمقراطية
Week 15	نماذج الديمقراطية
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		Yes
Recommended Texts		No
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information				
Module Title	**Mathematics II**		**Module Delivery**	
Module Type	**Core**		☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVEE207**			
ECTS Credits	**6**			
SWL (hr/sem)	**150**			
Module Level	1		**Semester of Delivery**	2
Administering Department	SCE		**College**	EE
Module Leader	Hussein M. Hussein		**e-mail**	Hussein.hussein@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail
Peer Reviewer Name	Ismael Khudhair Abdullah		**e-mail**	ismael.abdullah@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVEE206	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	13. Develop a deep understanding of advanced integration techniques, including trigonometric substitutions, partial fractions, integration by parts, and further substitutions. 14. Comprehend the principles of vector calculus, including the del operator, gradient, divergence, and curl, and their applications in system and control engineering. 15. Familiarize students with polar and cylindrical coordinate systems and their graphical representations. 16. Explore the convergence of sequences and series, including tests for monotonicity and convergence, and the analysis of alternating series. 17. Introduce power series and Taylor series expansions for functions, enabling students to approximate functions and study their properties. 18. Cultivate problem-solving skills and the ability to apply calculus concepts to practical engineering situations in the field of system and control engineering.
Module Learning Outcomes	13. Demonstrate a comprehensive understanding of advanced integration techniques and apply them effectively to solve a variety of integrals. Apply vector calculus principles, such as the del operator, gradient, divergence, and curl, to analyze vector fields in system and control engineering applications. 14. Interpret and manipulate equations in polar and cylindrical coordinates, and graphically represent functions in these coordinate systems. Analyze the convergence properties of sequences and determine convergence or divergence using appropriate tests. Apply various tests for series convergence and divergence, including geometric series, nth partial sum, and alternating series tests. 15. Construct power series representations and Taylor series expansions for functions, enabling accurate function approximation and analysis. 16. Solve engineering problems involving advanced integration techniques, vector calculus, sequences, and series. 17. Utilize mathematical reasoning and critical thinking skills to analyze and interpret mathematical concepts and their applications in system and control engineering. Develop proficiency in mathematical problem-solving, both independently and collaboratively, and communicate solutions effectively. 18. Demonstrate an awareness of the limitations and assumptions involved in using mathematical models and methods in system and control engineering. Reflect on the ethical and professional implications of applying calculus concepts and techniques in engineering contexts.

Indicative Contents	Indicative content includes the following. <u>METHODS OF INTEGRATION:</u> i) Trigonometric Substitutions. ii) Quadratics. iii) Partial fractions. iv) Integration by parts. v) Further Substitutions. [20hrs] <u>VECTOR CALCULUS:</u> i) vector function versus scalar function, ii) Del operator; Gradient; Divergence and Curl. [12 hrs] <u>POLAR COORDINATES:</u> i) The Polar Coordinate system. ii) Graphs of polar equations. [12 hrs] <u>SEQUENCES AND SERIES:</u> i) Sequences: convergence; Test of monotone ii) series: geometric series; nth partial sum; tests of convergence; alternating series. iii) Power and Taylor's series. [12 hrs]

Learning and Teaching Strategies	
Strategies	he main strategy for delivering this module in System and Control Engineering is to promote active student participation and enhance critical thinking skills. This will be achieved through interactive classes, engaging tutorials, and the inclusion of hands-on experiments and sampling activities that spark student interest. The classes will cover key calculus concepts through lectures, discussions, and visual aids, encouraging students to actively participate and contribute to class discussions. Interactive tutorials will reinforce understanding and problem-solving skills, allowing students to apply calculus principles collaboratively. Simple experiments and sampling activities will provide practical applications of calculus in system and control engineering, fostering a deeper understanding and curiosity for the subject. By implementing these strategies, the module aims to create an engaging learning environment that stimulates student engagement, cultivates critical thinking abilities, and highlights the real-world relevance of calculus in system and control engineering.

Student Workload (SWL)			
Structured SWL (h/sem)ل	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	87	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 5 and 6
	Assignments	2	10% (10)	2, 12	LO # 2, 3 and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1, 5 and 6
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Methods of Integration: Trigonometric Substitutions.
Week 2	Quadratics.
Week 3	Partial fractions.
Week 4	Integration by parts.
Week 5	Further Substitutions.
Week 6	Vector Calculus: Vector Function Versus Scalar Function.
Week 7	Del Operator, Gradient.
Week 8	Divergence and Curl.
Week 9	**Mid-Term Exam**
Week 10	Polar and Cylindrical Coordinates: The Polar Coordinate System.
Week 11	Graphs Of Polar Equations.
Week 12	Cylindrical Coordinate System.
Week 13	SEQUENCES AND SERIES: Sequences: convergence, Test of monotone.
Week 14	Series: geometric series, nth partial sum, tests of convergence, alternating series.
Week 15	Power and Taylor’s series.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	G. B. Thomas Jr., M. D. Weir, J. Hass, and F. R. Giordano, "Thomas' Calculus," 12th ed., Pearson, 2019.	Yes
Recommended Texts	Zill, D. G., Wright, W. S., & Cullen, M. R. (2011). Advanced Engineering Mathematics. Jones & Bartlett Publishers.	No
Websites	https://www.coursera.org/learn/introduction-to-calculus	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="4">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">AC Circuits Analysis</td><td>Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEE216</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">7</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">175</td></tr>
<tr><td>Module Level</td><td>1</td><td>Semester of Delivery</td><td>2</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td>EE</td></tr>
<tr><td>Module Leader</td><td>Nashwan Z. Hero</td><td>e-mail</td><td>Nashwan.hero@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td>Module Leader’s Qualification</td><td></td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td>E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Thakwan Akram jawad</td><td>e-mail</td><td>thakwan.jawad@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>NVEE215</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	19. To develop problem solving skills and understanding of circuit theory through the application of techniques. 20. To understand voltage, current and power from a given circuit. 21. This course deals with the basic concept of electrical circuits. 22. This is the basic subject for all electrical and electronic circuits. 23. To understand Kirchhoff's current and voltage Laws problems. 24. To perform mesh and Nodal analysis.
Module Learning Outcomes	19. Recognize how electricity works in electrical circuits. Also, list the various terms associated with electrical circuits. Then summarize what is meant by a basic electric circuit. 20. Discuss the reaction and involvement of atoms in electric circuits and describe electrical power, charge, and current. 21. Define Ohm's law. 22. Identify the basic circuit elements and their applications and discuss the operations of sinusoid and phasors in an electric circuit. Also, discuss the various properties of resistors, capacitors, and inductors. 23. Explain the two Kirchoff's laws used in circuit analysis. 24. Identify the capacitor and inductor phasor relationship with respect to voltage and current.
Indicative Contents	AC circuits – Time dependent signals, average and RMS values. Capacitance and inductance, energy storage elements, simple AC steady-state sinusoidal analysis. [10 hrs] AC Circuits – Phasor diagrams, definition of complex impedance, AC circuit analysis with complex numbers. [10 hrs] AC Circuits – Combining elements in series and parallel. Kirchhoff's laws and Ohm's law. Anatomy of a circuit, Network reduction, Introduction to mesh and nodal analysis. [20 hrs] Revision problem classes [6 hrs] AC Circuits – Impedance networks, voltage and current sources, Thevenin and Norton equivalent circuits, current and voltage division, input impedance, output impedance, coupling and decoupling capacitors, maximum power transfer, RMS and power dissipation, current limiting and over voltage protection. [15 hrs] RL, RC and RLC circuits - Frequency response of RLC circuits, simple filter and band-pass circuits, resonance and Q-factor, use of Bode plots, use of differential equations and their solutions. Time response (natural and step responses). Introduction to second order circuits. [15 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	92	**Structured SWL (h/w)**	6
Unstructured SWL (h/sem)	83	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	175		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 5 and 6
	Assignments	2	10% (10)	2, 12	LO # 1, 2, 3 and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 2, 4 and 5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Alternating Waveforms: Average value and root mean Square(rms) values
Week 2	Phasor Relationships for Circuit Elements
Week 3	Series and Parallel connection (Capacitors and Inductors)
Week 4	Impedance and Admittance
Week 5	Kirchhoff's Laws in Frequency Domain
Week 6	A.C. Circuit Theorems (Mesh Circuit analysis)
Week 7	A.C. Circuit Theorems (Nodal Circuit analysis)
Week 8	A.C. Circuit Theorems (Thevenin's theorems)
Week 9	A.C. Circuit Theorems (Norton theorems)
Week 10	Apparent Power and Power Factor correction
Week 11	R-C Transient: The Storage Phase
Week 12	R-C Transient: The Release Phase
Week 13	R-L Transient: The Storage Phase
Week 14	R-L Transient: The Release Phase

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to Agilent VEE and PSPICE
Week 2	Lab 2: Thévenin's / Norton's Theorem and Kirchhoff's Laws
Week 3	Lab 3: First-Order Transient Responses
Week 4	Lab 4: Second-Order Transient Responses
Week 5	Lab 5: Frequency Response of RC Circuits
Week 6	Lab 6: Frequency Response of RL Circuits
Week 7	Lab 7: Filters

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education	Yes
Recommended Texts	DC Electrical Circuit Analysis: A Practical Approach Copyright Year: 2020, dissidents.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

Grading Scheme				
Group	**Grade**		**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent		90 - 100	Outstanding Performance
	B - Very Good		80 - 89	Above average with some errors
	C – Good		70 - 79	Sound work with notable errors
	D - Satisfactory		60 - 69	Fair but with major shortcomings
	E - Sufficient		50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail		(45-49)	More work required but credit awarded
	F – Fail		(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Engineering Mechanics (Dynamics)</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☐ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC303</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>2</td></tr>
<tr><td colspan="2">Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td colspan="2">Ismael Khudhair Abdullah Al-Jobury</td><td>e-mail</td><td colspan="2">ismael.abdullah@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Lecturer Assistant</td><td colspan="2">Module Leader’s Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Mohanad Nihad Noaman</td><td>e-mail</td><td colspan="2">mohanad.noaman@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

Relation with other Modules			
Prerequisite module	**NVEESC302**	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Understanding and comprehending the laws and theories related to the motion of bodies by the action of the forces that applied to them, and developing the skills of solving problems related to them. 2. Knowing the types, forms and characteristics of the motions generated on bodies and classifying their vocabulary (location, displacement, distance, velocity, speed, acceleration, time) and knowing their forms and characteristics. 3. Knowing the coordinates through which the motion vocabulary of moving bodies is expressed. 4. Knowing the relationship between the vocabulary of motion and the possibility of representing it graphically. 5. Knowing the relationship between (force, mass, displacement, and velocity) and how to derive (work, energy, power, efficiency, momentum, impulse, and impact). 6. The study of dynamics in its two branches, kinematics and kinetics, is an essential introduction to the study of automation, robotics and systems modeling, which in turn are considered major courses in the Department of Systems and Control Engineering.
Module Learning Outcomes	1. Knowing the science of engineering mechanics and its basic vocabulary, as it is the origin of the dynamic's science. Also, Studying dynamics and its applications and related problems, and knowing its main branches, kinematics and kinetics, and what is the difference between them. 2. Knowledge of linear motion and its applications and knowledge of its main vocabulary (position, displacement, distance, velocity, speed, acceleration, and time) and the study of its forms, characteristics and coordinates that express it, knowing the difference between problems of constant acceleration and variable acceleration, and solve some of the related problems to it to enable understanding of the subject. Furthermore, knowing the relationship between the vocabulary of linear (position, displacement, distance, velocity, speed, acceleration, and time) and representing it graphically, and solve some related problems to enable understanding of the subject. 3. Knowing the motion of projectiles in both the horizontal and vertical directions, and knowing the difference between it and linear motion, and solve some problems related to it. Moreover, knowing of curved motion, its applications, knowing of its main vocabulary (location, displacement, velocity, acceleration, time), knowing of its forms, characteristics and coordinates that express it, and knowing of angular motion and rotational motion, and knowing of the difference between them, and solutions to some related problems to enable understanding of the subject. 4. Knowing the relative motion between moving objects and knowing the difference between it and absolute motion, and solve some related problems to enable understanding of the subject. Understanding the dependent motion between two bodies and how to analyze it, and solve some related problems to enable understanding of the subject. 5. Knowing the relationship between force, mass, and acceleration using Newton's second law, knowing the applications related to that, and solve some related problems to enable understanding of the subject. Together, these concepts enable the study relationship between force, mass, displacement and velocity, studying

	(work, kinetic energy, potential energy, power and efficiency) and knowing the difference between potential energy and kinetic energy and its applications in industrial life, and solve some related problems to enable understanding of the subject. 6. Knowing how to derive momentum and impulse forces, knowing their applications, and solve some problems related to them to enable understanding of the subject. Understand how to derive impact forces, knowing their applications, and solve some problems related to them to enable understanding of the subject.

Indicative Contents	Indicative content includes the following:
	Introduction to dynamics, Application of dynamics, Dynamics parts. [3 hrs]
	Part 1 – Kinematics: [32 hrs]
	- Rectilinear Kinematics: [16 hrs]
	  - Continuous Motion – Changeable acceleration problems. [4 hrs]
	  – Constant acceleration problems. [4 hrs]
	  - Erratic Motion (Graphic representation of the motion). [4 hrs]
	  - Motion of a Projectile. [4 hrs]
	- Curvilinear motion – Rectangular Components. [4 hrs]
	  – Normal and tangential Components. [4 hrs]
	- Relative-Motion of Two Particles Using Translating Axes. [4 hrs]
	- Absolute Dependent Motion Analysis of Two Particles. [4 hrs]
	Part 1 – Kinetics: [21 hrs]
	- Force and Acceleration: Newton's Second Law of Motion (The Equation of Motion). [4 hrs]
	- Work and Kinetic Energy - Principle of Work and Kinetic Energy. [5 hrs]
	- Potential Energy. [4 hrs]
	- Impulse and Momentum - Principle of Linear Impulse and Momentum. [4 hrs]
	- Impact. [4 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in introducing this unit is: - Sending the lecture to the students electronically three days before its scheduled date in the form of a (pdf) file with video clips (YouTube) showing the lecture with solutions to a number of related problems. - Giving the lecture and involving the students so that the lecture becomes a discussion to improve the students' skills and increase their understanding of the subject. - Conducting short exams in each lecture to urge students to follow up and increase their interest in the topic of the lecture.

	- Conducting an electronic meeting after each lecture if necessary to solve more problems related to the subject of the lecture to increase students' understanding of the subject.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2
Total SWL (h/sem)	100		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	10% (20)	3-8, 12-15	LO # 2, 3,…,6
	Assignments	2	10% (10)	5, 10	LO # 3, 6
	Projects / Lab.				
	Report	2	10% (10)	3, 5	LO # 2 and 3
Summative assessment	**Midterm Exam**	2 hr	10% (10)	10	LO # 1- 4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

		Material Covered
Week 1		Introduction to dynamics, Application of dynamics, Dynamics parts.
Week 2	**Kinematics**	Rectilinear Kinematics: Continuous Motion – Changeable acceleration problems.
Week 3		Rectilinear Kinematics: Continuous Motion – Constant acceleration problems.
Week 4		Rectilinear Kinematics: Erratic Motion (Graphic representation of the motion).
Week 5		Motion of a Projectile.
Week 6		Curvilinear motion: Rectangular Components.
Week 7		Curvilinear motion: Normal and tangential Components.
Week 8		Relative-Motion of Two Particles Using Translating Axes
Week 9		Absolute Dependent Motion Analysis of Two Particles
Week 10		**Mid-term Exam**
Week 11	**Kinetics**	Force and Acceleration: Newton's Second Law of Motion (The Equation of Motion).
Week 12		Work and Kinetic Energy - Principle of Work and Kinetic Energy.
Week 13		Potential Energy.
Week 14		Impulse and Momentum - Principle of Linear Impulse and Momentum.
Week 15		Impact.
Week 16		**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	“Engineering Mechanics (Dynamics) “, By: R.C. Hibbeler.	Yes
Recommended Texts	“Engineering Mechanics (Dynamics) “, By: J.L. Meriam.	No
Websites	https://youtube.com/@ismaelal-jobury6914	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information			
Module Title	Computer Programming	Module Delivery	
Module Type	Core		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	NVEESC304		
ECTS Credits	5		
SWL (hr/sem)	125		

Module Level	1	Semester of Delivery	2
Administering Department	SCE	College	EE
Module Leader	Abdulhameed Nabeel Hameed	e-mail	abdulhamed.hameed@uoninevah.edu.iq
Module Leader's Acad. Title	Ass. Lecturer	Module Leader's Qualification	M.Sc.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Mohammed S. Qasim	e-mail	mohammed.qasim@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	Version Number	1.0

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1- To introduce students to the fundamental concepts of C++ programming, including its syntax, structure, and the key components that make up a C++ program. 2- To understand and implement basic decision-making structures using if, if else and switch statements in C++. 3- To learn how to create and use the for, while, and do-while loop for repetitive tasks. 4- To explore the declaration and initialization of one-dimensional and two-dimensional arrays in C++. 5- To learn the syntax for declaring, defining, and calling functions in C++.
Module Learning Outcomes	1- Understand the Basics of C++ Programming. 2- Implement Control Flow Statements: Decision-making. 3- Apply Looping Structures. 4- Work with Arrays in C++. 5- Understand and Implement Functions in C++.
Indicative Contents	1- Introduction to C++ Programming. 2- Operators in C++. 3- Control Flow Statements: Decision-making. 4- Looping in C++. 5- Arrays in C++. 6- C++ Functions.

Learning and Teaching Strategies	
Strategies	1- Lectures and Demonstrations: Introduce key concepts through clear, engaging lectures and live demonstrations of coding techniques. 2- Hands-on Coding Practice: Encourage active participation by having students write and modify code during class to apply what they learn immediately. 3- Pair Programming and Collaborative Learning: Promote peer-to-peer learning by having students work together, solving problems and explaining their code to each other. 4- Guided Problem Solving: Support students in breaking down problems into manageable parts, applying programming concepts like loops, arrays, and functions. 5- Quizzes and Formative Assessments: Regular quizzes help identify knowledge gaps and ensure students are on track. 6- Project-based Learning: Assign small coding projects that require the use of multiple C++ concepts to encourage creativity and practical application.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO # 1, and 2
	Assignments	1	10% (10)	12	LO # 3
	Projects / Lab	14	15% (15)	Continuous	
	Report	1	5% (5)	13	LO # 4 , 5
Summative assessment	**Midterm Exam**	4 hr	10% (10)	8	LO # 1- 4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to C++
Week 2	Operators in C++.
Week 3	Control Flow Statements: Decision-making (if single-selection statement).
Week 4	Control Flow Statements: Decision-making (if..else single-selection statement).
Week 5	Control Flow Statements: Decision-making (Nested if..else statement).
Week 7	Control Flow Statements: Decision-making (switch multiple-selection statement).
Week 8	Control Flow Statements: Decision-making (switch, break, and continue).
Week 9	**Midterm Exam**
Week 10	Looping (for statement).
Week 11	Looping (while statement).
Week 12	Looping (do-while statement).
Week 13	Declaration and initialization of One-dimensional array in C++.
Week 14	Declaration and initialization of Two-dimensional Array in C++.
Week 15	C++ Functions: Function declaration, definition, and calling.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Starting with the Code::Blocks software
Week 2	Starting with C++ Programs
Week 3	Simple programs in C++
Week 4	Operators in C++
Week 5	Decision-making (if statement)
Week 6	Decision-making (if-else statement)
Week 7	Decision-making (switch statement)
Week 8	Control Flow: break and continue
Week 9	**Midterm Exam**
Week 10	Looping (for statement)
Week 11	Looping (while statement)
Week 12	Looping (do-while statement)
Week 13	Arrays in C++ (One-dimensional)
Week 14	Arrays in C++ (Two-dimensional)
Week 15	Functions in C++ (Declaration, Definition, and Calling)
Week 16	Review and Final Lab Assessment

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1- C++ Programming: From Problem Analysis to Program Design" by D. S. Malik. 2- Accelerated C++: Practical Programming by Example.	No
Recommended Texts	"C++: The Complete Reference" by Herbert Schildt	No
Websites	1- Youtube, https://www.youtube.com/watch?v=ZzaPdXTrSb8. 2- Coursera, https://www.coursera.org/specializations/hands-on-cpp.	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Digital Design</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC331</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>2</td></tr>
<tr><td colspan="2">Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td colspan="2">Mohammed A.Thanoon</td><td>e-mail</td><td colspan="2">mohammed.alsayed@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>MSc</td></tr>
<tr><td>Module Tutor</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Mohammed N.Younus</td><td>e-mail</td><td colspan="2">mohammed.younus@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date5</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Introduction to Digital Systems: Introduce students to the basic principles of digital systems, including binary number systems, digital representation of data, and Boolean algebra. 2. Logic Gates and Boolean Algebra: Familiarize students with the different types of logic gates and their behavior. Teach Boolean algebra and its application in digital circuit design and analysis. 3. Combinational Logic Design: Enable students to design and analyze combinational logic circuits using various building blocks such as multiplexers, decoders, encoders, and arithmetic circuits. 4. Sequential Logic Design: Introduce students to the concept of sequential circuits, including flip-flops, registers, counters, and memory units. Teach the design and analysis of sequential circuits using state diagrams and state tables. 5. Digital Circuit Simulation: Provide students with hands-on experience in simulating digital circuits using computer-aided design (CAD) tools. Teach the use of simulation software to verify the functionality and performance of digital circuits. 6. Digital Integrated Circuits: Introduce students to the basics of digital integrated circuits (ICs) and their applications. Cover topics such as logic families, IC technologies, and IC packaging. 7. Introduction to Programmable Logic Devices (PLDs): Familiarize students with programmable logic devices such as programmable logic arrays (PLAs) and field-programmable gate arrays (FPGAs). Teach the design and implementation of digital circuits using PLDs. 8. Digital System Testing and Fault Diagnosis: Introduce students to the techniques used for testing and diagnosing faults in digital systems. Cover topics such as fault models, test generation, and fault diagnosis algorithms. 9. Digital System Applications: Explore various applications of digital systems in areas such as data processing, communication, control systems, and embedded systems.
Module Learning Outcomes	1. Demonstrate a thorough understanding of the digital techniques' fundamental principles and concepts. 2. Apply Boolean algebra and logic gates to design and analyze digital circuits. 3. Design and implement digital circuits using appropriate software and hardware tools. Evaluate and troubleshoot digital circuits for correct functionality and performance. 4. Utilize multiplexers, decoders, encoders, and other digital components in circuit design. Explain the principles and techniques of data transmission in digital communication systems.

	5. Analyze and evaluate the performance of digital systems, considering factors such as speed, reliability, and power consumption. Apply critical thinking and problem-solving skills to address challenges in digital circuit design and implementation. 6. Collaborate effectively in team projects, demonstrating good communication and teamwork skills. Stay updated with the latest advancements and trends in digital techniques and apply them to real-world engineering problems.
Indicative Contents	Indicative content includes the following. 1. Introduction to Digital Systems: • Binary number systems and conversions • Digital representation of data • Logic levels and logic states • Digital signals and waveforms 2. Boolean Algebra and Logic Gates: • Boolean algebra fundamentals • Logic gates and their truth tables • Logic gate implementation using basic electronic components. • Logic gate properties and universal gates 3. Combinational Logic Circuits: • Combinational logic design principles • Combinational circuit analysis and simplification • Arithmetic circuits (adders, subtractors) • Multiplexers and demultiplexers • Encoders and decoders 4. Sequential Logic Circuits: • Flip-flops and latches • Analysis and design of sequential circuits • Synchronous and asynchronous sequential circuits • Registers and counters • State machines and state diagrams 5. Digital Integrated Circuits: • Overview of digital integrated circuits (ICs) • Types of ICs: gates, multiplexers, flip-flops, counters, etc.

	- IC technologies: TTL, CMOS, ECL - IC specifications and datasheets 6. Programmable Logic Devices (PLDs): - Introduction to PLDs: PAL, PLA, CPLD, FPGA - Architecture and configuration of PLDs - Designing and programming PLDs - Applications of PLDs in digital systems 7. Digital Circuit Simulation and Analysis: - Introduction to digital circuit simulation tools (e.g., Logisim, Proteus) - Simulation of digital circuits and waveforms - Timing analysis and propagation delay - Troubleshooting and debugging digital circuits 8. Design Methodologies and Tools: - Overview of digital design methodologies (e.g., hierarchical design, top-down design) - Introduction to hardware description languages (HDL) such as VHDL or Verilog - Design entry and synthesis tools - Design verification and testing techniques 9. Emerging Trends in Digital Techniques: - Advanced topics such as low-power design, digital signal processing, hardware/software co-design, etc. - Emerging technologies and future directions in digital systems

Learning and Teaching Strategies	
Strategies	1. Attend Lectures and Take Notes: Actively participate in lectures, listen attentively, and take comprehensive notes. Note down key concepts, examples, and explanations provided by the instructor. Review your notes regularly to reinforce your understanding. 2. Read the Recommended Textbooks: Consult the recommended textbooks for the module. Read the relevant chapters or sections to gain a deeper understanding of the topics covered. Pay attention to explanations, diagrams, and examples provided in the textbooks.

	3. Engage in Practical Work: Digital Techniques often involve hands-on practical work. Make use of laboratory sessions or practical assignments to gain practical experience in designing and implementing digital circuits. Experiment with different circuit configurations and observe the outcomes. 4. Solve Practice Problems: Practice solving problems and exercises related to the topics covered. This helps in reinforcing your understanding and developing problem-solving skills. Look for additional practice problems in textbooks, online resources, or provided by the instructor. 5. Collaborate with Peers: Form study groups or engage in discussions with your peers. Explaining concepts to others or discussing challenging topics can enhance your understanding. Collaborative learning allows for sharing different perspectives and can help clarify doubts. 6. Utilize Online Resources: Take advantage of online resources such as tutorials, video lectures, interactive simulations, and online forums. These resources can provide alternative explanations, additional examples, and opportunities for self-paced learning. 7. Seek Clarification: If you encounter difficulties or have questions, don't hesitate to seek clarification from your instructor or teaching assistants. Attend office hours or ask questions during class to address any confusion and ensure a clear understanding of the concepts. 8. Review and Revise Regularly: Digital Techniques involves building upon foundational concepts. Regularly review previously covered material to reinforce your understanding and make connections between different topics. Set aside dedicated time for revision before exams or assessments. 9. Practice Digital Circuit Simulation: Familiarize yourself with digital circuit simulation tools such as Logisim, Proteus, or other software available. Use these tools to simulate and visualize the behavior of digital circuits, verify your designs, and gain hands-on experience. 10. Stay Updated with Emerging Trends: Keep up with current trends and advancements in digital techniques. Read research papers, articles, and industry publications to stay informed about the latest developments in digital systems design and emerging technologies.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	23	**Unstructured SWL (h/w)**	2
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, and 6
	Assignments	2	10% (10)	2, 12	LO # 3, 4 and 5
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 4, 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-5
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Digital Techniques, Number Systems and Binary Arithmetic
Week 2	Boolean Algebra and Logic Gates, Combinational Logic Circuit
Week 3	Combinational Logic Circuits (continued), Multiplexers, and Demultiplexers
Week 4	Sequential Logic Circuits: Latches and Flip-Flops, Sequential Logic Circuits: Counters
Week 5	Sequential Logic Circuits: Shift Registers, State Machines, and Finite State Automata
Week 6	Introduction to Digital Integrated Circuits, Combinational MSI (Medium-Scale Integration) Circuits
Week 7	Mid-term Exam
Week 8	Sequential MSI Circuits, Introduction to Programmable Logic Devices (PLDs)
Week 9	Introduction to Field-Programmable Gate Arrays (FPGAs), Verilog or VHDL Introduction
Week 10	Timing and Clock Signals in Digital Circuits, Synchronous and Asynchronous Sequential Logic
Week 11	Memory Devices: ROM, RAM, and Flash Memory
Week 12	Memory Interfacing and Address Decoding
Week 13	Arithmetic Circuits and Arithmetic Logic Units (ALUs)
Week 14	Introduction to Digital Signal Processing (DSP)
Week 15	Review of Key Concepts
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to KL-31001 DIGITAL LOGIC LAB
Week 2	Lab 2: logic Gates
Week 3	Lab 3: NAND, NOR, XOR Gates.
Week 4	Lab 4: AND-OR-INVERTER (A-O-I) Gate Circuits
Week 5	Lab 5: Bit Parity Generator Circuit
Week 6	Lab 6: Comparator Circuit
Week 7	Lab 7: Adder and Subtractor Circuits
Week 8	Lab 8: BCD Adder and 2's Complement Circuit
Week 9	Lab 9: Decoder Circuit
Week 10	Lab 10: Encoder Circuit

Week 11	Lab 11: Multiplexer Circuit
Week 12	Lab 12: Demultiplexer Circuits

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Digital Design" by M. Morris Mano and Michael D. Ciletti: This textbook provides a comprehensive introduction to digital logic and design. It covers topics such as Boolean algebra, combinational and sequential logic circuits, and digital system design. It is widely used in introductory digital design courses.	Yes
Recommended Texts	1. "Digital Design: Principles and Practices" by John F. Wakerly: This book provides a comprehensive introduction to digital design, covering topics such as digital logic, sequential logic, and computer organization. It includes numerous examples, exercises, and design projects. 2. "Digital Fundamentals" by Thomas L. Floyd and R. Fletcher: This textbook covers the basics of digital electronics, including number systems, logic gates, combinational and sequential circuits, and memory devices. It offers clear explanations and includes practical examples and exercises. 3. "Digital Design and Computer Architecture" by David Harris and Sarah Harris: This book combines digital design principles with computer architecture concepts. It covers topics such as Boolean algebra, combinational and sequential circuits, datapath and control unit design, and memory systems. It also includes practical examples and exercises. 4. "Digital Electronics: Principles, Devices, and Applications" by Anil K. Maini: This text provides a comprehensive overview of digital electronics, including digital logic, combinational and sequential circuits, and digital integrated circuits. It covers both theoretical concepts and practical applications. 5. "Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, and Greg Moss: This book offers a thorough introduction to digital systems, covering topics such as digital logic, memory, programmable logic devices, and microprocessors. It includes numerous examples, exercises, and practical applications. 6. "Digital Electronics: A Practical Approach with VHDL" by William Kleitz: This book combines	No

	theoretical concepts with practical applications of digital electronics. It covers topics such as logic gates, Boolean algebra, combinational and sequential circuits, and VHDL programming. It includes hands-on exercises and design projects. 7. "Introduction to Digital Systems" by Ercegovac and Lang: This textbook provides a comprehensive introduction to digital systems, including digital logic, Boolean algebra, combinational and sequential circuits, and computer arithmetic. It includes numerous examples and exercises.	
Websites	1. All About Circuits (https://www.allaboutcircuits.com/): This website offers comprehensive tutorials, articles, and resources on various topics related to digital circuits, logic gates, and electronics. It covers both theoretical concepts and practical applications. 2. Khan Academy (https://www.khanacademy.org/): Khan Academy provides free online courses and video tutorials on a wide range of subjects, including digital electronics. It covers fundamental concepts, Boolean algebra, logic gates, and more. 3. Electronics Hub (https://www.electronicshub.org/): Electronics Hub is a platform that offers tutorials, projects, and resources for digital electronics and related topics. It includes articles on digital logic, sequential circuits, microcontrollers, and more. 4. Digital Electronics by Tutorials Point (https://www.tutorialspoint.com/digital_electronics/index.htm): Tutorials Point provides an online tutorial on digital electronics, covering topics such as logic gates, flip-flops, counters, and shift registers. It offers clear explanations and examples. 5. Learn.Digilentinc (https://learn.digilentinc.com/): Digilent is a company specializing in educational electronics and provides learning resources on various topics, including digital electronics. Their website offers tutorials, projects, and reference materials for learning digital techniques. 6. Electronics Tutorials (https://www.electronics-tutorials.ws/): Electronics Tutorials provides comprehensive tutorials on digital electronics, covering topics such as number systems, logic gates, sequential circuits, and more. It includes practical examples and interactive simulations. 7. Neso Academy (https://www.youtube.com/user/nesoacademy): Neso Academy's YouTube channel offers video lectures on digital electronics and related subjects. The videos cover a wide range of topics, including logic gates, sequential circuits, and digital system design.	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**English I**	**Module Delivery**
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVU11**	
ECTS Credits	**2**	
SWL (hr/sem)	50	

Module Level	1	**Semester of Delivery**	1
Administering Department	SCE	**College**	EE
Module Leader		**e-mail**	
Module Leader's Acad. Title	Noor Mothafar Hamid	**Module Leader's Qualification**	MS.D.
Module Tutor	Name (if available)	**e-mail**	noorm.hame@duoninevah.edu.iq
Peer Reviewer Name	Name	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	25. To develop skills, reading, writing and understanding of English language through the application of teaching techniques. 26. To understand scientific subjects and technical terms through reading and comprehension. 27. This course deals with the basic concepts of scientific subjects. 28. This course handles how to write simple research and how to make a successful presentation. 29. To understand the scientific language in English.
Module Learning Outcomes	25. Recognize parts of speech and tenses in English language and list the various terms associated with scientific texts. 26. Summarize what is meant by a basic electric circuit and discuss Electric currents, series and parallel circuits. 27. Describe electrical power, charge, and current and discuss computers, communication and the future of computers. 28. Identify the basic circuit elements and their applications. Also, explain energy types and forms. 29. Discuss the various properties of radio waves and vacuum tubes and explain modulation. 30. Discuss Electromagnetism.
Indicative Contents	Indicative content includes the following. 1.parts of speech _verb _ noun _ pronoun 2.Tenses _Past _Present _future 3.Electric currents and circuit _AC/DC _parallel, serious _Grounding, fuse, short circuit 4.Radio waves and vacuum tubes 5. Electromagnetism. 6. The future of computers, communication applications. _fiber optics.

	7. Induction. _Electric generator _Electric transformer _self-induction _servomechanism 8. Incandescent lamp. 9. Energy. _types of energy _forms of energy 10. Introduction to electron and electricity. 11.Electricity and electronics.

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation by reading, writing and comprehension in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, presentation, interactive tutorials, by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	10% (10)	4,6	LO #1, 2 and 3
	Assignments	2	10% (10)	9, 12	LO # 4, 5 and 6
	Projects / Lab.				
	Report	1	10% (10)	13	LO # 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1- 4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Parts of speech
Week 2	Tenses
Week 3	Electric currents and circuit
Week 4	Radio waves and vacuum tubes
Week 5	The future of computers, communication applications.
Week 6	Induction -Electric generator -Electric transformer
Week 7	Mid-term Exam
Week 8	Induction -Self-induction -Servomechanism
Week 9	Incandescent lamp.
Week 10	Energy. -types of energy -forms of energy
Week 11	Introduction to electron and electricity.
Week 12	Electricity and electronics
Week 13	The cathode ray tube
Week 14	Propagation
Week 15	Modulation
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	English in electrical engineering and electronics. The language of electrical and electronic engineering in English.	Yes
Recommended Texts	English for electrical engineering and computing.	No
Websites	https://www.askoxford.com/betterwriting/succesfulcv/application/?view=uk	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="4">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Arabic I</td><td>Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Base</td><td rowspan="4">☒ Theory
☐ Lecture
☐ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVU16</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">2</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">50</td></tr>
<tr><td>Module Level</td><td>1</td><td>Semester of Delivery</td><td>2</td></tr>
<tr><td>Administering Department</td><td></td><td>College</td><td>Electronics Engineering</td></tr>
<tr><td>Module Leader</td><td>Abdullah Mohammed Qader</td><td>e-mail</td><td></td></tr>
<tr><td>Module Leader's Acad. Title</td><td>Assistant Lecturer</td><td>Module Leader's Qualification</td><td>MSc</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td></td></tr>
<tr><td>Peer Reviewer Name</td><td></td><td>e-mail</td><td></td></tr>
<tr><td>Scientific Committee Approval Date</td><td>Feb. 01, 2025</td><td>Version Number</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	تهدف هذه الوحدة إلى تعزيز مهارات اللغة وتنمية التفكير وتمكين الطلاب من معرفة القواعد الأساسية للغة العربية ، وكذلك تمكينهم من القدرة على الإلقاء و التحدث باللغة السليمة الخالية من الأخطاء النحوية.
Module Learning Outcomes	من المتوقع أن يكون الطلاب قادرين على : 1. تعلم قواعد لغوية مفيدة في حياتهم المهنية مستقبلًا ، وذلك في صياغة الكتب الرسمية أو نحوها. 2. ان يميز الطالب بين أنواع الكلمات (اسم، فعل، حرف) وتوظيفها في السياقات الصحيحة. 3. أن يستطيع الطالب إعراب الجمل بشكل صحيح وفقاً للقواعد النحوية. 4. أن يتعرف الطالب على الجمل الاسمية والفعلية ويعرف تركيب كل منهما. 5. أن يتقن الطالب القواعد الصرفية مثل تصريف الأفعال حسب الأوزان الصرفية. 6. أن يتمكن الطالب من التعرف على بعض الأساليب البلاغية مثل التشبيه والاستعارة والكناية واستخدامها.
Indicative Contents	يتضمن المحتوى الإرشادي ما يلي: مدخل إلى علوم العربية ، والتعرف على أقسام الكلام في اللغة العربية ، والتعرف على الفعل وعلاماته و الحرف وعلاماته ، وكذلك علامات الإعراب الأصلية و الفرعية ، والتفريق بين الجملتين الاسمية والفعلية ، وكذلك التعرف على شبه الجملة بنوعيها ، والتعرف على المعرب والمبني، والميزان الصرفي والمشتقات في اللغة ، والتفريق بين همزتي الوصل والقطع ، والتعرف على ال الشمسية والقمرية ، والضاد والظاء ، والتاء المبسوطة والمربوطة.

Learning and Teaching Strategies	
Strategies	اتباع طريقة التعليم المباشر من خلال عرض المادة وشرحها والاستعانة بالادوات التعليمية لشرحها من خلال توضيح اليات المفهوم العلمي للغة العربية

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	25% (10)	3, 10	LO #1, and 2
	Assignments	2	25% (10)	5, 12	LO # 1, 6, and 3
	Class work	1	25% (10)	9	LO # 4
	Report	1	10% (10)	14	LO # 5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO #1 – 4
	Final Exam	2hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	علوم اللغة العربية
Week 2	أقسام الكلام
Week 3	الفعل وعلاماته
Week 4	الحرف وعلاماته
Week 5	علامات الإعراب الأصلية
Week 6	علامات الإعراب الفرعية
Week 7	الجملة الاسمية
Week 8	الجملة الفعلية
Week 9	شبه الجملة
Week 10	المعرب والمبني
Week 11	الميزان الصرفي
Week 12	المشتقات
Week 13	همزة القطع والوصل
Week 14	ال الشمسية والقمرية
Week 15	التاء المفتوحة والمربوطة / الضاد والظاء
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	البلاغة الواضحة ، علي الجارم و مصطفى أمين التحفة السنية في شرح المقدمة الآجرومية ، محمد محيي الدين عبد الحميد الصرف الواضح ، عبدالجبار علوان النايلة علم العروض والقافية ، عبدالعزيز عتيق	Yes
Recommended Texts		No
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Engineering Analysis I**	**Module Delivery**
Module Type	**Basic**	☒ **Theory**
Module Code	**NVEE208**	☐ **Lecture**
ECTS Credits	**5**	☐ **Lab**
SWL (hr/sem)	**125**	☒ **Tutorial**

		☐ **Practical** ☐ **Seminar**

Module Level	2	**Semester of Delivery**	3
Administering Department	SCE	**College**	EE
Module Leader	Abdurahman Basil AYOUB	**e-mail**	abdulrahman.ayoub@uoninevah.edu.iq
Module Leader's Acad. Title	Asst. Lecturer	**Module Leader's Qualification**	MSc
Module Tutor		**e-mail**	E-mail
Peer Reviewer Name	Abdulallah I.	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVEE207	**Semester**	2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. **Understanding Differential Equations** – Learn methods for solving first and second-order differential equations, including exact solutions and numerical approaches. 2. **Laplace Transforms** – Apply Laplace transforms to simplify and solve differential equations, particularly in engineering and control systems. 3. **Matrix Theory** – Develop proficiency in matrix operations, which are essential for solving systems of equations and understanding linear transformations. 4. **Multiple Integrals** – Gain the ability to evaluate double and triple integrals. 5. **Applied Problem-Solving** – Use mathematical techniques in real-world applications, such as robotics, physics, and engineering mechanics.
Module Learning Outcomes	31. **Solve Differential Equations** – Apply methods for first and second-order differential equations, including exact solutions and numerical techniques. 32. **Use Laplace Transforms** – Understand and apply Laplace transforms to simplify and solve differential equations, particularly in engineering contexts. 33. **Apply Matrix Theory** – Perform matrix operations and use them in solving systems of equations and transformations. 34. **Evaluate Multiple Integrals** – Compute double and triple integrals. 35. **Apply Mathematical Concepts to Engineering** – Use differential equations, Laplace transforms, and matrix theory in real-world applications like robotics, control systems, and physics.

Indicative Contents	**Differential Equations (40)** • Definition and classification of ordinary differential equations (ODEs) • First-order ODEs: Variable separable, homogeneous, linear, exact methods • Second-order ODEs: Undetermined coefficients, variation of parameters • Applications in engineering and physics **Laplace Transforms (35)** • Definition and fundamental properties • Laplace transforms of elementary functions • Inverse Laplace transforms and their applications • Solving differential equations using Laplace transforms **Matrix Theory (25)** • Basic operations: Addition, multiplication, inversion • Determinants and eigenvalues • Applications in linear systems and numerical analysis **Multiple Integrals (25)** • Double and triple integrals • Applications in physics and engineering mechanics

Learning and Teaching Strategies	
Strategies	**Differential Equations** 1. **Classification First** – Identify whether the equation is first-order, second-order, linear, or nonlinear. 2. **Choose the Right Method** – Use separation of variables, integrating factors, or exact equations for first-order problems. 3. **For Second-Order Equations** – Apply undetermined coefficients or variation of parameters. 4. **Laplace Transform Approach** – Convert differential equations into algebraic equations for easier manipulation. **Laplace Transforms** 1. **Use Transform Tables** – Recognize common transforms to speed up calculations. 2. **Apply Properties** – Utilize linearity, shifting, and convolution for complex functions.

	3. **Inverse Laplace Transform** – Convert back to the time domain using partial fraction decomposition. 4. **Engineering Applications** – Solve control system equations efficiently. **Multiple Integrals** 1. **Iterated Integration** – Break down double and triple integrals into stepwise calculations. 2. **Change of Variables** – Use polar, cylindrical, or spherical coordinates for simplification. 3. **Numerical Methods** – Apply Monte Carlo or Riemann sum approximations when analytical solutions are difficult.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	77	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20% (20)	5, 11	LO #1, 3 and 5
	Assignments	2	10% (10)	2, 10	LO # 1, 2 and 5
	Online Assignments	1	5% (5)	7, 9	LO # 1
	Report	1	5% (5)	13	LO # 3
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Definition of Ordinary Differential Equations, First Order D. Eqs. (Variable Separable, Homogeneous, Linear, Exact.) (Tutorial)
Week 2	Definition of Ordinary Differential Equations, First Order D. Eqs. (Variable Separable, Homogeneous, Linear, Exact.) (Tutorial)
Week 3	Definition of Ordinary Differential Equations, First Order D. Eqs. (Variable Separable, Homogeneous, Linear, Exact.) (Tutorial)
Week 4	Second Order Differential Equations(Undetermined coefficients, Variation of parameters.) (Tutorial)
Week 5	Second Order Differential Equations(Undetermined coefficients, Variation of parameters.) (Tutorial)
Week 6	
Week 7	Properties of Laplace Transform. (Tutorial)
Week 8	**Mid-Exam**
Week 9	Inverse Laplace Transform. (Tutorial)
Week 10	Applied Laplace Transform to Solve Differential Equations (Tutorial)
Week 11	Applied Laplace Transform to Solve Differential Equations (Tutorial)
Week 12	Matrix Theory Basic operations. (Tutorial)
Week 13	Matrix Theory Basic operations. (Tutorial)
Week 14	Multiple Integral – (Double Integrals)
Week 15	Changing the order of integration in double integrals
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	**Advanced Engineering Mathematics:** By Kreyszig 10th edition, 2011	No
Recommended Texts	**Calculus:** By Weir, Hass and Thomas Prentice Hall, 12th edition 2010	No
Websites	https://www.coursera.org/	

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Signals and Systems I</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Basic</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEE210</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td>2</td><td colspan="2">Semester of Delivery</td><td colspan="2">3</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="3">EEC</td></tr>
<tr><td>Module Leader</td><td>Ahmed Jameel Abdulqader</td><td>e-mail</td><td colspan="3">ahmed.abdulqader@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td colspan="3"></td></tr>
<tr><td>Peer Reviewer Name</td><td>Abulhameed Nabeel</td><td>e-mail</td><td colspan="3">abdulhamed.hameed@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	30. To introduce the fundamentals of signals and systems 31. To support applied modules in areas such as networks, electromagnetic fields and control theory 32. To provide an introduction to the Laplace transform and the Z-transform as tools for linear systems theory and analysis 33. To develop an awareness and understanding of the use of Fourier Transform, Fourier Series, Convolution and Correlation techniques to the study of signals and linear systems 34. To develop skills in the application of applied numeracy and algebraic techniques
Module Learning Outcomes	36. Describe different types of signals and systems and discuss the limitations of the Laplace transform in the context of engineering problems 37. Explain the implications of sampling signals and the basic theory of the Z-transform. Also, be able to demonstrate an understanding of Fourier Series and Fourier Transform techniques. Moreover, be able to demonstrate an understanding of Convolution and Correlation techniques. Furthermore, be able to explain and use the theorems associated with Fourier Transform techniques 38. Be able to describe the use of Correlation and Convolution techniques to analyze linear time invariant systems 39. Be able to use the Laplace transform in the analysis and characterization of linear, time-invariant systems 40. Be able to compare and contrast the Laplace & Fourier transforms in an engineering context 41. Be able to apply Fourier Transform techniques to describe the characteristics of signals
Indicative Contents	Indicative content includes the following. Signals and Systems: [10 hrs] Basic Definitions, Mathematical Models, Continuous- Time and Discrete-Time systems Signal and System Characteristics and Models [20 hrs] Basic Operations on Signals; Signal Characteristics; System Representations and Models; System Characteristics Continuous- Time Signals and Systems [30 hrs] Time –Domain Representations of Continuous- Time Signals; Sinusoidal and Complex Exponential Signals; Singularity Function Signals; Signal Energy and Power.

	Time Domain Analysis of Continuous-Time Signals [20 hrs] System Equation Solution; System Impulse Response; Zero-State Response of Linear; Time Invariant System; The Superposition Integral; Continuous-Convolution and Properties. Frequency-Domain Representation of Continuous- Time Signal [40 hrs] Spectra and Bandwidth of Continuous- Time Signals; Fourier Series Representations of Signals; Amplitude and Phase Spectra of Periodic signals; Complex Fourier Series Representations of Signals; The Fourier Transform and Spectra of aperiodic Energy Signals; The Fourier Transform and Spectra of Non energy signals. Frequency-Domain Analysis of Continuous- Time System [20 hrs] System Frequency Response; Frequency-Response Determination; Frequency Response of Electric Circuits; Phase Delay and Group Delay; Bode Plots of Amplitude and Phase Responses. Analysis of Continuous- Time System Using the Laplace Transform [10 hrs] The Laplace Transform; Laplace Transform Evaluations and Theorems; Evaluations of Inverse Laplace Transform; System Transfer Function; Frequency Response.

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 3, 6
	Assignments	2	10% (10)	4, 12	LO # 1, 2 and 3
	Lab	3	15% (15)	Continuous	All
	Seminar	1	5% (10)	10	LO # 2, 4 and 6
Summative assessment	**Midterm Exam**	1 hr	10% (10)	7	LO # 1-3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction of signals and systems
Week 2	Signal and System Characteristics and Models
Week 3	Signal and System Characteristics and Models
Week 4	Continuous- Time Signals and Systems
Week 5	Continuous- Time Signals and Systems
Week 6	Time Domain Analysis of Continuous-Time Signals
Week 7	Mid-term Exam
Week 8	Time Domain Analysis of Continuous-Time Signals
Week 9	Time Domain Analysis of Continuous-Time Signals
Week 10	Frequency-Domain Analysis of Continuous- Time System
Week 11	Frequency-Domain Analysis of Continuous- Time System
Week 12	Frequency-Domain Analysis of Continuous- Time System
Week 13	Analysis of Continuous- Time System Using the Laplace Transform
Week 14	Analysis of Continuous- Time System Using the Laplace Transform
Week 15	Frequency Response of Electric Circuits
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Generation of continuous time signals
Week 2	
Week 3	Lab 2: BASIC SIGNAL OPERATIONS
Week 4	
Week 5	Lab 3: System properties
Week 6	
Week 7	Lab 4: Computation of Convolution
Week 8	
Week 9	Lab 5: Fourier series coefficients calculations
Week 10	
Week 11	Lab 6: Fourier Transform Properties
Week 12	
Week 13	Lab 7: Applications I
Week 14	
Week 15	Lab 8: Applications II
Week 16	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Signals and Systems Edition 4.0 by Michael D. Adams Copyright Year: 2022	No
Recommended Texts	Signals and Systems primer with MATLAB by MATTHEW N. O. SADIKU WARSAME H. ALI Copyright Year: 2016.	No
Websites	https://www.coursera.org	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>**Module Title**</td><td colspan="2">Control I</td><td colspan="3">**Module Delivery**</td></tr>
<tr><td>**Module Type**</td><td colspan="2">Core</td><td colspan="3" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>**Module Code**</td><td colspan="2">NVEESC305</td></tr>
<tr><td>**ECTS Credits**</td><td colspan="2">6</td></tr>
<tr><td>**SWL (hr/sem)**</td><td colspan="2">150</td></tr>
<tr><td>**Module Level**</td><td>2</td><td colspan="2">**Semester of Delivery**</td><td colspan="2">3</td></tr>
<tr><td>**Administering Department**</td><td>SCE</td><td>**College**</td><td colspan="3">EEC</td></tr>
<tr><td>**Module Leader**</td><td>Muhammed A. Ibrahim</td><td>**e-mail**</td><td colspan="3">muhammed.ibrahim@uoninevah.edu.iq</td></tr>
<tr><td>**Module Leader’s Acad. Title**</td><td>Assistant Professor</td><td colspan="2">**Module Leader’s Qualification**</td><td colspan="2">Ph.D.</td></tr>
<tr><td>**Module Tutor**</td><td></td><td>**e-mail**</td><td colspan="3">E</td></tr>
<tr><td>**Peer Reviewer Name**</td><td>Abdullah Ibrahim Abdullah</td><td>**e-mail**</td><td colspan="3">abdullah.abdullah@uoninevah.edu.iq</td></tr>
<tr><td>**Scientific Committee Approval Date**</td><td>01/06/2023</td><td>**Version Number**</td><td colspan="3">1.0</td></tr>
</table>

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The aim of this course: 1) Develop a strong mathematical background: a) Understand and apply fundamental mathematical concepts relevant to control systems. b) Acquire proficiency in algebra, calculus, and linear algebra necessary for control system analysis. 2) Explore control system configurations: a) Examine various control system architectures and their applications. b) Understand the principles and characteristics of open loop and closed-loop control systems. 3) Master block diagram reduction techniques: a) Learn systematic methods to simplify complex block diagrams. b) Apply reduction techniques to analyze and design control systems efficiently. 4) Understand signal flow graphs: a) Gain proficiency in representing control systems using signal flow graphs. b) Analyze and interpret the behavior of control systems through signal flow graph analysis. 5) Analyze the time response of control systems: a) Study the time-domain behavior of control systems. b) Analyze and interpret transient and steady-state responses of control systems. 6) Investigate stability of control systems: a) Understand the concept of stability in control systems. b) Analyze stability using various techniques such as Routh-Hurwitz criterion. 7) Perform root locus analysis: a) Learn the fundamentals of root locus analysis. b) Apply root locus techniques to analyze the behavior and stability of control systems. 8) Integrate theoretical concepts with practical applications: a) Apply the acquired knowledge to practical control system problems. b) Use simulation tools and software to implement and analyze control system designs.
Module Learning Outcomes	Upon successful completion of the module on Control Systems Fundamentals and Analysis, students will be able to: 1- Demonstrate a solid understanding of mathematical concepts relevant to control systems, including Laplace transform, algebra, calculus, and linear algebra, and apply them effectively in control system analysis. 2- Identify and explain various control system configurations, such as open-loop and closed-loop systems, and evaluate their advantages and limitations in different applications. Also, apply block diagram reduction techniques to simplify complex control system diagrams and analyze the overall system behavior. 3- Construct and analyze signal flow graphs to represent and evaluate the behavior of control systems. Also, analyze the time response of control systems, including transient and steady-state responses, and interpret the results in terms of system stability and performance. 4- Assess the stability of control systems using different methods, such as the Routh-Hurwitz criterion, and determine the stability margins of the system.

	5- Perform root locus analysis to analyze and design control systems, and understand the impact of system parameters on stability and performance. 6- Apply theoretical concepts and analytical techniques to practical control system problems. Furthermore, utilize simulation tools and software to implement and analyze control system designs, and interpret simulation results to validate theoretical predictions.
Indicative Contents	1- Mathematical Background: [6 hrs] a. Review of algebraic concepts and manipulations. b. Calculus techniques relevant to control systems, such as differentiation and integration. c. Linear algebra and matrix operations in control system analysis. 2- Control System Configurations: [6 hrs] a. Open loop and closed-loop control systems. b. Feedback and feedforward control architectures. c. Advantages and limitations of different control system configurations. 3- Block Diagram Reduction: [10 hrs] a. Block diagram representation of control systems b. Reduction techniques, including series, parallel, and feedback connections c. Simplification methods for complex block diagrams 4- Signal Flow Graphs: [14hrs] a. Representation of control systems using signal flow graphs. b. Mason's gain formula for analyzing signal flow graphs. c. Determination of overall transfer function from a signal flow graph. 5- Time Response: [14 hrs] a. Analysis of transient and steady state responses of control systems. b. Time-domain specifications, such as rise time, settling time, and overshoot. c. Effects of system parameters on time response characteristics. 6- Stability of Control Systems: [10 hrs] a. Concepts of stability and instability in control systems. b. Routh-Hurwitz stability criterion. 7- Root Locus Analysis: [15 hrs] a. Root locus plots and their interpretation. b. Root locus design techniques for improving system performance and stability.

Learning and Teaching Strategies	
Strategies	1- Interactive Lectures: • Incorporate interactive elements within lectures, such as asking questions, conducting polls, or initiating discussions. • Encourage students to actively participate by sharing their insights, answering questions, and engaging in debates related to the lecture topics. 2- Problem-Based Learning: • Present real-world control system problems and challenges that require frequency response analysis. • Divide students into groups and assign them specific problems to solve, allowing them to apply the concepts learned and critically analyze different approaches. 3- Case Studies and Examples: • Provide case studies and examples that demonstrate the practical applications of the response analysis. • Encourage students to analyze and discuss these case studies, applying their critical thinking skills to identify the underlying control system challenges and propose solutions. 4- Hands-on Experiments and Simulations: • Conduct hands-on experiments or simulations using software tools (e.g., MATLAB/Simulink) to explore the system response analysis. • Guide students through the process of setting up experiments, collecting data, and analyzing the response characteristics. 5- Group Projects: • Assign group projects that require students to analyze, and optimize control systems. • Encourage collaboration and critical thinking within the groups, promoting discussions on design decisions, trade-offs, and system performance. 6- Problem-Solving Sessions: • Conduct problem-solving sessions where students can bring their questions or challenges related to the system response analysis. • Guide students in analyzing the problems, identifying relevant concepts, and developing systematic problem-solving strategies.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 8 and 9
	project	1	5% (5)	12	LO # 3, 4, 6 and 7
	Lab	3	15% (15)	Continuous	All

	H. W.	2	10%(10)	Continuous	LO#1-9
Summative assessment	**Midterm Exam**	1 hr	10% (10)	7	LO # 1-7
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Control Engineering. (Contents, definitions and basic concepts)
Week 2	Mathematical Background (Laplace Transform, Partial Fraction Expansion and Inverse Laplace)
Week 3	Control System Basics (Control System Configurations, Analysis and Design Objectives, Understanding the Transfer Function (of SISO and MIMO) and the characteristic equation)
Week 4	Block diagram reduction (Typical Elements of Block Diagrams, Common topologies of reduction, Block Diagram Reduction via Familiar Forms, Block Diagram Reduction via Moving Blocks to Create Familiar Forms).
Week 5	Signal flow graph (SFG)- Part 1 - Basic Elements of an SFG, SFG Algebra.
Week 6	Signal flow graph (SFG)- Part 2 - (Mason Gain Rule).
Week 7	Signal flow graph (SFG)- Part 3 - (Finding the system's transfer function using Mason rule)
Week 8	Time response- Part 1 (time response of continuous-data systems, typical test signals for the time response, The unit-step response and time-domain specifications)
Week 9	Time response- Part 2 (Steady-State Error of Linear Continuous-Data Control Systems).
Week 10	Time response- Part 3 (Transient response of 1st order systems, 2^{nd} and higher order Systems)
Week 11	Stability of control Systems (Routh Hurwitz Stability Criterion, basic Routh table)
Week 12	Stability of control Systems (Routh special cases)
Week 13	Root Locus Analysis- Part 1 (Define a root locus, State the properties of a root locus)
Week 14	Root Locus Analysis- Part 2 (Root locus plot, General rules of constructing)
Week 15	Root Locus Analysis- Part 3 (Root locus plot refining)
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: LAB Introduction to the control engineering by Using Matlab Programming.
Week 2	Lab 2: LAB Study of finding the Transfer Function By Matlab Programming Part 1.
Week 3	Lab 3: LAB Study of finding the Transfer Function By Matlab Programming Part 2.
Week 4	Lab.4 Plot the pole-zero configuration in s-plane for the given transfer function using MATLAB.
Week 5	Lab 5: LAB Study of plotting the block diagram reduction By Matlab Programming.

Week 6	Lab 6: LAB study of applying the Mason rule using Matlab Programming
Week 7	Lab 7: LAB study of finding the transient response of 1^{st} order system.
Week 8	Lab 8: LAB study of finding the transient response of 2^{nd} order system.
Week 9	Lab 9,10: Determine the time response of the given system subjected to any arbitrary input
Week 10	
Week 11	Lab 11,12: LAB study of finding the steady state error.
Week 12	
Week 13	Lab 13,14: Plotting of the root locus.
Week 14	
Week 15	Lab 15: Frequency Response Analysis

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Katsuhiko Ogata "Modern Control Engineering" 5th Edition	Yes
Recommended Texts	B. Kuo, “Automatic Control System,” 2010, 9^{th} edition	No
Websites	https://www.youtube.com/@MATLAB/playlists	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="4">Module Information</th></tr>
<tr><td>Module Title</td><td>Matlab Programming</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td>Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td>NVEESC306</td></tr>
<tr><td>ECTS Credits</td><td>3</td></tr>
<tr><td>SWL (hr/sem)</td><td>75</td></tr>
<tr><td>Module Level</td><td>2</td><td>Semester of Delivery</td><td>3</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td>EEC</td></tr>
<tr><td>Module Leader</td><td>Zeyad Tariq Shareef</td><td>e-mail</td><td>Zeyad.tariq@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Assistant Lecturer</td><td>Module Leader’s Qualification</td><td>MSc</td></tr>
<tr><td>Module Tutor</td><td>None</td><td>e-mail</td><td>None</td></tr>
<tr><td>Peer Reviewer Name</td><td>Abulhameed Nabeel</td><td>e-mail</td><td>abdulhamed.hameed@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC304</td><td>Semester</td><td>2</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	35. To learn how to use/interact with Matlab GUI effectively and look for help from inside the Matlab. 36. To learn how to create Matlab scripts and make/manipulate Matlab variables. 37. To understand Matlab plot. 38. To learn vector and matrix indexing. 39. To learn how write efficient Matlab code, Vectorization. 40. To learn program flow control. 41. To learn Matlab user-defined functions. 42. To learn how read and write data to txt, excel, etc. 43. To learn cell arrays and structures. 44. To learn SIMULINK basics.
Module Learning Outcomes	42. Undertake arithmetic on scalars, vectors and matrices. 43. Create 2D and 3D plots of mathematical functions and data. 44. Solve mechanical electrical engineering problems using Matlab scripts. 45. Write Matlab functions to solve engineering problems. 46. Read and analyze data from in txt, xls and other formats. 47. Use MATLAB and its SIMULINK tool for physical systems modelling and simulation.
Indicative Contents	Indicative content includes the following: (hours for only SSWL) Introduction to Matlab GUI, how to look for help in Matlab, Matlab scripts. [4hrs] Making and manipulating variables. [4hrs] Automatic initialization and vector indexing. [4hrs] Matrix indexing. [4hrs] Writing an efficient code, Vectorization. [4hrs] Introduction to Matlab plot. [4hrs] Flow control: conditions and loops. [4hrs] User-defined functions. [4hrs] User-defined functions variable input and output arguments. [4hrs] Global and persistent variables. [4hrs] Read and write data to txt and excel files. [4hrs] Cell arrays and structures. [4hrs] Introduction to MATLAB GUI and SIMULINK. [8hrs]

Learning and Teaching Strategies	
Strategies	hands-on exercises and programming assignments throughout the course. This will allow students to apply their knowledge, practice programming, and reinforce their understanding of MATLAB. Real-world examples to demonstrate how MATLAB can be used in practical applications. This can help students connect theoretical concepts to real-world scenarios and increase their motivation. Interactive learning which Includes activities such as group discussions, case studies, and problem-solving exercises that require students to actively engage with the material. providing feedback on student assignments and projects. Constructive feedback helps students understand their strengths and areas for improvement, fostering their growth and learning. Sharing additional resources, such as online tutorials, textbooks, and MATLAB documentation, to supplement the course material. This will allow students to explore further on their own and deepen their understanding of MATLAB.

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	13	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	75		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	15% (10)	3, 5, 10	LO #1, 2, 3 and 4
	Assignments	1	5% (10)	12	LO # 1-5
	Lab sessions	3	15% (10)	Continuous	LO # 1-6
	Seminar	1	5% (10)	14	LO # 1-6
Summative assessment	**Midterm Exam**	1 hour	10% (10)	7	LO # 1-3
	Final Exam	2 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to MATLAB environment, how to look for help in Matlab, Matlab scripts.
Week 2	Making and manipulating variables.
Week 3	Automatic initialization and vector indexing.
Week 4	Matrix indexing.
Week 5	Writing an efficient code, Vectorization.
Week 6	Introduction to Matlab plot.
Week 7	Mid-term Exam.
Week 8	Flow control: conditions and loops.
Week 9	User-defined functions.
Week 10	User-defined functions variable input and output arguments.
Week 11	Global and persistent variables.
Week 12	Read and write data to txt and excel files.
Week 13	Cell arrays and structures.
Week 14	Introduction to MATLAB GUI.
Week 15	Introduction to MATLAB SIMULINK.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1 to Week 3	MATLAB Built-in functions
Week 4 to Week 5	Manipulation matrices in MATLAB
Week 6 to Week 7	Plotting
Week 8 to Week 9	User-Defined Functions and User-Controlled Input/Output
Week 10 to Week 11	Logical Functions, Selection Structures and Repetition
Week 12 to Week 13	MATLAB GUI basics
Week 14 to Week 15	Use SIMULINK to model some basic systems
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	• Holly Moore, "MATLAB for Engineers", Pearson, 4th Edition, 2015. • Introduction to Programming in MATLAB® by Sourav Dey Danilo Šćepanović, Ankit Patel, Patrick Ho.	No
Recommended Texts	• What Every Engineer Should Know About MATLAB and Simulink by Adrian B. Biran, Moshe M.G. Breiner. • Stormy Attaway, "MATLAB: A practical Introduction to Programming and Problem Solving", Butterworth-Heinemann, 3rd Edition, 2013 • Steven T. Karis, "Introduction to Simulink with Engineering Applications", Orchard Publications, 3rd Edition, 2011	No
Websites	https://www.mathworks.com/help/matlab/getting-started-with-matlab.html	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information					
Module Title	**Analog Electronics I**			**Module Delivery**	
Module Type	**Basic**			☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**NVEE212**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	2		**Semester of Delivery**		3
Administering Department	SCE		**College**	EEC	
Module Leader	Rafal Alshaker		**e-mail**	rafal.mahmod@uoninevah.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**		M.Sc.
Module Tutor			**e-mail**		
Peer Reviewer Name	Nashwan Z. Hero		**e-mail**	Nashwan.hero@uoninevah.edu.iq	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	45. Be able to apply the proper biasing to insure operation in the active region. 46. Understand how to measure the important voltage levels of a BJT transistor configuration and use them to determine whether the network is operating properly. 47. Be able to perform a load-line analysis of the most common BJT configurations. 48. Become familiar with the *r e* , hybrid, and hybrid π models for the BJT transistor. 49. Understand the effects of a source resistance and load resistor on the overall gain and characteristics of an amplifier. 50. Become acquainted with the frequency response of a BJT amplifier. 51. Be able to find the Miller effect capacitance at the input and output of an amplifier due to a feedback capacitor.
Module Learning Outcomes	1. Understand the fundamental operation of BJT Transistors. Also, analyze BJT characteristics and parameters. 2. Perform D.C. analysis for various biasing configurations. 3. Understand and model BJT behavior using small-signal models. 4. Conduct A.C. analysis for the common-emitter configuration, the common-base configuration and common-collector (emitter-follower) configurations. 5. Analyze multistage amplifiers 6. Perform low-frequency analysis of amplifier circuits and analyze high-frequency response of amplifier circuits.
Indicative Contents	Indicative content includes the following. TRANSISTOR CONSTRUCTION, transistor operation, common-base configuration common-emitter configuration, The common-collector configuration. [15 hrs] operating point:, The circuit, The emitter-bias, The voltage-divider bias configuration, collector feedback configuration, miscellaneous bias configuration and emitter-follower configuration. [15 hrs] AMPLIFICATION IN THE AC DOMAIN: The equivalent circuit for the common-emitter configuration, common-base equivalent circuit and common-collector configuration. [15 hrs] LOW-FREQUENCY ANALYSIS—BODE PLOT, impact of the Rl, RS, Ci, CE and Co on the low-frequency response. [15 hrs] HIGH-FREQUENCY ANALYSIS—BODE PLOT, impact of the Rl, RS, Cbe, Cce, Cbc and the Miller capacitance *CMi* on the high-frequency response. [15 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	6, 10	LO # 2 and 4
	Assignments	2	10% (10)	Continuous	LO # 1-6
	Lab	2	10% (10)	Continuous	LO # 1-6
	Online Assignment	2	10% (10)	Continuous	LO # 1-6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction – BJT Transistor
Week 2	Transistor Characteristics and Parameters
Week 3	D.C analysis of fixed-bias configuration
Week 4	D.C analysis of emitter-bias configuration
Week 5	D.C analysis of voltage-divider -bias configuration and emitter-follower configuration.
Week 6	D.C analysis of collector feedback -bias configuration
Week 7	BJT Transistor Modeling
Week 8	A.C analysis for the common-emitter configuration
Week 9	A.C analysis for the common-base configuration
Week 10	A.C analysis for the common-collector configuration
Week 11	Multistage Amplifiers
Week 12	LOW-FREQUENCY ANALYSIS for critical points frequency

Week 13	LOW-FREQUENCY ANALYSIS for critical points frequency
Week 14	HIGH-FREQUENCY ANALYSIS for critical points frequency
Week 15	HIGH-FREQUENCY ANALYSIS for critical points frequency
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus	
Week	**Material Covered**
Week 1	Lab 1: Input and output characteristics
Week 2	
Week 3	Lab 2: D.C load line and Q-point
Week 4	
Week 5	Lab 3: common-emitter Amplifier
Week 6	
Week 7	Lab 4: common- base Amplifier
Week 8	
Week 9	Lab 5: common- collector Amplifier
Week 10	
Week 11	Lab 6: Two stage amplifier
Week 12	
Week 13	Lab 7: Frequency Response
Week 14	
Week 15	**Preparatory week before the final Exam**
Week 16	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Electronic Devices and Circuit Theory, Eleventh Edition Robert L. Boylestad Louis Nashelsky Electronic-devices-9-th-edition-thomas-floyd	Yes
Recommended Texts	Hughes, E. et al. (2008) *Electrical and Electronic Technology*, 10th Edn., Prentice-Hall.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings

	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information				
Module Title	**Computer II**		**Module Delivery**	
Module Type	**Basic**		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**NVU18**			
ECTS Credits	**3**			
SWL (hr/sem)	**75**			
Module Level	2		**Semester of Delivery**	3
Administering Department	SEC		**College**	EEC
Module Leader			**e-mail**	
Module Leader's Acad. Title			**Module Leader's Qualification**	
Module Tutor			**e-mail**	
Peer Reviewer Name			**e-mail**	
Scientific Committee Approval Date			**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVU10	**Semester**	1
Co-requisites module	None	**Semester**	

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents</th></tr>
<tr><td>Module Aims</td><td>
1. Enhance Technical Problem-Solving Skills
o Teach networking fundamentals (LAN/WAN) and cybersecurity threats.
o Develop troubleshooting skills for hardware/software issues.
2. Explore Digital Economy Tools
o Cover e-commerce, digital banking, and cloud services (e.g., Office 365).
o Demonstrate how technology streamlines business processes.
3. Deepen AI Knowledge with Real-World Applications
o Explain core AI techniques (machine learning, NLP) and their use in industries like healthcare and finance.
o Analyze AI’s role in smartphones (e.g., adaptive apps, real-time translation).
4. Critically Evaluate AI’s Societal Impact
o Discuss ethical dilemmas (job displacement, surveillance).
o Encourage debate on future trends (autonomous systems, smart cities).
</td></tr>
<tr><td>Module Learning Outcomes</td><td>
1. Troubleshoot Technical Issues
Diagnose common hardware/software problems and apply fixes.
Configure basic network settings and identify security threats.
2. Leverage Digital Tools for Professional Tasks
Use advanced spreadsheet functions (pivot tables, data validation).
Implement e-commerce principles (online banking, digital payments).
3. Analyze AI Technologies
Compare AI techniques (e.g., machine learning vs. rule-based systems).
Evaluate AI applications in sectors like healthcare or finance.
4. Debate AI’s Societal Impact
Critique ethical dilemmas (job displacement, surveillance).
Propose solutions for responsible AI use in modern contexts.
</td></tr>
<tr><td>Indicative Contents</td><td>
1. Networking & Security
• Network types (LAN/WAN), components (routers, switches)
• Cybersecurity: Threats (malware, hacking), prevention (firewalls, encryption)
• Troubleshooting: Diagnosing connectivity issues
2. Advanced Digital Tools
• Spreadsheets:
</td></tr>
</table>

	◦ **Pivot tables, data validation, advanced functions (VLOOKUP)** • **E-Commerce:** ◦ **Online banking, digital payments (mobile wallets, cryptocurrencies)** • **Cloud Computing:** ◦ **Collaborative tools (Google Workspace, Microsoft Teams)** **3. AI Technologies & Applications** • **Core Techniques:** ◦ **Machine learning (supervised/unsupervised), neural networks** ◦ **Computer vision, natural language processing (NLP)** • **Industry Applications:** ◦ **Healthcare (diagnostic tools, robotics)** ◦ **Finance (fraud detection, chatbots)** ◦ **Smartphones (facial recognition, real-time translation)** **4. AI Ethics & Future Trends** • **Ethical challenges: Job displacement, surveillance, bias in algorithms** • **Future directions: Autonomous vehicles, smart cities, AI in education** • **Debate topics: "Should AI replace human jobs?"** • o)

Learning and Teaching Strategies	
Strategies	1. **Case-Based Learning** ◦ Analyze real AI applications (healthcare, finance) ◦ Small-group ethics debates 2. **Project-Based Challenges** ◦ Network setup simulations ◦ No-code AI model building 3. **Socratic Discussions** ◦ Critical debates on AI bias/impact 4. **Reflective Portfolios** ◦ Screenshots + essays documenting progress

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	13	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	75		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO # 2, and 3
	Assignments	2	10% (10)	2, 12	LO # 1, and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 3
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1 - 3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Network Fundamentals (LAN/WAN, Topologies)
Week 2	Cybersecurity Threats (Malware, Phishing)
Week 3	Advanced Spreadsheets (Pivot Tables, VLOOKUP)
Week 4	E-Commerce Systems (Payment Gateways)
Week 5	Cloud Computing (Collaboration Tools)
Week 6	Machine Learning Basics
Week 7	Natural Language Processing (NLP)
Week 8	Computer Vision (Image Recognition)
Week 9	AI in Healthcare (Diagnostic Tools)
Week 10	AI in Finance (Fraud Detection)
Week 11	AI in Smartphones (Voice Assistants)
Week 12	AI Ethics (Bias, Privacy)
Week 13	Future AI Trends (Autonomous Systems)
Week 14	Capstone Project Planning
Week 15	AI Solution Prototyping
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Image Classifier (Teachable Machine)
Week 2	Basic Chatbot Design
Week 3	Image Recognition Demo
Week 4	AI Diagnostic Tools Study
Week 5	Fraud Detection Pattern Analysis
Week 6	Voice Assistant API Exploration
Week 7	Bias Detection in AI Models

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. **"Networking Essentials"** – Jeffrey S. Beasley (6th Edition) o Covers LAN/WAN, security, and troubleshooting. 2. **"AI Superpowers"** – Kai-Fu Lee (Ch. 1-5) o Examines real-world AI applications and ethics. 3. **"Hands-On Machine Learning with Scikit-Learn & TensorFlow"** – Aurélien Géron (2nd Ed., Ch. 1-4) o Practical ML foundations (simplified for non-specialists).	No
Recommended Texts	1. **"The Ethical Algorithm"** – Michael Kearns & Aaron Roth o Discusses bias, privacy, and AI ethics. 2. **"Futureproof: 9 Rules for Humans in the Age of Automation"** – Kevin Roose o Explores AI's societal impact.	no
Websites	1. **Cisco Networking Academy (SkillsForAll.com)** – Free networking labs. 2. **Google AI Experiments (experiments.withgoogle.com/ai)** – Interactive AI demos. 3. **Kaggle (kaggle.com/learn/intro-to-ai)** – Beginner-friendly AI courses.	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information			
Module Title	**Engineering Analysis II**	**Module Delivery**	
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVEE209**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
Module Level	2	**Semester of Delivery**	4
Administering Department	SCE	**College**	EE
Module Leader	Abdulrahman Basil AYOUB	**e-mail**	abdulrahman.ayoub@uoninevah.edu.iq
Module Leader's Acad. Title	Asst. Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Abdulallah I.	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVEE208	**Semester**	3
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	52. **Develop Analytical Skills**: Enhance your ability to solve differential equations, both ordinary and partial, using various methods like power series, Frobenius method, and special functions (e.g., Legendre and Bessel equations). 53. **Master Multiple Integrals**: Build proficiency in evaluating double and triple integrals, including changing the order of integration and using polar coordinates. 54. **Understand Special Functions**: Explore the properties and applications of Legendre polynomials and Bessel functions in real-world scenarios. 55. **Apply Mathematical Techniques**: Use these methods to address practical problems in robotics, control systems, and engineering mechanics. 56. **Prepare for Advanced Topics**: Lay a strong foundation for further studies in numerical analysis, integral transforms, and advanced PDEs.
Module Learning Outcomes	1. **Solve Complex Differential Equations**: o Apply methods like power series, Frobenius method, and special functions (Legendre and Bessel equations) to solve ordinary differential equations. o Classify and solve partial differential equations using techniques like separation of variables. 2. **Evaluate Multiple Integrals**: o Compute double integrals in polar coordinates and change the order of integration for complex regions. o Apply these techniques in physics and engineering contexts. 3. **Understand Special Functions**: o Explore the properties and applications of Legendre polynomials and Bessel functions in real-world scenarios. 4. **Apply Mathematical Techniques**: o Use these methods to address practical problems in robotics, control systems, and engineering mechanics. 5. **Develop Analytical Reasoning**: o Enhance problem-solving skills and logical reasoning through structured approaches to mathematical challenges.
Indicative Contents	**1. Multiple Integrals** • Double integrals in Cartesian and polar coordinates. • Changing the order of integration for complex regions. • Applications in physics and engineering, such as calculating areas and volumes. **2. Power Series Solutions**

	- Solving differential equations using power series expansions. - Radius and interval of convergence. - Applications in approximating solutions for equations with variable coefficients. **3. Frobenius Method** - Solving differential equations near singular points. - Recurrence relations for coefficients. - Applications in engineering and physics. **4. Special Functions** - Legendre’s equations and Legendre polynomials. - Bessel’s equations and Bessel functions. - Applications in spherical and cylindrical coordinate systems. **5. Partial Differential Equations (PDEs)** - Classification of PDEs: elliptic, parabolic, and hyperbolic. - Solving PDEs using separation of variables. - Applications in heat transfer, wave propagation, and fluid dynamics.

Learning and Teaching Strategies	
Strategies	**1. Multiple Integrals** • **Visualize the Region**: Sketch the region of integration to understand the limits and simplify the setup. • **Change Coordinates**: Use polar, cylindrical, or spherical coordinates for symmetry or complex regions. • **Practice Changing Order**: Work on problems that require changing the order of integration to build intuition. **2. Power Series Solutions** • **Understand Convergence**: Familiarize yourself with the radius and interval of convergence for series solutions. • **Work Through Recurrence Relations**: Practice deriving and solving recurrence relations for coefficients. • **Start with Simple Examples**: Begin with straightforward differential equations to build confidence. **3. Frobenius Method** • **Identify Singular Points**: Learn to classify singular points as regular or irregular. • **Master Recurrence Relations**: Focus on solving the relations that arise from the Frobenius method. • **Compare with Power Series**: Understand how Frobenius extends the power series method. **4. Special Functions (Legendre and Bessel Equations)** • **Study Properties**: Learn the orthogonality and recurrence relations of Legendre polynomials and Bessel functions. • **Explore Applications**: Apply these functions to problems in physics, such as wave equations and heat conduction. • **Use Graphical Tools**: Visualize these functions to understand their behavior. **5. Partial Differential Equations (PDEs)** • **Classify PDEs**: Practice identifying PDEs as elliptic, parabolic, or hyperbolic. • **Separation of Variables**: Solve problems step-by-step using this technique. • **Boundary Conditions**: Pay attention to initial and boundary conditions, as they guide the solution. **General Tips** • **Work on Examples**: Solve a variety of problems to reinforce concepts. • **Use Resources**: Refer to textbooks, online tutorials, and lecture notes for additional practice. • **Collaborate**: Discuss problems with peers or instructors to gain new insights.

Student Workload (SWL)			
Structured SWL (h/sem)	47	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	78	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	10% (10)	3, 9, 13	LO #
	Assignments	2	10% (10)	2, 8	LO #
	Seminar	1	10% (10)	Continuous	
	Report	1	10% (10)	11	LO #
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO #
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Double Integrals in Polar Coordinates
Week 2	Multiple Integral – (Triple Integral)
Week 3	Solution of differential equation by power series
Week 4	Solution of differential equation by power series
Week 5	Solution of differential equation by FROBENIUS method
Week 6	Solution of differential equation by FROBENIUS method
Week 7	Solution of differential equation by LEGENDRE'S equation
Week 8	**Mid-exam**
Week 9	Solution of differential equation by LEGENDRE'S equation
Week 10	Solution of differential equation by BESSEL'S equations
Week 11	Solution of differential equation by BESSEL'S equations
Week 12	Partial differential equation (Classification of PDEs)
Week 13	Solving PDEs by (Separation of Variables Technique)
Week 14	Solving PDEs by (Separation of Variables Technique)
Week 15	Review Lecture
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Rank, Eigen values, Eigenvectors. (Tutorial)
Week 2	Cayley-Hamilton Theorem. (Tutorial)
Week 3	Definition of double integral (Integration Limits are Constants, Integration Limits are Variables, Reversing the order of Integration). (Tutorial)
Week 4	Definition of double integral (Integration Limits are Constants, Integration Limits are Variables, Reversing the order of Integration). (Tutorial)
Week 5	Change to Polar Coordinates (Tutorial)
Week 6	Triple Integrals (Tutorial)
Week 7	Surface Area (Tutorial)

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		
Recommended Texts		
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Control II</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC309</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td>2</td><td colspan="2">Semester of Delivery</td><td colspan="2">4</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="3">EEC</td></tr>
<tr><td>Module Leader</td><td>Ali Khaleel Mahmood</td><td>e-mail</td><td colspan="3">ali.mahmood@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">M.Sc.</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td colspan="3"></td></tr>
<tr><td>Peer Reviewer Name</td><td>Abdullah Ibrahim Abdullah</td><td>e-mail</td><td colspan="3">abdullah.abdullah@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC305</td><td>Semester</td><td>3</td></tr>
<tr><td>Co-requisites module</td><td></td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The aim of this course is to give the students the ability to analyze any control system by using different methods. This includes the analyses of the transient response, steady state response and most importantly the stability. In addition, they will have the ability to represent systems using different methods such as the transfer function and state space then choose the most related one. By the end of this course, students will be able to make full analysis for control systems and be ready for the design of the control systems in the next year.
Module Learning Outcomes	48. Recognize the principles of Analog control system analysis. Also, list the various terms associated with frequency response. 49. Summarize what is meant by frequency response analysis. 50. Discuss the reaction and involvement of gain and phase shift in frequency response analysis. Add to that study the methods used to describe the frequency response. 51. Define the Bode plot, its analysis, rules, and sketching steps and discuss the Bode plot Tabulation method and its plotting steps. 52. Discuss the Bode plot Analytical method and its plotting steps. 53. Discuss the Frequency domain specifications and explain the stability criteria, find the gain margin, and phase margin.
Indicative Contents	Indicative content includes the following. 1. Introduction to Control Systems and Frequency Response [12 hrs] ❖ Overview of control systems and their importance. ❖ Introduction to frequency response analysis and its relevance. ❖ Basic concepts of transfer functions and Laplace transforms. 2. Frequency Response Characteristics. [12 hrs] ❖ Magnitude response: gain, resonant frequencies and bandwidth. ❖ Phase response: phase shift, phase margin, phase crossover frequency. ❖ Gain/Phase margins: definition, significance, interpretation. 3. Bode plots [18 hrs] ❖ Introduction to Bode plots as a graphical representation of frequency response. ❖ Construction of Bode plots from transfer functions. ❖ Interpreting Bode plots for gain, phase, and stability analysis. 4. Frequency Response Analysis Techniques [16 hrs] ❖ Analytical methods: evaluating frequency response using algebraic manipulation. ❖ Numerical methods: using MATLAB for frequency response analysis. ❖ Experimental methods: measuring frequency response using experimental setupsStability Analysis using Frequency Response 5. Stability Analysis using Frequency Response [16 hrs] ❖ Stability criteria based on frequency response: gain and phase margins, stability bounds ❖ Relationship between frequency response and stability analysis.

Learning and Teaching Strategies	
Strategies	7- Interactive Lectures: • Incorporate interactive elements within lectures, such as asking questions, conducting polls, or initiating discussions. • Encourage students to actively participate by sharing their insights, answering questions, and engaging in debates related to the lecture topics. 8- Problem-Based Learning: • Present real-world control system problems and challenges that require frequency response analysis. • Divide students into groups and assign them specific problems to solve, allowing them to apply the concepts learned and critically analyze different approaches. 9- Case Studies and Examples: • Provide case studies and examples that demonstrate the practical applications of frequency response analysis. • Encourage students to analyze and discuss these case studies, applying their critical thinking skills to identify the underlying control system challenges and propose solutions. 10- Hands-on Experiments and Simulations: • Conduct hands-on experiments or simulations using software tools (e.g., MATLAB/Simulink) to explore frequency response analysis. • Guide students through the process of setting up experiments, collecting data, and analyzing the frequency response characteristics. 11- Group Projects: • Assign group projects that require students to analyze, and optimize control systems using frequency response techniques. • Encourage collaboration and critical thinking within the groups, promoting discussions on design decisions, trade-offs, and system performance. 12- Problem-Solving Sessions: • Conduct problem-solving sessions where students can bring their questions or challenges related to frequency response analysis. • Guide students in analyzing the problems, identifying relevant concepts, and developing systematic problem-solving strategies.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, and 6
	Assignments	2	10% (10)	2, 12	LO # 2, and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 3, 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1- 4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction of Frequency Response.
Week 2	Review about some basic skills [(Trigonometry& Sinusoidal), Lows of Logarithms, Log-log and log-linear (semi log) scales.
Week 3	Introduction to Bode Plot.
Week 4	Bode analysis.
Week 5	Rules and steps of sketching Bode plot.
Week 6	Bode plot using Tabulation method- Part 1
Week 7	Bode plot using Tabulation method- Part 2
Week 8	Bode plot using Tabulation method- Part 3
Week 9	Bode plot using Analytical method- Part 1
Week 10	Bode plot using Analytical method- Part 2
Week 11	Bode plot using Analytical method- Part 3
Week 12	Frequency domain specifications.
Week 13	Frequency response stability.
Week 14	Finding the gain margin and phase margin from the system's transfer function.
Week 15	Finding the gain margin and phase margin from the plot of the Bode.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: LAB Introduction to frequency response by Using Matlab Programming.
Week 2	Lab 2: LAB Study of finding the log values By Matlab Programming.
Week 3	Lab 3: LAB Study of plotting the Bode plot By Matlab Programming.
Week 4	Lab 4: LAB study of finding Bode plot for different systems using Matlab Programming
Week 5	Lab 5: Tutorial
Week 6	Lab 6: LAB study of finding Gain Margin and Phase Margin using Matlab Programming
Week 7	Lab 7: Pre-test preparation.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	N. Nise "Control Systems Engineering", 2011 6th edition.	No
Recommended Texts	B. Kuo, "Automatic Control System," 2010, 9^{th} edition	No
Websites	https://www.youtube.com/@MATLAB/playlists	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Analog Electronics II</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEE213</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td colspan="2">2</td><td colspan="2">Semester of Delivery</td><td>4</td></tr>
<tr><td>Administering Department</td><td colspan="2">SEC</td><td>College</td><td colspan="2">EEC</td></tr>
<tr><td>Module Leader</td><td colspan="2">Nashwan Z. Hero</td><td>e-mail</td><td colspan="2">Nashwan.hero@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td colspan="2">Assistant Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td>Peer Reviewer Name</td><td colspan="2">Rafal Alshaker</td><td>e-mail</td><td colspan="2">rafal.mahmod@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td colspan="2">01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

Relation with other Modules			
Prerequisite module	NVEE212	**Semester**	3
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	57. Be able to apply the proper biasing to insure operation in the active region. 58. Understand how to measure the important voltage levels of a FET transistor configuration and use them to determine whether the network is operating properly. 59. Be able to perform a load-line analysis of the most common FET and MosFET configurations. 60. Become familiar with the $r\ e$, hybrid, and hybrid π models for the FET and MosFET transistor. 61. Understand the effects of a source resistance and load resistor on the overall gain and characteristics of an amplifier. 62. Become acquainted with the frequency response of a FET and MosFET amplifier. 63. Be able to find the Miller effect capacitance at the input and output of an amplifier due to a feedback capacitor.
Module Learning Outcomes	1. Analyze and compare the performance of fundamental analogue circuits. 2. Produce designs for simple analogue circuits. 3. Use computer modeling techniques and practical experiments to verify and assess theoretical predictions.
Indicative Contents	Indicative content includes the following. TRANSISTOR CONSTRUCTION, transistor operation, common-gate configuration common-drain configuration, The common-source configuration. [15 hrs] AMPLIFICATION IN THE DC DOMAIN: operating point:, The fixed-bias circuit, The self-bias, The voltage-divider bias configuration.[15 hrs] AMPLIFICATION IN THE AC DOMAIN: The equivalent circuit for the common-gate configuration, common-drain circuit and common-source configuration. [15 hrs] LOW-FREQUENCY ANALYSIS—BODE PLOT, impact of the Rl, RS, Ci, Cs and Co on the low-frequency response. [15 hrs] HIGH-FREQUENCY ANALYSIS—BODE PLOT, impact of the Rl, RS, Cgs, Cgd, Cds and the Miller capacitance CMi on the high-frequency response. [15 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, and 2
	Assignments	2	10% (10)	2, 12	LO # 1, and 2
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 2 and 3
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction -
Week 2	FET Transistor regions
Week 3	D.C load line and Q-point
Week 4	D.C analysis of fixed-bias configuration
Week 5	D.C analysis of self-bias configuration
Week 6	D.C analysis of voltage-divider -bias configuration
Week 7	D.C analysis of MosFET amplifier.
Week 8	A.C analysis for the common-source configuration
Week 9	A.C analysis for the common-gate configuration
Week 10	A.C analysis for the common-drain configuration
Week 11	Two stage amplifier
Week 12	LOW-FREQUENCY ANALYSIS for critical points frequency
Week 13	LOW-FREQUENCY ANALYSIS for critical points frequency

Week 14	HIGH-FREQUENCY ANALYSIS for critical points frequency
Week 15	HIGH-FREQUENCY ANALYSIS for critical points frequency
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Input and output characteristics
Week 2	Lab 2: common-source Amplifier of FET
Week 3	Lab 3: common-drain Amplifier of FET
Week 4	Lab 4: common-gate Amplifier of FET
Week 5	Lab 5: common-drain Amplifier of MosFET
Week 6	Lab 6: common-source Amplifier of MosFET
Week 7	Lab 7: Frequency Response

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Electronic Devices and Circuit Theory, Eleventh Edition Robert L. Boylestad Louis Nashelsky	Yes
Recommended Texts	Hughes, E. et al. (2008) *Electrical and Electronic Technology*, 10th Edn., Prentice-Hall.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Measurement and Sensors</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="5">☒ Theory
☐ Lecture
☐ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC311</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Module Level</td><td>2</td><td colspan="2">Semester of Delivery</td><td colspan="2">4</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="3">EE</td></tr>
<tr><td>Module Leader</td><td>Mohammed Nussrat Younus</td><td>e-mail</td><td colspan="3">Mohammed.younus@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">MSc.</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td colspan="3"></td></tr>
<tr><td>Peer Reviewer Name</td><td>Yazen H. Shaker</td><td>e-mail</td><td colspan="3">Yazen.shaker@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	64. To develop an awareness of the principles of measurement and instrument characteristics. 65. To become familiar with the operation and use of a variety of filters. 66. To realize the operation principle of several sensors and recognize the key issues in selecting the right instrument. 67. To be acquainted with several types of actuators 68. To understand modern signal transmission techniques and relevant standards. 69. To become aware of the sampling theorem, ADC and DAC.
Module Learning Outcomes	**Intended Knowledge Outcomes** At the end of this module students should be able to have 1. Knowledge of instrumentation technology, including characteristics, standards and operation principle. Familiarity with filtration and op amp circuits 2. Understanding the design concepts and operation of a broad range of electro-mechanical actuator devices. 3. Awareness of modern signal acquisition and transmitting technology 4. Recognize both static and dynamic requirements of instrumentation and measurement systems. 5. Specify and select appropriate sensors for a wide range of systems and applications. 6. Apply acquired knowledge to the design and modelling of measurement systems. Also, develop and implement data acquisition and signal transmitting strategies using DAQ devises, transmitter and controller.
Indicative Contents	Indicative content includes the following. Introduction to measurement system [8 hrs.] • General architecture • Static characteristics (Range, Span, Accuracy, Precision, Resolution, Sensitivity, Linearity, Hysteresis, Repeatability and Reproducibility) Passive filters [4 hrs.] • Basic components • Low Pass filter • High pass filter • Band pass filter Operation Amplifier (Op amp) [12 hrs.] • Inverting amplifier

	• Non-inverting amplifier • Voltage follower • Summing amplifier • Comparator • Differential amplifier • Integrator amplifier • Differentiator amplifier • Instrumentation amplifier Sensors [16 hrs.] • Position measurement o Limit switch o Proximity sensors o Potentiometer o LVDT o Encoders • Stress & strain measurement o Strain gauge • Temperature measurement o Metal strip o RTD o Thermistor o Thermocouple • Acceleration & vibration measurements • Pressure measurement • Speed measurement Actuators [4 hrs.] • Dc motor • Servo motor • Stepper motor • Solenoid Transmitters [4 hrs.] • 2-wire / 3-wire transmitters • Current transmitter 0-20 / 4-20 • Voltage transmitter 0-10 / -10-10 Analog & Digital interfaces [8 hrs.] • Sampling theorem • ADC • DAC

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is interactive learning through the visualization via flow charts, graphic and pictures that helps students to receive the information in a simpler, clear and systematic way. Also, depending on group work by dividing student into small groups of mixed abilities. By doing so, those who have more knowledge of the subject can share their knowledge and help their peers understand the topic better. Adapt Inquiry-Based learning to Encouraging learners to ask a lot of questions that does not only motivate students to think more practically but also helps them to become independent learners.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	3,7,10	LO #2,4, and 6
	Assignments	1	10% (10)	12	LO # 1, 2, 3, and 6
	Lab.	1	10% (10)	Continuous	All
	Report	1	5% (10)	13	LO # 4, and 6
Summative assessment	**Midterm Exam**	2 hrs.	15% (10)	11	LO # 1-4
	Final Exam	3 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
Week	**Material Covered**
Week 1	Introduction to measurement system / General architecture / Static characteristics (Range, Span, Accuracy, Precision, Resolution)
Week 2	Static characteristics (Sensitivity, Linearity, Hysteresis, Repeatability and Reproducibility)
Week 3	Passive filters • Basic components • Low Pass filter • High pass filter • Band pass filter
Week 4	Operation Amplifier (Op amp) • Inverting amplifier • Non-inverting amplifier

	• Voltage follower
Week 5	Operation Amplifier (Op amp) • Summing amplifier • Comparator • Differential amplifier
Week 6	Operation Amplifier (Op amp) • Integrator amplifier • Differentiator amplifier • Instrumentation amplifier
Week 7	Sensors • Limit switch • Proximity sensors • Potentiometer • LVDT
Week 8	Sensors • Encoders • Strain gauge
Week 9	Sensors • Metal strip • RTD • Thermistor • Thermocouple
Week 10	Sensors • Pressure measurement • Speed measurement
Week 11	Mid-term Exam
Week 12	Actuators • Dc motor • Servo motor • Stepper motor • Solenoid
Week 13	Transmitters • 2-wire / 3-wire transmitters • Current transmitter 0-20 / 4-20 • Voltage transmitter 0-10 / -10-10
Week 14	Analog & Digital interfaces • Sampling theorem • ADC
Week 15	Analog & Digital interfaces • DAC
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to measurement lab
Week 2	Read and test the static characteristics of several sensor
Week 3	Passive filters • Low Pass filter • High pass filter • Band pass filter
Week 4	Operation Amplifier (Op amp) • Inverting amplifier • Non-inverting amplifier • Voltage follower
Week 5	Operation Amplifier (Op amp) • Summing amplifier • Comparator • Differential amplifier
Week 6	Operation Amplifier (Op amp) • Integrator amplifier • Differentiator amplifier
Week 7	Sensors • Limit switch • Proximity sensors • Potentiometer
Week 8	Sensors • Encoders • Strain gauge
Week 9	Sensors • RTD • Thermocouple
Week 10	Sensors • Pressure sensor • Tachometer
Week 11	Mid-term lab Exam
Week 12	Actuators • Dc motor • Servo motor • Stepper motor • Solenoid
Week 13	• Current transmitter • Voltage transmitter

Week 14	• ADC
Week 15	• DAC
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Introduction to Instrumentation and Measurements, Third Edition, Robert B. Northrop. 2. Introduction to Mechatronics and Measurement Systems, Fourth Edition, David G. Alciatore and Michael B. Histand.	No
Recommended Texts	Measurement, Instrumentation and Sensors Handbook.	No
Websites	https://www.udemy.com/course/sensors-sensor-fundamentals/	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="4">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="1">Machines</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td>Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td>NVEESC312</td></tr>
<tr><td>ECTS Credits</td><td>5</td></tr>
<tr><td>SWL (hr/sem)</td><td>125</td></tr>
<tr><td>Module Level</td><td>2</td><td>Semester of Delivery</td><td>4</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td>EEC</td></tr>
<tr><td>Module Leader</td><td>Saif Saad Mahmood</td><td>e-mail</td><td>Saif.mahmood@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Asist.Lecturer</td><td>Module Leader’s Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td></td></tr>
<tr><td>Peer Reviewer Name</td><td></td><td>e-mail</td><td></td></tr>
<tr><td>Scientific Committee Approval Date</td><td></td><td>Version Number</td><td></td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	Understanding Electrical Machines Principle Analyzing Electrical Machines Behavior Control Strategies System Integration Practical Applications Problem-Solving Skills Laboratory Skills Teamwork and Communication Professional Development
Module Learning Outcomes	54. Understand how voltage is induced in a rotating loop and how curved pole faces contribute to a constant flux, and thus more constant output voltages. 55. Understand the power flow diagram for de machines, and know the types of de motors in general use. Understand the equivalent circuit of a de motor. 56. Understand how to derive the torque-speed characteristics of separately excited, shunt, series, and compounded de motors. 57. Understand how to control the speed of different types of de motors. 58. Understand the special characteristics of series de motors, and the applications. Also, understand the methods of starting dc motors safely, and the equivalent circuit of a dc generator. 59. Understand the purpose of a transformer in a power system. Add to that, how real transformers approximate the operation of an ideal transformer, where be able to explain how copper losses, leakage flux, hysteresis, and eddy currents are modeled in transformer equivalent circuits.

Indicative Contents	Introduction - A Simple Rotating Loop between Curved Pole Faces. The Voltage Induced in a Rotating Loop / Getting DC Voltage Out of the Rotating Loop / The Induced Torque in the rotating loop.(2 hrs.). Commutation and Armature Construction in Real DC Machine. .(2 hrs.). Power Flow and Losses in DC Machines. .(2 hrs.). Introduction to DC Motors. The Equivalent Circuit of a DC Motor. The Magnetization Curve of a DC Machine. Separately Excited and Shunt DC Motors.(2 hrs.). Permanent-Magnet DC Motor. The Series DC Motor. The Compounded DC Motor. .(2 hrs.). Motor Starters. Solid-State Speed Controllers. .(2 hrs.). DC Motor Efficiency Calculations. .(2 hrs.). Mid-term Exam. .(2 hrs.). Introduction to DC Generators. The Separately Excited Generator. .(2 hrs.). The Shunt DC Generator. The Series DC Generator.(2 hrs.). The Cumulatively Compounded DC Generator. The Differentially Compounded DC Generator. .(2 hrs.). Types and Construction of Transformers. The Ideal Transformer. .(2 hrs.). Theory of Operation of Real Single-Phase Transformers. The Equivalent Circuit of a Transformer. .(2 hrs.). Transformer Voltage Regulation and Efficiency. .(2 hrs.). Instrument Transformers. .(2 hrs.).

Learning and Teaching Strategies	
Strategies	Visual Aids Problem-Solving Exercises Real-World Applications Group Projects Simulations and Virtual Labs Multimedia Resources Real-Life Examples

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, and 3
	Assignments	2	10% (10)	2, 12	LO # 3, and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 4, 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1 – 4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction - A Simple Rotating Loop between Curved Pole Faces. The Voltage Induced in a Rotating Loop / Getting DC Voltage Out of the Rotating Loop / The Induced Torque in the rotating loop.
Week 2	Commutation and Armature Construction in Real DC Machine.
Week 3	Power Flow and Losses in DC Machines.
Week 4	Introduction to DC Motors. The Equivalent Circuit of a DC Motor. The Magnetization Curve of a DC Machine. Separately Excited and Shunt DC Motors
Week 5	Permanent-Magnet DC Motor. The Series DC Motor. The Compounded DC Motor.
Week 6	Motor Starters. Solid-State Speed Controllers.
Week 7	DC Motor Efficiency Calculations.
Week 8	Mid-term Exam.
Week 9	Introduction to DC Generators. The Separately Excited Generator.
Week 10	The Shunt DC Generator. The Series DC Generator
Week 11	The Cumulatively Compounded DC Generator. The Differentially Compounded DC Generator.
Week 12	Types and Construction of Transformers. The Ideal Transformer.
Week 13	Theory of Operation of Real Single-Phase Transformers. The Equivalent Circuit of a Transformer.
Week 14	Transformer Voltage Regulation and Efficiency.
Week 15	Instrument Transformers.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: THE CONSTRUCTION OF DC MACHINE
Week 2	Lab 2: Simulation of DC Machines
Week 3	Lab 3: POWER FLOW AND LOSSES IN DC MACHINES
Week 4	Lab 4: DC separated excited motor speed characteristic with the variation of supply voltage
Week 5	Lab 5: Relationship between speed and induced voltage for separately excited DC generator
Week 6	Lab 6: Simulation of Permanent Magnet DC Machines with starter
Week 7	Lab 7: Simulation of single-phase transformer

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Electrical Machinery Fundamentals" edited by Stephen J. Chapman.	Yes
Recommended Texts	Theraia Bl, Theraia Ak "ELECTRICAL TECHNOLOGY"	yes
Websites	https://www.coursera.org	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information			
Module Title	**Engineering Drawing**	**Module Delivery**	
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVEE201**		
ECTS Credits	**2**		
SWL (hr/sem)	**50**		
Module Level	2	**Semester of Delivery**	4
Administering Department	SCE	**College**	EE
Module Leader	Yazen Hudhaifa Shakir	**e-mail**	yazen.shakir@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc.
Module Tutor		**e-mail**	E-mail
Peer Reviewer Name	Ismail Khudhair , Ahmed Nidham Mohammed	**e-mail**	ismael.Khudhair@uoninevah.ed Ahmed.Nidham@uonievah.edu
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Numerical Analysis**	**Module Delivery**
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☐ **Lab**
Module Code	**NVEE**	
ECTS Credits	**6**	
SWL (hr/sem)	**150**	

		☒ Tutorial ☐ Practical ☐ Seminar

Module Level	3	**Semester of Delivery**	5
Administering Department	SCE	**College**	EE
Module Leader	Abdurahman Basil AYOUB	**e-mail**	abdulrahman.ayoub@uoninevah.edu.iq
Module Leader's Acad. Title	Asst. Lecturer	**Module Leader's Qualification**	MSc
Module Tutor		**e-mail**	E-mail
Peer Reviewer Name	Abdulallah I.	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	• **Understanding Numerical Methods:** Developing a solid grasp of iterative techniques for root finding, including Fixed Point Iteration, Newton-Raphson, Bisection, and False Position methods. • **Solving Differential Equations Numerically:** Applying numerical approaches like Euler's Method and Runge-Kutta to approximate solutions for ordinary differential equations. • **Integrating Functions Numerically:** Exploring integral approximation methods, such as the Trapezoidal Rule and Simpson's Rule, to compute definite integrals in cases where analytical solutions are impractical. • **Enhancing Computational Skills:** Strengthening problem-solving abilities by implementing these numerical methods in practical engineering and mathematical contexts. • **Connecting Theory to Applications:** Recognizing real-world applications of numerical techniques, particularly in control systems, robotics, and engineering mechanics.
Module Learning Outcomes	1. **Root Finding Techniques:** Demonstrate proficiency in numerical methods for solving single-variable equations, including Fixed Point Iteration, Newton-Raphson, Bisection, and False Position methods. 2. **Numerical Solutions for Differential Equations:** Apply Euler's Method and Runge-Kutta techniques to approximate solutions for ordinary differential equations. 3. **Numerical Integration Skills:** Utilize numerical approaches like the Trapezoidal Rule and Simpson's Rule to approximate definite integrals. 4. **Computational Thinking:** Develop problem-solving strategies by implementing these numerical methods in engineering and applied mathematics contexts. 5. **Algorithmic Implementation:** Gain hands-on experience with coding or algorithm development to apply numerical techniques in computational environments. 6. **Application in Engineering and Robotics:** Recognize how these methods contribute to engineering mechanics, control systems, and assistive technologies like smart wheelchair systems.

Indicative Contents	**Section 1: Root-Finding Methods** • Fixed-Point Iteration: Principles and convergence criteria • Newton-Raphson Method: Implementation, advantages, and limitations • Bisection Method: Stepwise approach and error estimation • False Position Method: Comparative analysis with bisection **Section 2: Numerical Solutions of Ordinary Differential Equations (ODEs)** • Euler's Method: Forward, backward, and modified Euler techniques • Runge-Kutta Methods: Higher-order approximations and their efficiency • Stability and Error Analysis: Evaluating numerical accuracy in ODE solutions **Section 3: Numerical Integration Techniques** • Trapezoidal Rule: Application in definite integrals and approximation errors • Simpson's Rule: Quadratic interpolation and accuracy comparisons • Adaptive Integration: Refining results using iterative methods **Section 4: Computational Applications** • Algorithm Design and Implementation in Engineering Contexts • Applications in Control Systems, Robotics, and Assistive Technologies • Case Studies: Real-world examples of numerical techniques in practice

Learning and Teaching Strategies	
Strategies	**1. Understanding Core Concepts Thoroughly** • Develop a strong foundation in numerical methods by reviewing theory before diving into problem-solving. • Compare different root-finding techniques (e.g., Newton-Raphson vs. Bisection) by analyzing their efficiency and convergence properties. **2. Practical Application & Problem-Solving** • Work through numerical examples step by step to reinforce algorithm implementation. • Apply methods like Runge-Kutta in real-world contexts such as control systems or robotics. **3. Computational Implementation** • Utilize programming tools (such as MATLAB or Python) to experiment with numerical techniques. • Write small scripts to automate computations and visualize solutions dynamically.

	4. Error Analysis & Optimization • Pay attention to accuracy, stability, and computational cost of each method. • Compare numerical vs. analytical solutions to understand limitations. **5. Connecting Topics Across Engineering Domains** • Relate numerical techniques to robotics, assistive technologies, and control system optimization. • Explore case studies that highlight practical applications of integration and differential equation solutions.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w**	3
Unstructured SWL (h/sem)	102	**Unstructured SWL (h/w)**	7
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20% (20)	5, 11	LO # 2, 3 and 5
	Assignments	2	10% (10)	2, 10	LO # 1
	Online Assignments	1	5% (5)	7, 9	LO # 1
	Report	1	5% (5)	13	LO # 2
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Roots of Single Equations (Fixed point Iteration)
Week 2	Roots of Single Equations (Newton-Raphson Method)
Week 3	Roots of Single Equations (Bisection Technique)
Week 4	Roots of Single Equations (secant Method)
Week 5	Roots of Single Equations (False Position Method)
Week 6	Numerical Solution of Ordinary Differential Equations (ODE) using Euler Method
Week 7	Numerical Solution of Ordinary Differential Equations (ODE) using Euler Method
Week 8	**Mid – Exam**
Week 9	Numerical Solution of Ordinary Differential Equations (ODE) using Euler Method
Week 10	Numerical Solution of Ordinary Differential Equations (ODE) using Runge-Kutta
Week 11	Numerical Solution of Ordinary Differential Equations (ODE) using Runge-Kutta
Week 12	Numerical Solution of integral using trapezoidal rule.
Week 13	Numerical Solution of integral using trapezoidal rule.
Week 14	Numerical Solution of integral using Simpson's rule
Week 15	Numerical Solution of integral using Simpson's rule
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	NUMERICAL METHODS FOR ENGINEERS, SEVENTH EDITION – 2015	No
Recommended Texts	Numerical Analysis – 9th edition – 2011	No
Websites		

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Digital Control**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial**
Module Code	**NVEESC307**	
ECTS Credits	**5**	
SWL (hr/sem)	**125**	

		☐ **Practical** ☐ **Seminar**

Module Level	3	**Semester of Delivery**	5
Administering Department	SCE	**College**	EE
Module Leader	Abdullah Ibrahim Abdullah	**e-mail**	Abdullah.abdullah@uoninevah.edu.iq
Module Leader's Acad. Title	Assistant Professor	**Module Leader's Qualification**	M.Sc.
Module Tutor	/	**e-mail**	/
Peer Reviewer Name	/	**e-mail**	/
Scientific Committee Approval Date	01/06/2023	**Version Number**	1

Relation with other Modules			
Prerequisite module	NVEESC309	**Semester**	4
Co-requisites module	None	**Semester**	None

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	To present the basic concepts on analysis and design of sampled data control system and to apply these concepts to typical physical processes.
Module Learning Outcomes	Upon the successful completion of the course, students will be able to: 1. Understand fundamentals of discrete-data systems by applying principles of engineering and mathematics. 2. Study the discrete-time system operation based on Z-transform 3. Design and analyze digital control systems for different engineering applications using MATLAB.
Indicative Contents	**1-Introduction to discrete time control system [5 hours]** Concepts of discrete control systems, Sampling theory, why digital control? quantizatio and quantization error, Analog to digital and digital to analog conversion, Examples o digital control systems. **2-Z-transform [15 hours]** Fundamentals of Z-Transform, Definition, Z-Transform Using Partial Fraction, Z Transform Using Residue Method, Properties of the z transform, Inversion of the Z transform, Power series**,** long division, partial fractions, Residue Method, Z-transfor method for solving difference equation. **3-Modeling of digital control systems [10 hours]** Discrete-time Block Diagrams, The ZOH Transfer Function, Pulse transfer function, Puls transfer function of closed loop system. **4-Time Response [10 hours]** Long division method, Difference Equations, Partial-fraction Expansion **5-Stability of Discrete Systems [15 hours]** Mapping of s-plane to z-plane, Factorization Method, Jury Test, Routh–Hurwitz criterion **6-Steady State Error [5 hours]** Step Function input, Ramp Function input, Parabolic Function input **7- Root Locus in the z-plane [10 hours]** Rules for Drawing Root Locus, Root Locus without Zero Order Hold, Root Locus wit Zero Order Hold ,Discrete PID controller, Discrete PID Controller Tuning

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO # 1, 2,3
	Assignments	2	10% (10)	2, 12	LO # 1,2
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO # 1,2
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1,2
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Introduction to discrete time control system** Concepts of discrete control systems, Sampling theory, why digital control? quantization, and quantization error, Analog to digital and digital to analog conversion Examples of digital control systems.
Week 2	**Z-transform** Fundamentals of Z-Transform, Definition, Z-Transform Using Partial Fraction
Week 3	Z-Transform Using Residue Method ,Properties of the z transform,
Week 4	Inversion of the Z-transform, Power series, long division, partial fractions, Z-transform method for solving difference equation
Week 5	**Modeling of digital control systems** Discrete-time Block Diagrams, The ZOH Transfer Function, Pulse transfer function
Week 6	Pulse transfer function of closed loop system
Week 7	**Time Response** Long division method, Difference Equations
Week 8	Partial-fraction Expansion.
Week 9	**Mid exam**
Week 10	**Stability of Discrete Systems** Mapping of s-plane to z-plane, Factorization Method
Week 11	Jury Test
Week 12	Routh–Hurwitz criterion
Week 13	**Steady State Error** Step Function input, Ramp Function input, Parabolic Function input
Week 14	**Root Locus in the z-plane** Rules for Drawing Root Locus, Root Locus without Zero Order Hold
Week 15	Root Locus with Zero Order Hold , Discrete PID controller, Discrete PID Controller Tuning.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1 Introduction to DC Lap.
Week 2	Lab 2: Sampling and quantization (ADC)
Week 3	Lab 3: Zero Order Hold (DAC)
Week 4	Lab 4: Familiarization with Digital Control System Toolbox
Week 5	Lab 5: Determination of z-Transform, Inverse z-Transform
Week 6	Lab 6: Step Response of a Discrete Time System and Effect of Sampling Time on System Response
Week 7	Lab 7: Region of Convergence (ROC) & Pole Zero Map of Discrete Systems
Week 8	Lab 8: Stability of Discrete Control Systems
Week 9	**Mid exam**
Week 10	Lab 9: System Stability –Jury test
Week 11	Lab 10: System Stability Routh–Hurwitz criterion
Week 12	Lab 11: System Stability Routh–Hurwitz criterion
Week 13	Lab 12: Discrete PI Controller
Week 14	Lab 13: Discrete PD Controller
Week 15	Lab 14: Discrete PID Controller
Week 16	**Final exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	M. Sami Fadali, Antonio Visioli "Digital Control Engineering Analysis and Design" Second Edition, 2013	Yes
Recommended Texts	Philips, Nagle Fourth Edition "Digital Control System analysis and design",2015	Yes
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="4">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Digital Signal Processing I</td><td>Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Basic</td><td rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEE204</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">125</td></tr>
</table>

<table>
<tr><td>Module Level</td><td>3</td><td>Semester of Delivery</td><td>5</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td>EEC</td></tr>
<tr><td>Module Leader</td><td>Ahmed Jameel Abdulqader</td><td>e-mail</td><td>ahmed.abdulqader@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td>Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td></td></tr>
<tr><td>Peer Reviewer Name</td><td>Abdulrahman</td><td>e-mail</td><td></td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	70. To develop problem solving skills and understanding of digital signal processing through the analysis of application techniques. 71. To understand analysis, synthesis and implementation of a given signal and system. 72. This course deals with the basic concept of DSP. 73. This is the basic subject for all digital signal and its application. 74. To perform digital filter design and its analysis.
Module Learning Outcomes	After successful completion of this module, students will: 60. Be able to apply the discrete Fourier series for analysis of a range of signals. 61. Be able to apply the discrete Fourier transform for analysis of a range of signals. 62. Be able to apply the discrete Z transform for analysis of a range of signals. 63. Be able to design a digital filter based on a given specification. 64. Be able to design and implement a variety of DSP algorithms in MATLAB.
Indicative Contents	Indicative content includes the following. Introduction [20 hrs] Basic elements of Digital Signal Processing, Need of Digital Signal Processing over Analog Signal Processing, A/D and D/A conversion, Sampling continuous signals and spectral properties of sampled signals Discrete-time Signals and System [30 hrs] Elementary discrete-time signals, Linearity, Shift invariance, Causality of discrete systems, Recursive and Non-recursive discrete-time systems, Convolution sum and impulse response, Linear Time-invariant systems characterized by constant coefficient difference equations, Stability of LTI systems, Implementation of LTI system Discrete Fourier Transform [40 hrs] Definition and applications, Frequency domain sampling and for reconstruction, Forward and Reverse transforms, Relationship of the DFT to other transforms, Properties of the Discrete Fourier Transform: Periodicity, Linearity and Symmetry Properties, Multiplication of two DFTs and Circular Convolution, Time reversal, Circular time shift and Multiplication of two sequences circular frequency shift, Circular correlation and Parseval's Theorem, Efficient computation of the DFT: Algorithm, applications, Applications of FFT Algorithms. Z-Transform [30 hrs] Definition of the z-transform, One-side and two-side transforms, ROC, Left-side, Right-sided and two-sided sequences, Region of convergence, Relationship to causality, Inverse z-transform-by long division, by partial fraction expansion, Z-transform properties-delay advance, Convolution, Parseval's theorem, Z-transform function H (z)-transient and steady state sinusoidal response, pole-zero relationship stability Convolution and Correlation [10 hrs]

	Transfer Functions and Frequency Response [10 hrs] Vector Interpretation of Frequency Response [10 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, and 3
	Assignments	2	10% (10)	2, 12	LO # 2, 4, and 5
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	9	LO # 1-4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Basic elements of digital signal Processing:
Week 2	Sampling Theorem
Week 3	Classification of Discrete Time systems
Week 4	Discrete Fourier Series: Spectra of periodic digital signals.
Week 5	Discrete Fourier Series: Properties of series.
Week 6	Discrete Fourier Transform: Properties.
Week 7	Discrete Fourier Transform: Frequency response of LTI systems.
Week 8	Convolution and Correlation
Week 9	Mid-term Exam
Week 10	Discrete and fast Fourier Transform
Week 11	Z- Transform: Review.
Week 12	Z- Transform: Z-plane poles and zeros.
Week 13	System Analysis Using Z-Transform
Week 14	Transfer Functions and Frequency Response
Week 15	Vector Interpretation of Frequency Response
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Representation of Basic Signals in Digital Signal Processing
Week 2	Lab 2: Verification of Sampling Theorem
Week 3	Lab 3: Impulse Response of LTI Systems
Week 4	Lab 4: Discrete Fourier Series
Week 5	Lab 5: Discrete Fourier Series: Properties of series
Week 6	Lab 6: Discrete Fourier Transform
Week 7	Lab 7: Discrete Fourier Transform: Frequency response of LTI systems.
Week 8	Lab 8: Convolution and Correlation
Week 9	Mid-term Exam
Week 10	Lab 10: Discrete and fast Fourier Transform
Week 11	Lab 11: Z- Transform: Review.
Week 12	Lab 12: Z- Transform: Z-plane poles and zeros.
Week 13	Lab 13: Z transform Commands and Pole Zero Plotting in Z plane
Week 14	Lab 14: System Analysis Using Z-Transform
Week 15	Lab 15: Transfer Functions and Frequency Response
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	J.G. Proakis and D.G. Manolakis, Digital Signal Processing, Prentice Hall of India. 2009	No
Recommended Texts	A.V. Oppenheim, Discrete-Time Signal Processing, Prentice Hall, 2009.	No
Recommended Texts	S.K. Mitra, Digital Signal Processing, A Computer-based Approach, McGraw Hill, 2008	No
Websites	https://www.coursera.org	

\

Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>**Module Title**</td><td colspan="3">**Thermodynamics**</td><td colspan="2">**Module Delivery**</td></tr>
<tr><td>**Module Type**</td><td colspan="3">**Core**</td><td colspan="2" rowspan="5">☒ **Theory**
☐ **Lecture**
☐ **Lab**
☒ **Tutorial**
☐ **Practical**
☐ **Seminar**</td></tr>
<tr><td>**Module Code**</td><td colspan="3">**NVEESC314**</td></tr>
<tr><td>**ECTS Credits**</td><td colspan="3">**4**</td></tr>
<tr><td>**SWL (hr/sem)**</td><td colspan="3">**100**</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td>**Module Level**</td><td>3</td><td colspan="2">**Semester of Delivery**</td><td colspan="2">5</td></tr>
<tr><td>**Administering Department**</td><td>SCE</td><td>**College**</td><td colspan="3">EE</td></tr>
<tr><td>**Module Leader**</td><td>Mohammed Nussrat Younus</td><td>**e-mail**</td><td colspan="3">Mohammed.younus@uoninevah.edu.iq</td></tr>
<tr><td>**Module Leader’s Acad. Title**</td><td>Assistant Prof.</td><td colspan="2">**Module Leader’s Qualification**</td><td colspan="2">MSc.</td></tr>
<tr><td>**Module Tutor**</td><td></td><td>**e-mail**</td><td colspan="3"></td></tr>
<tr><td>**Peer Reviewer Name**</td><td>Ismael Khudhair</td><td>**e-mail**</td><td colspan="3">ismael.Khudhair@uoninevah.ed</td></tr>
<tr><td>**Scientific Committee Approval Date**</td><td>01/04/2025</td><td colspan="2">**Version Number**</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>**Prerequisite module**</td><td>None</td><td>**Semester**</td><td></td></tr>
<tr><td>**Co-requisites module**</td><td>None</td><td>**Semester**</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	75. To develop an awareness of the principles of 1st law of thermodynamics. 76. To become familiar with variable thermodynamics processes and cycles. 77. To analysis the operation principle of several steady flow devices. 78. To understand the concepts behind 2nd law of thermodynamics. 79. To become aware of irreversibility and thermodynamic efficiency.
Module Learning Outcomes	**Intended Knowledge Outcomes** At the end of this module students should be able to 7. Explain the fundamental concepts of thermodynamics, including systems, surroundings, state functions, and the laws of thermodynamics. 8. Apply the First Law of Thermodynamics to analyze energy conservation in closed and open systems, including work, heat, and internal energy changes. 9. Utilize the Second Law of Thermodynamics to evaluate entropy changes, reversibility, and the efficiency of heat engines and refrigerators. 10. Analyze thermodynamic cycles (e.g., Carnot, Rankine, Brayton) to determine performance metrics such as thermal efficiency and coefficient of performance. 11. Use thermodynamic property tables and equations of state to solve problems involving enthalpy and internal energy of ideal gases
Indicative Contents	Indicative content includes the following. Introduction to Thermodynamics Concepts and Definitions of Systems, Properties of Systems, Process and States, Ideal Gas Law, Zeroth Law of Thermodynamic. Energy, Forms of Energy, Energy Transfer by Heat, Energy Transfer by Work, Internal Energy, 1st Law of Thermodynamics, Specific Heat and Heat Capacity, Change of Phase and Heat Latent. 1st Law of Thermodynamics Applied to Close System, Thermodynamics process: Isobaric Process, Isometric Process, Isothermal Process, Polytropic Process, Adiabatic Process, Thermodynamics Cycles. 1st Law of Thermodynamics Applied to Control Volume, Enthalpy, Energy Analysis of Steady Flow Devices: Nozzles and Diffusers, Turbines and Compressors, Heat Exchangers, Mixing Chambers. 2nd Law of Thermodynamics, Thermal Energy Reservoirs, Heat Engines, Thermal Efficiency, Refrigerators, Coefficient of Performance (COP), Carnot cycle, Reversible and Irreversible processes, Entropy, Isentropic Process, Isentropic Efficiency, Power Cycles

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is interactive learning through the visualization via flow charts, graphic and pictures that helps students to receive the information in a simpler, clear and systematic way. Also, depending on group work by dividing student into small groups of mixed abilities. By doing so, those who have more knowledge of the subject can share their knowledge and help their peers understand the topic better. Adapt Inquiry-Based learning to Encouraging learners to ask a lot of questions that does not only motivate students to think more practically but also helps them to become independent learners.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	24% (10)	3,7,10	All
	Homework	1	5% (10)	12	LO # 1,3, 4,
	Project	1	5% (10)	Continuous	1,2,3
	Seminar	1	6% (10)	13	All
Summative assessment	**Midterm Exam**	1 hr.	10% (10)	11	LO # 1-4
	Final Exam	2 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
Week	**Material Covered**
Week 1	Introduction to Thermodynamics, Concepts and Definitions of Systems, Properties of Systems, Process and States, Ideal Gas Law, Zeroth Law of Thermodynamic
Week 2	Energy, Forms of Energy, Energy Transfer by Heat, Energy Transfer by Work, Internal Energy
Week 3	1st Law of Thermodynamics, Specific Heat and Heat Capacity, Change of Phase & Heat Latent
Week 4	1st Law of Thermodynamics to Close System, Thermodynamics process: Isobaric Process,
Week 5	Isometric Process, Isothermal Process
Week 6	Polytropic Process, Adiabatic Process
Week 7	Thermodynamics Cycles
Week 8	1st Law of Thermodynamics Applied to Control Volume, Enthalpy, Energy Analysis of Steady Flow Devices:
Week 9	Nozzles and Diffusers, Turbines and Compressors
Week 10	Heat Exchangers, Mixing Chambers
Week 11	Mid-term Exam
Week 12	2nd Law of Thermodynamics, Thermal Energy Reservoirs, Heat Engines,
Week 13	Thermal Efficiency, Refrigerators, Coefficient of Performance (COP), Carnot cycle, Reversible and Irreversible processes
Week 14	Entropy, Isentropic Process, Isentropic Efficiency
Week 15	Rankine and Brayton Power Cycles
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	

Week 9	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Thermodynamics: an Engineering Approach 7th Edition by Yunus A. Cengel 2. Fundamental of Engineering Thermodynamics 5th Edition by Michael J. Moran and Howard N. Shapiro	No
Recommended Texts	1. Fundamentals of Thermodynamics 6th Edition by e. Sonntag, C. borgnakke and G. vanwylen	No
Websites	https://www.udemy.com/course/Thermodynamics	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="4">Module Information</th></tr>
<tr><td>Module Title</td><td>Control Systems Design</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td>Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td>NVEESC315</td></tr>
<tr><td>ECTS Credits</td><td>6</td></tr>
<tr><td>SWL (hr/sem)</td><td>150</td></tr>
</table>

Module Level	3	**Semester of Delivery**	5
Administering Department	SCE	**College**	EE
Module Leader	Mr. Salam Ibrahim	**e-mail**	salam.khather@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	/	**e-mail**	/
Peer Reviewer Name	/	**e-mail**	/
Scientific Committee Approval Date	1/6/2023	**Version Number**	1

Relation with other Modules			
Prerequisite module	NVEESC309	**Semester**	4
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	80. The objective of control system design is to construct a system that has a desirable response to standard inputs. 81. A desirable transient response is one that is sufficiently fast without excessive oscillations. 82. A desirable steady-state response is one that follows the desired output with sufficient accuracy. 83. Performance Specifications. 84. System Compensation. 85. Design Procedures of control systems. 86. Discusses the root-locus analysis and design of control systems, including positive feedback systems and conditionally stable systems Plotting root loci with MATLAB is discussed in detail. Design of lead, lag, and lag-lead compensators with the root-locus method is included. 87. Discusses the frequency-response analysis and design of control systems. The stability criterion is presented in an easily understandable manner. The Bode diagram approach to the design of lead, lag, and lag-lead compensators is discussed. 88. Deals with basic PID controllers. Computational approaches for obtaining optimal parameter values for PID controllers are discussed in detail, particularly with respect to satisfying requirements for step-response characteristics.
Module Learning Outcomes	65. Treats the root-locus method of analysis and design of control systems. The design process, from modeling to specification of the control problem and controller design will be emphasized. 66. Design by Root-Locus Method including design of lead, lag, and lag-lead compensators. 67. Parallel Compensation Technique. 68. Treats the frequency-response method of analysis and design of control systems. Design by the Frequency-Response Method (Bode Diagrams) including design of lead, lag, and lag-lead compensators. 69. Tuning of PID controllers and discusses PID controllers. Also, using Ziegler–Nichols Rules for Tuning PID Controllers 70. Design of PID Controllers with Frequency-Response approach.

Indicative Contents	Indicative content includes the following. <u>The Root-Locus Method:</u> Treats the root-locus method of analysis and design of control systems. The design process, from modeling to specification of the control problem and controller design will be emphasized. Design by Root-Locus Method including design of lead, lag, and lag-lead compensators. Parallel Compensation Technique. [25 hrs] <u>The Frequency-Response Method:</u> Treats the frequency-response method of analysis and design of control systems. Design by the Frequency-Response Method (Bode Diagrams) including design of lead, lag, and lag-lead compensators. [30 hrs] <u>PID controllers:</u> Tuning of PID controllers. Discusses PID controllers. Ziegler–Nichols Rules for Tuning PID Controllers and design of PID Controllers with Frequency-Response approach. [15 hrs]

Learning and Teaching Strategies	
Strategies	This course will introduce important concepts in the design of control systems. Special effort will be made to provide example problems at strategic points so that the students will have a clear understanding of the subject matter discussed. Learning control implies that the control system contains sufficient computational ability so that it can develop representations of the mathematical model of the system being controlled and can modify its own operation to take advantage of this newly developed knowledge.

Student Workload (SWL)			
Structured SWL (h/sem)	92	**Structured SWL (h/w)**	6
Unstructured SWL (h/sem)	58	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 5 and 6
	Assignments	2	10% (10)	2, 12	LO # 2, 3, and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 4, 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1 - 5
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to design.
Week 2	Introduction to Root-Locus.
Week 3	Design by Root-Locus Method including design of lead compensators.
Week 4	Design by Root-Locus Method including design of lag compensators.
Week 5	Design by Root-Locus Method including design of lag-lead compensators.
Week 6	Parallel Compensation Technique.
Week 7	Mid-term Exam
Week 8	Introduction to the Frequency-Response Method (Bode Diagrams).
Week 9	Design by the Frequency-Response Method including design of lead compensators.
Week 10	Design by the Frequency-Response Method including design of lag compensators.
Week 11	Design by the Frequency-Response Method including design of lag-lead compensators.
Week 12	PID Controllers.
Week 13	Ziegler–Nichols Rules for Tuning PID Controllers.
Week 14	Design of PID Controllers with Frequency-Response.
Week 15	Example Problems.
Week 16	Preparatory week before the final Exam.

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Brief Overview of Matlab Programming.
Week 2	Lab 2: The use of MATLAB for obtaining responses of control systems.
Week 3	Lab 3: Lead Compensation Techniques Based on the Root-Locus Approach.
Week 4	Lab 4: Lag Compensation Techniques Based on the Root-Locus Approach.
Week 5	Lab 5: LAG–LEAD COMPENSATION Techniques Based on the Root-Locus Approach
Week 6	Lab 6: Parallel Compensation Based on the Root-Locus Approach.
Week 7	Midterm Lab Exam
Week 8	Lab 7: Example Problems.
Week 9	Lab 8: Basic Characteristics of Lead Compensation by frequency-response approach.
Week 10	Lab 9: Basic Characteristics of Lag Compensation by frequency-response approach.
Week 11	Lab 10: Basic Characteristics of Lag- Lead Compensation by frequency-response approach.
Week 12	Lab 11: Obtain the unit-step response curve of PID-controlled system designed by use of the Ziegler–Nichols tuning rule.
Week 13	Lab 12: Tuning PID Controllers.
Week 14	Lab 13: Design of PID Controllers with Frequency-Response.
Week 15	Lab 14: Example Problems.
Week 16	Preparatory week before the final Exam.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Modern Control Engineering By Katsuhiko Ogata.	Yes
Recommended Texts	Control Systems Engineering By Norman S. Nise.	Yes
Websites	/	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Industrial Management and Ethics</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Basic</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☐ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEE202</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td>Module Level</td><td>3</td><td>Semester of Delivery</td><td colspan="3">5</td></tr>
<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="3">EE</td></tr>
<tr><td>Module Leader</td><td>Thabit H. Thabit</td><td>e-mail</td><td colspan="3">Thabit.thabit@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td>Module Leader’s Qualification</td><td colspan="3">MSc</td></tr>
<tr><td>Module Tutor</td><td>/</td><td>e-mail</td><td colspan="3">/</td></tr>
<tr><td>Peer Reviewer Name</td><td>Moatasem H. M. Salih</td><td>e-mail</td><td colspan="3">Moatasem.hood@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>1/6/2023</td><td>Version Number</td><td colspan="3">1</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	89. التركيز على القضايا المهنية المرتبطة بالتصميم والإنتاج والاستخدام الآمن للتقنية في المنظمة وتأثير الهندسة على المجتمع والبيئة. 90. تعزيز التفكير الأخلاقي لدى الطلاب وتطوير قدراتهم في اتخاذ القرارات الأخلاقية في سياق العمل الهندسي 91. تعزيز الوعي بالمسؤولية الاجتماعية للمهندسين ودورهم في تحقيق التنمية المستدامة وحماية البيئة وتعزيز التكنولوجيا التي تلبي احتياجات المجتمع. 92. تطوير قدرات الطلاب على العمل الجماعي والتعاون الأخلاقي مع زملائهم في الهندسة من خلال التواصل الفعال وحل المشكلات المشتركة وتعزيز قيم الاحترام والتعاطف في بيئة العمل. 93. تزويد الطلاب بالأدوات والمفاهيم الأخلاقية اللازمة لاتخاذ القرارات الهندسية المناسبة من خلال تعرفهم على كيفية تحليل المشكلات الإدارية والمالية والأخلاقية في الممارسة الهندسية واتخاذ القرارات المستدامة المناسبة باختصار، تهدف المادة إلى تزويد طلاب الأقسام الهندسية بالمعرفة والمهارات الأخلاقية اللازمة لممارسة مهنة الهندسة بشكل أخلاقي ومسؤول، وتوفير الإطار الأخلاقي لاتخاذ القرارات الهندسية المناسبة وتعزيز التعاون والمسؤولية الاجتماعية في المجال الهندسي.
Module Learning Outcomes	1. إكتساب الطلاب فهما عميقا للقضايا الأخلاقية المرتبطة بالعمل الهندسي، بما في ذلك التصميم والإنتاج والاستخدام الآمن للتقنية, حيث يمكن للطلاب التعرف على التحديات الأخلاقية الفريدة التي تنشأ في سياق الهندسة والتفكير في كيفية التعامل معها بشكل فعال. 2. إكتساب الطلاب المهارات اللازمة لاتخاذ القرارات الإدارية والمالية والأخلاقية في سياق العمل الهندسي حيث سيتعلم الطلاب كيفية تحليل المشاكل التي تواجههم في المنظمة او المشروع، وتقييم البدائل الممكنة واتخاذ القرارات المسؤولة والمستدامة. 3. يتوقع أن يصبح الطلاب على دراية بدورهم ومسؤولياتهم الاجتماعية كمهندسين, حيث سيكتسب الطلاب فهما لأهمية التوازن بين الاحتياجات التكنولوجية والاهتمامات الاجتماعية والبيئية وسيتعلمون كيفية تطبيق المبادئ الإدارية والمالية والأخلاقية في تصميم وتنفيذ الحلول الهندسية. 4. نمو قدرة الطلاب على التعاون والتواصل الفعال مع زملائهم في المجال المنظمي وإكتسابهم المهارات اللازمة للعمل الجماعي وحل المشكلات المشتركة بطريقة أخلاقية ومسؤولة. 5. المساهمة في تطوير الطلاب كأشخاص ومهنيين, حيث يمكن للطلاب تطوير قدراتهم في التفكير النقدي وحل المشكلات واتخاذ القرارات المدروسة، والتعامل بشكل فعال مع التحديات الأخلاقية والمهنية في مجال الهندسة. باختصار، من المتوقع أن تمنح مادة طلاب الأقسام الهندسية المعرفة والمهارات الأخلاقية والمهنية الضرورية لممارسة الهندسة بطريقة أخلاقية ومسؤولة، والتعامل مع التحديات الأخلاقية المرتبطة بالمجال الهندسي.
Indicative Contents	

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	67	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20% (10)	5, 10	LO #1, and 2
	Assignments	2	10% (10)	2, 12	LO # 3, and 4
	Report	1	10% (10)	13	LO # 3 and 2
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	مقدمة حول الإدارة الصناعية والتوجهات الحالية لها: (تعريف ونطاق الإدارة الصناعية, أهمية الإدارة الصناعية للمهندسين المهنيين, التطور التاريخي والاتجاهات الحالية في الإدارة الصناعية)
Week 2	الهيكل التنظيمي وتصميم المنظمة: (أنواع الهياكل التنظيمية, مبادئ واعتبارات التصميم التنظيمي, دور المهنيين الهندسيين في التصميم التنظيمي)
Week 3	القيادة وإدارة الفريق: (أساليب القيادة وإمكانية تطبيقها في البيئات الهندسية, بناء فرق هندسية فعالة, تحفيز وإدارة الفرق الهندسية)
Week 4	إدارة العمليات: (نظرة عامة على مبادئ إدارة العمليات, تصميم العملية وتحسينها في المنظمات الهندسية)
Week 5	إدارة سلسلة التوريد والاعتبارات اللوجستية
Week 6	ادارة مشروع: (تخطيط المشروع والجدولة والتحكم, إدارة المخاطر في المشاريع الهندسية, تقنيات التواصل والتعاون الفعال في المشروع)
Week 7	إمتحان منتصف الكورس
Week 8	إدارة الجودة: (أساسيات إدارة الجودة في السياقات الهندسية, تقنيات ضبط وضمان الجودة, مبادئ Six-Sigma والصناعة الرشيقة في العمليات الهندسية)
Week 9	إدارة الابتكار والتكنولوجيا: (إدارة التغيير التكنولوجي في المنظمات الهندسية, استراتيجيات لتعزيز الابتكار والإبداع, حقوق الملكية الفكرية وحماية الابتكار)
Week 10	التحليل المالي واتخاذ القرار في المنظمات الهندسية
Week 11	مبادئ موازنة المشروع ومراقبة التكاليف
Week 12	الاعتبارات الأخلاقية والاجتماعية: (القضايا الأخلاقية في الإدارة الصناعية, الاستدامة البيئية والمسؤولية الاجتماعية للشركات, الأخلاق المهنية للمهندسين)
Week 13	دراسات الحالة: الحالة التطبيقية الأولى – دولياً
Week 14	دراسات الحالة: الحالة التطبيقية الثانية – محلياً
Week 15	مناقشة مشاريع الطلبة
Week 16	الإمتحان النهائي

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	
Week 16	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Qi, E., Shen, J., and Dou, R. (2014). Industrial Engineering and Engineering Management: Theory and Apply of Industrial Management, Springer Berlin, Heidelberg.	Yes
Recommended Texts	Eilon, S., Hall, R., and King, J. (1966). Exercises in Industrial Management: A Series of Case Studies, Macmillan, St. Martin's Press, New York.	Yes
Websites	/	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Digital Signal Processing II**	**Module Delivery**
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVEE205**	
ECTS Credits	**5**	
SWL (hr/sem)	**125**	

Module Level	3	**Semester of Delivery**	6
Administering Department	SCE	**College**	EE
Module Leader	Ahmed Jameel Abdulqader	**e-mail**	ahmed.abdulqader@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVEE204	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Content	
Module Aims	94. To develop problem solving skills and understanding of digital signal processing through the analysis of application techniques. 95. To understand analysis, synthesis and implementation of a given signal and system. 96. This course deals with the basic concept of DSP. 97. This is the basic subject for all digital signal and its application. 98. To perform digital filter design and its analysis.
Module Learning Outcomes	1. Apply application of DFT for the analysis of digital signals and systems. 2. Design different types of IIR and FIR filters. 3. Characterize the effects of finite precision representation on digital filters. 4. Design multirate filters. 5. Apply different types of adaptive filters appropriately in practical systems
Indicative Contents	Indicative content includes the following. Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency 81 transformation in the analog domain. [16 hrs] Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations. Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations. [16 hrs] Introduction to Adaptive Filters like LMS [4 hrs] Introduction to Adaptive Filters like RLS [4 hrs] Circular Convolution [4 hrs] Applications of Filter Banks in Audio Processing [4 hrs] Applications of Filter Banks in Image Processing [4 hrs] Other applications [4 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, and 4
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 5
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Non-recursive & Recursive Systems
Week 2	Analysis of Discrete Time Linear Shift Invariant Systems
Week 3	Discrete Time Systems Described by Difference Equations.
Week 4	Framework for Digital Filter Design
Week 5	Finite Impulse Response Digital Filter Design
Week 6	Infinite Impulse Response Digital Filter Design
Week 7	Mid-term Exam
Week 8	Butterworth Filter Design System Analysis
Week 9	Chebyshev Filter Design System Analysis
Week 10	Introduction to Adaptive Filters like LMS
Week 11	Introduction to Adaptive Filters like RLS
Week 12	Circular Convolution
Week 13	Applications of Filter Banks in Audio Processing
Week 14	Applications of Filter Banks in Image Processing
Week 15	Other applications
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Non-recursive & Recursive Systems
Week 2	Lab 2: Analysis of Discrete Time Linear Shift Invariant Systems
Week 3	Lab 3: Discrete Time Systems Described by Difference Equations.
Week 4	Lab 4: Framework for Digital Filter Design
Week 5	Lab 5: Finite Impulse Response Digital Filter Design
Week 6	Lab 6: Infinite Impulse Response Digital Filter Design
Week 7	Mid-term Exam
Week 8	Lab 8: Butterworth Filter Design System Analysis
Week 9	Lab 9: Chebyshev Filter Design System Analysis
Week 10	Lab 10: Introduction to Adaptive Filters like LMS
Week 11	Lab 11: Introduction to Adaptive Filters like RLS
Week 12	Lab 12: Circular Convolution
Week 13	Lab 13: Applications of Filter Banks in Audio Processing
Week 14	Lab 14: Applications of Filter Banks in Image Processing
Week 15	Lab 15: Other applications
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	J.G. Proakis and D.G. Manolakis, Digital Signal Processing, Prentice Hall of India. 2009	No
Recommended Texts	A.V. Oppenheim, Discrete-Time Signal Processing, Prentice Hall, 2009.	No
Recommended Texts	S.K. Mitra, Digital Signal Processing, A Computer-based Approach, McGraw Hill, 2008	No
Websites	https://www.coursera.org	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Industrial Networks</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td colspan="3" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEESC316</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">100</td></tr>
<tr><td colspan="2">Module Level</td><td>3</td><td colspan="2">Semester of Delivery</td><td>6</td></tr>
<tr><td colspan="2">Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td colspan="2">Abdulhameed Nabeel Hameed</td><td>e-mail</td><td colspan="2">abdulhamed.hameed@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Ass. Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Name (if available)</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Yazen H. Shakir</td><td>e-mail</td><td colspan="2">Yazen.shakir@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Understanding Network Fundamentals: The module aims to introduce students to the basic concepts of computer networks, including network architectures, types of networks, network topologies, and network layering models. 2. Understanding Data Transmission Medium: The module aims to introduce students to the types of transmission mediums such as shielded twisted pair cable, coaxial cable, fiber optical cable Wi-Fi, and Bluetooth. 3. Exploring Network Devices: The module aims to familiarize students with various network devices, such as routers, switches, and hubs. Students will learn about their functionalities, configurations, and how they contribute to network connectivity. 4. Exploring Network Addressing: The module aims to explore and analyze network addressing, including IPv4 addressing, Address Mask, and Glassful Addressing. 5. Understanding different network architectures commonly used in industrial networks, such as fieldbus systems (e.g., Profibus, DeviceNet), and Ethernet-based networks (e.g., EtherNet/IP, PROFINET). 6. Knowledge of Network Protocols: Students can gain knowledge about various protocols used in industrial networks, such as Modbus, CAN (Controller Area Network), and others. They can learn about the features, functions, and usage scenarios of these protocols. 7. Troubleshooting and Maintenance: Students can develop skills in troubleshooting industrial network issues, such as network connectivity problems, device configuration errors, signal interference, and data transmission failures. 8. Industrial Internet of Things (IIoT): Students can explore the role of industrial networks in the context of the Industrial Internet of Things.
Module Learning Outcomes	Upon successful completion of this module, students will be able to: 71. Understand the fundamental concepts and principles of computer networks, including network architectures, types of networks (such as LAN, WAN, and MAN), network topologies, TCP/IP (Transmission Control Protocol/Internet Protocol) suite, and network topologies. 72. Explain the basics and types of guided data transmission media such as Unshielded Twisted Pair (UTP) Cable., Shielded Twisted Pair (STP) Cable., Coaxial Cable, fiber optical cable Wi-Fi, and Bluetooth. 73. Demonstrate knowledge of network architecture, components, and their functionalities, such as routers, switches, and hubs. Evaluate and compare different network architectures, such as client-server and peer-to-peer models, and their advantages and disadvantages. 74. Understand and analyze network addressing, including IPv4 addressing, Address Mask, Glassful Addressing (Class A, B, C, and D), and IPv4 types. 75. Explain the fundamental principles and concepts of industrial networks. Also, identify and compare different types of industrial network topologies and communication protocols. 76. Design and configure industrial networks based on specific requirements and

	constraints, and Integrate industrial networks with IoT and cloud computing platforms.
Indicative Contents	Indicative content includes the following. <u>Part A - Introduction to Computer Networks:</u> Definitions and basic concepts – network architectures, types of networks, network topologies, Protocols ،Standards ،and Standard organizations. [10 hrs] Network architectures and models – Principles of Protocol Layering, OSI Protocol Layering Model, TCP/IP Protocol Suite, Encapsulation and Decapsulation. [5 hrs] Transmission Media and Networking Devices – Unshielded Twisted Pair (UTP) Cable, Shielded Twisted Pair (STP) Cable, Coaxial Cable, and Optical Fiber. Wireless transmission media, Wi-Fi, and Bluetooth. NICs ،Hubs ،Repeaters ،Bridges and Switches, and Routers. [10 hrs] IP Addressing – Introduction to IPv4 addressing, Address Mask, and Glassful addressing, IPv4 addressing types. [10 hrs] <u>Part B – Industrial Networks</u> Introduction to Industrial Networks - Overview of industrial networks, components of industrial networks (field devices, controllers, switches, and routers). [5 hrs] Industrial Communication Standards: Serial data communication interface standards - (RS 232,422,485 standards). [5 hrs] Industrial Communication Protocols - Introduction to industrial communication protocols such as (Profibus, Modbus, EtherNet/IP, and DeviceNet), the characteristics, advantages, and limitations of these protocols. [10 hrs] Fieldbus-Based Industrial Networks - Introduction to fieldbus systems and their applications, Types of fieldbus protocols (Profibus, DeviceNet, CANbus), Fieldbus network architecture and components, Configuration and addressing in fieldbus networks. [5 hrs] Industrial IoT - Overview of the Industrial Internet of Things (IIoT), Integration of industrial networks with IoT devices and cloud platforms, Industrial Network Design and Implementation. [10 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is: 1- Understand the fundamentals: Start by building a solid foundation of knowledge about industrial networks. Familiarize yourself with the basic concepts, protocols, and architectures commonly used in industrial environments. This will help you grasp more advanced topics later on. 2- Engage in hands-on learning: Industrial networks are best understood through practical experience. Try to get access to real-world industrial equipment, such as programmable logic controllers (PLCs) or industrial routers, and practice configuring and troubleshooting network setups. If physical equipment is not readily available, consider using simulation software to simulate industrial network environments. 3- Take advantage of online resources: The internet offers a wealth of resources for learning about industrial networks. Look for online tutorials, video courses, and educational websites that provide in-depth explanations and demonstrations of industrial network concepts. Websites like Cisco Learning Network,

	Rockwell Automation, and Siemens Industry Online Support are great starting points.

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	38	**Unstructured SWL (h/w)**	2
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO # 1 – 6
	Assignments	1	10% (10)	12	LO # 5 and 6
	Lab	7	10% (10)	Continuous	
	Report	1	5% (5)	13	LO # 3, 5 and 6
Summative assessment	**Midterm Exam**	4 hr	15% (15)	7	LO # 1-5
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Introduction and Definitions:** • Introduction to Data Communication، Networks، Protocols، Standards، and Standard organizations.
Week 2	**Basic Concepts:** • Overview of Line configuration، Topology، Categories of networks, and Communication modes.
Week 3	**Network Models:** • Principles of Protocol Layering. • OSI Protocol Layering Model. • TCP/IP Protocol Suite • Encapsulation and Decapsulation.
Week 4	**Transmission media:** • Wired transmission media: Unshielded Twisted Pair (UTP) Cable, Shielded Twisted Pair (STP) Cable, Coaxial Cable, and Optical Fiber. • Wireless transmission media: Wi-Fi, and Bluetooth.
Week 5	**Networking and Internetworking Devices:** • Networking devices: NICs، Hubs، Repeaters، Bridges and Switches., Internetworking devices: Routers.
Week 6	**Internet Protocol (IPv4) 1:** • Introduction to IPv4 addressing, Address Mask, and Glassful addressing.

Week 7	**Internet Protocol (IPv4) 2:** • IPv4 addressing types.
Week 8	**Midterm Exam**
Week 9	**Introduction to Industrial Networks:** • Overview of industrial networks and their importance in industrial automation • Key components of industrial networks: field devices, controllers, switches, and routers.
Week 10	**Industrial Communication Standards:** • Serial data communication interface standards (RS 232,422,485 standards)
Week 11	**Industrial Communication Protocols 1:** • Introduction to various industrial communication protocols such as Profibus, Modbus, EtherNet/IP, and DeviceNet.
Week 12	**Industrial Communication Protocols 2:** • Understanding the characteristics, advantages, and limitations of different protocols
Week 13	**Fieldbus-Based Industrial Networks** • Introduction to fieldbus systems and their applications • Types of fieldbus protocols (e.g., Profibus, DeviceNet, CANbus) • Fieldbus network architecture and components • Configuration and addressing in fieldbus networks
Week 14	**Industrial IoT:** • Overview of the Industrial Internet of Things (IIoT) • Integration of industrial networks with IoT devices and cloud platforms • Edge computing in industrial networks.
Week 15	**Industrial Network Design and Implementation:** • Guidelines for designing and implementing industrial networks based on specific requirements • Design considerations for scalability, reliability, and fault tolerance
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to CISCO Packet Tracer network simulator
Week 2	Building networks using different network topologies
Week 3	Data capturing in Packet Tracer
Week 4	Cabling twisted pair cables using RJ 45 connectors
Week 5	Building and Configuring small networks
Week 6	Configuring and testing network connectivity
Week 7	Assignment IP addressing information to network devices
Week 8	**Midterm Exam**
Week 9	Using Packet Tracer in industrial networks
Week 10	Designing and configuring industrial networks 1
Week 11	Designing and configuring industrial networks 2
Week 12	Designing and configuring wireless industrial network 1
Week 13	Designing and configuring wireless industrial network 2
Week 14	Building industrial IoT networks (IIoT networks) 1
Week 15	Building industrial IoT networks (IIoT networks) 2
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1- "Introduction to Data Comm. And Networking" (5th edition), by Pehrouz Forouzan. 2- "Industrial Network Basics: Practical Guides for the Industrial Technician" by Cisco Networking Academy.	No
Recommended Texts	Industrial Network Security: Securing Critical Infrastructure Networks for Smart Grid.	No
Websites	1- Coursera: Coursera provides courses on industrial networking and automation. 2- YouTube: YouTube has a wealth of tutorial videos on industrial networking.	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**PLC**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVEESC317**	
ECTS Credits	**4**	
SWL (hr/sem)	**100**	

Module Level	3	**Semester of Delivery**	6
Administering Department	SCE	**College**	EE
Module Leader	Yazen Hudhaifa Shakir	**e-mail**	yazen.shakir@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	Abdurrahman Basil	**e-mail**	E-mail
Peer Reviewer Name	Mohammed N. Younis	**e-mail**	Mohammed.younus@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	Aims 77. Understanding Relay-Based Control: Classic control theory aims to provide an understanding of how relays can be used for motor control. This involves studying the principles of relay operation, such as ON/OFF switching based on threshold values, and their application in controlling motor behavior. 78. Motor Start/Stop Control: Classic control theory focuses on designing relay-based control strategies for motor start/stop operations. The aim is to develop control algorithms that utilize relays to control the motor's power supply and enable smooth and controlled starting and stopping of the motor. 79. To study the classification of industrial control systems. 80. What they control and how they control 81. Possess knowledge and familiarity with both IEC and NEMA standards. 82. To study the main components of Programmable Logic Controller 83. To study Basic Functions of Ladder Diagram as a Programming language 84. To study the on-off control of industrial applications. 85. To study Programmable Logical Controllers (PLCs) with industrial applications. 86. To study data types and data flow compatibility using PLCs
Module Learning Outcomes	1. Understanding the history, context and components of industrial control systems. Also, understanding the classical circuits for Motor control (three phase and single phase). Moreover, understanding practical on-off control systems with the use of PLCs. 2. Understanding practical PLCs with their application to Solve tasks. Outstanding of PLC programming Languages and Reading electrical schematic diagrams. 3. Understand the fundamentals of ladder diagram programming: Demonstrate a solid understanding of ladder diagram programming as a graphical language used in programmable logic controllers (PLCs), including the basic symbols, elements, and structure. 4. Apply basic control logic concepts: Apply fundamental control logic concepts in ladder diagram programming, such as series and parallel circuits, branching, and decision-making using conditional instructions. 5. Design and implement basic control systems: Design and implement ladder diagram programs to control basic industrial processes, including motor control, conveyor systems, and simple logic operations. 6. Utilize timers and counters effectively: Understand the functionality and usage of timers and counters in ladder logic programming and apply them appropriately in control systems to achieve desired timing and counting operations. Troubleshoot ladder logic programs: Identify and resolve common programming errors and faults in ladder logic programs using effective troubleshooting techniques, including online monitoring and debugging tools.

<table>
<tr><td>Indicative Contents</td><td>Indicative content includes the following.
<u>Part A – Classic Control Industrial Panel Components</u> [8 hrs.]
key components of the typical industrial control panel that you need to be familiar with:
Power Circuit.
Control Circuit.
Switches.
Terminal Blocks.
Contactors.
Motor Drives.
Transformers.
Overcurrent Protection Devices.
<u>Part B – Schematic Electrical Standards IEC and NEMA</u> [8 hrs.]
These standards provides rules for the composition of designations and names for the identification of signals and signal connections. Includes the designation of power supply circuits...
<u>Part C- Ladder diagram</u> [20 hrs.]
- Power Flow Indicators in LAD
- Generic Instructions in LAD (Generic instructions provide a quick, keyboard method for picking and placing instructions in LAD.)
- Symbol Table / Global Variable Table
- Understanding the Timer Instructions for SIEMENS and Delta PLCs (On-Delay Timer (TON) for timing a single interval, Retentive On-Delay Timer (TONR) for accumulating a number of timed intervals, Off-Delay Timer (TOF) for extending time past an off (or false condition), such as for cooling a motor after it is turned off.)
- Bit Logic operation, Ladder diagram – Integer Math operations, Compare operations
<u>Part D- Practical examples wiring I/Os</u> [20 hrs.]
- Describe the I/O section of a programmable controller, Identify DIP switches, Describe the proper wiring connections for input and output devices and their corresponding module
- Sinking and Sourcing connections
- Practical examples and Assignments</td></tr>
</table>

<table>
<tr><th colspan="2">Learning and Teaching Strategies</th></tr>
<tr><td>Strategies</td><td>- Hands-on Laboratory Exercises: Practical exercises using real or simulated PLC hardware allow students to apply theoretical knowledge and gain hands-on experience. This includes wiring and configuring PLC systems, creating ladder logic programs, and testing their functionality.</td></tr>
</table>

	- Case Studies and Real-world Applications: Presenting real-world examples and case studies helps students understand how PLCs are used in various industries. Analyzing and discussing these applications enhances their problem-solving abilities and exposes them to different control scenarios. - Interactive Discussions and Group Work - Simulations and Virtual Environments: Utilizing software-based PLC simulations and virtual environments provides a cost-effective and flexible approach to practice programming and troubleshooting. Students can experiment with different scenarios and observe the outcomes in a controlled environment. - Online Resources and Tutorials: Supplementing traditional teaching methods with online resources, tutorials, and interactive platforms can enhance students' independent learning. These resources may include video tutorials, online forums, PLC programming software, and online quizzes or assessments. - Industry Guest Speakers and Site Visits: Inviting industry professionals as guest speakers or organizing site visits to industrial facilities utilizing PLCs provides students with firsthand insights into real-world applications and industry practices. This bridges the gap between academia and industry. - Continuous Professional Development: Encouraging students to stay updated with the latest advancements in PLC technology through continuous professional development opportunities, such as workshops, conferences, or online courses, ensures they remain well-informed and adaptable in a rapidly evolving field.

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	38	**Unstructured SWL (h/w)**	2.5
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 12	LO #1, 2, and 6
	Assignments	1	10% (10)	13	LO # 1-3
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 3, 4 and 6
Summative assessment	**Midterm Exam**	1 hr	10% (10)	7	LO # 1-4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	1. Introduction – Industrial control Panel components, what they control? And how they control? What is PLC? and it's Hardware components
Week 2	2. Main Industrial components and how they work (Contactors, Relays , Overload and Push buttons types)
Week 3	3. Reading electrical Schematic diagrams for power and control circuits for single and three phase motors, Wiring Diagrams
Week 4	4. Introduction to PLC Programming Languages, Ladder Diagrams, Ladder Diagram Rules, Basic Stop/Start Circuit, Sequenced Motor Starting Digital Logic Gates – Part 1
Week 5	5. Ladder Diagrams, Ladder Diagram Rules, Basic Stop/Start Circuit, Sequenced Motor Starting Digital Logic Gates – Part 2
Week 6	6. Data Type, Memory Types and properties, Memory Organization and Addressing, Introduction to special memory
Week 7	7. Mid-term Exam
Week 8	8. Ladder diagram – Bit Logic operations
Week 9	9. Timers Types and Timing diagram for them
Week 10	10. Ladder diagram – Compare operations
Week 11	11. Ladder diagram – Integer Math operations
Week 12	12. Counters
Week 13	13. Describe the I/O section of a programmable controller, Identify DIP switches, Describe the proper wiring connections for input and output devices and their corresponding module
Week 14	14. Sinking and sourcing
Week 15	15. Examples, real applications
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	**Introduction Logo Soft Comfort, Step 7- Micro Win, Delta PLC Compilers**
Week 2	**Introduction to CADe_SIMU ,** CADe SIMU is a program used to create power schemes, control how they behave and see the simulations in real time. It is one of the best simulation programs for classic control or relay-based control for industrial panels
Week 3	**At the end of the session, students will be familiarized with the following:** 1. LOGO Wiring 2. Testing LOGO PLC Practically 3. Switches 4. Coils
Week 4	**At the end of the session, students will be familiarized with the following:** 1. Internal coil 2. Forward and Reverse Motor direction
Week 5	**At the end of the session, students will be familiarized with the following :** 1. Power and control circuits for Star – Delta Connection 2. Ladder diagram for Star – Delta Connection
Week 6	1. Logic Gates and Motor control circuits (Latching and interlocking) using CAD_SIMU 2. Sequenced Motor Starting Digital Logic Gates implementation
Week 7	Ladder diagram – Bit Logic operations

Week 8	Timers Types and Timing diagram for them
Week 9	Mid Exam
Week 10	Ladder diagram – Compare operations
Week 11	Ladder diagram – Integer Math operations
Week 12	Counters
Week 13	Practical example
Week 14	Practical example
Week 15	Practical example
Week 16	Preparatory work for final exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	***Automating Manufacturing Systems with PLCs*** , Year: 2010 Hugh Jack	Available Online
Recommended Texts	Title ***Programmable Logig Controllers: Hardware and Programming*** Author Max Rabiee , Year:2017 ISBN: 1631269348, 9781631269349	Available Online
Websites	https://www.youtube.com/channel/UCUKKQwBQZczpYzETkZNxi-w https://www.youtube.com/@A_R_94 https://www.udemy.com/course/classic-control-l/ https://youtube.com/playlist?list=PLhJQWRdDvAThM4S6APm6IpyfBhg1iEiHl	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	After completing this course module, the student must be able to: 1. Define the terms related to computer-aided drafting systems in general and AutoCAD; for specific. 2. Identify the important tools used to create technical drawings in CAD; 3. Create electronic drawings (e-drawing) using CAD; 4. Apply the usefulness of the knowledge and skills in computer aided drafting as applied in his/her professional development. 5. Examine the utility of AutoCAD Electrical as a software solution for the creation and manipulation of schematic diagrams. 6. Applies knowledge of mathematics, science and engineering, 7. Design and conduct experiments, as well as to analyze and interpret data
Module Learning Outcomes	1- Using AutoCAD Interface: Students should become familiar with the AutoCAD user interface, including the various tools, menus, and commands available in the software. 2- Creating 2D Drawings: Learners should gain proficiency in creating accurate and detailed 2D drawings using AutoCAD. This includes drawing lines, circles, arcs, polygons, and other geometric shapes. Modifying and Editing Drawings: Students should be able to modify existing drawings by using AutoCAD's editing tools. This involves techniques such as scaling, stretching, rotating, mirroring, and trimming objects. 3- Working with Layers and Line-types: Participants should learn how to effectively use layers to organize and manage different elements of a drawing. They should also understand line-types and how to apply them to objects. Adding Annotations and Dimensions: Learners should be able to add text annotations, labels, and dimensions to their drawings using AutoCAD's annotation tools. This includes adding dimensions, text, and leaders to convey information accurately. 4- Creating and Managing Blocks: Students should gain proficiency in creating reusable blocks in AutoCAD. This involves creating block definitions, inserting blocks into drawings, and modifying blocks when necessary. 5- Understanding 3D Concepts: Gain a clear understanding of fundamental 3D concepts, including coordinate systems, viewpoints, and 3D navigation techniques. Creating Basic 3D Objects: Learn how to create basic 3D objects, such as cubes, spheres, cylinders, cones, and pyramids, using AutoCAD's 3D modeling tools. Furthermore, Modifying 3D Objects: Develop the ability to modify 3D objects by moving, rotating, scaling, mirroring, or stretching them in 3D space to achieve the desired shape and position. 6- Performing Printing and Plotting: Participants should learn how to set up and configure layouts for printing and plotting drawings. They should understand the different print settings, paper sizes, and scales. Furthermore, Glance to the basic electrical diagrams in AutoCAD Electrical

Indicative Contents	Indicative content includes the following. Part A – 2D Drawing 1- Drawing Area: The drawing area is where the actual geometry and objects are created. 2- Lines and Polylines: Lines and polylines are fundamental objects used to represent edges, outlines, and boundaries of various components in the drawing. They can be straight or curved, and they form the basis for creating other geometric shapes. 3- Circles and Arcs: 4- Layers: Layers are used to organize and control the visibility of different elements in the drawing. 5- Text: Text is used to add annotations, labels, and other textual information to the drawing 6- Dimensions: AutoCAD offers various dimensioning tools to add accurate measurements to the drawing. Linear dimensions, angular dimensions, and radial dimensions can be added to specify distances, angles, and sizes of objects. 7- Blocks and Symbols: Blocks are pre-defined groups of objects that can be reused multiple times in a drawing. They are often used to represent standard components or symbols. AutoCAD allows users to create custom blocks or use existing libraries of blocks and symbols. 8- Plotting and Printing: AutoCAD provides tools for plotting and printing the final drawing. This includes specifying the paper size, scale, print area, and setting up the plot style to control line weights and colors when generating physical or digital outputs. **[60 hr.]** Part B – 3D Drawing Introduction to 3D Modeling, Navigating the 3D workspace in AutoCAD Creating basic 3D geometric shapes (cubes, spheres, cylinders) , Editing and modifying basic 3D objects , Applying basic transformations (move, rotate, scale) to 3D objects Advanced 3D Objects, Using viewports to control multiple views of a 3D model Controlling perspective and orthographic views, Understanding and utilizing the 3D navigation tools **[34 hr.]** Part C – AutoCAD Electrical Introduction to workspace and main difference in panels Create simple projects inside AutoCAD Electrical [**6 hr.]**

Learning and Teaching Strategies	
Strategies	• Hands-On Practice: Provide ample opportunities for students to practice using AutoCAD through hands-on exercises and projects. • Visual Aids and Examples: Utilize visual aids, such as slides, diagrams, and video tutorials, to complement your explanations and make complex concepts more understandable. Provide examples and showcase real-world applications of AutoCAD to demonstrate its relevance and inspire students. • Resources and References: Provide students with additional resources, such as textbooks, online tutorials, and reference guides, to support their learning outside the classroom. Recommend reputable websites, forums, and communities where they can seek further assistance and expand their knowledge. • Continuous Learning: Encourage students to continue learning AutoCAD beyond the classroom. Highlight the importance of staying up-to-date with new features, tools, and techniques by exploring online resources, attending webinars, or participating in AutoCAD user communities.

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	3, 9	LO # 2, 3 and 4
	Assignments	2	10% (10)	4, 13	LO # 4 and 5
	Projects / Lab.	1	10% (10)	15	LO # 6
	Report	1	10% (10)	13	LO # 3, 5 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	**Introduction to CAD , Introduction to AutoCAD**
Week 2	**AutoCAD Fundamentals** • Screen layout • Have a brief look at the AutoCAD Toolbars • Opening existing Drawing files • Saving your works • Coordinates systems
Week 3	**Basics of Drawing or drafting (2D) in AutoCAD** • Preparing the area of drawing • Drawing Lines • Polyline • Polygons • Circle drawing methods • View Port Tools
Week 4	• Two practical examples for practicing on AutoCAD Interface and coordinate systems
Week 5	**2D- Modify Commands** Using the following Commands: • Move , Copy , Rotate ,Mirror • Trim, fillets, offset • Scale , Array
Week 6	• Two practical examples for practicing on AutoCAD Modify Tools
Week 7	**Annotation and Layers** • Multiline Texts • Create linear dimensions • Layer Properties • Create group of objects
Week 8	• Two practical examples for practicing on Dimensions and layers for two different figures
Week 9	• Review on 2D- drafting with answering questions for students
Week 10	**Basics of 3D in AutoCAD-Part 1** • Why use 3D drawing • Introduction to Orthographic Projection and Isometric • Switching to 3D- Modelling workspace in AutoCAD
Week 11	**Basics of 3D in AutoCAD-Part 2** • Introduction to the Modelling commands (Basics) (Extrude, Press Poll and Solid Editing Tools)
Week 12	• One practical examples for practicing on 3D figure and Solid editing
Week 13	• Two different multi-view projections tutorials
Week 14	**Glance to AutoCAD Electrical** • Introduction to AutoCAD electrical and how to use wire panel
Week 15	• Create projects and dealing with templates based on IEC standards for Control Engineers
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	150 CAD Exercises Book by Sachidanand JHA	NO
Recommended Texts	1- Fundamentals of Engineering Drawing - By : Ahmed Nidham Mohammed Publisher: Dar Al-Waddah For Publishing & Distribution - Amman - Jordan ISBN: 9789923190906 2. / Fundamentals of AutoCAD 2020 By : Ahmed Nidham Mohammed Edition: First Publisher: Dar Al-Waddah For Publishing & Distribution - Amman - Jordan ISBN: 9789923190418	Available online
Websites	https://www.youtube.com/c/CADCAMTUTORIAL https://www.computeraideddesignguide.com/ https://autocadfiles.com/	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information					
Module Title	**English II**		**Module Delivery**		
Module Type	**Basic**		☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**		
Module Code	**NVU15**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	2		**Semester of Delivery**	4	
Administering Department	SCE		**College**	EE	
Module Leader			**e-mail**		
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor	Name (if available)		**e-mail**		
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	NVU11	**Semester**	2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The aim of this course is to build students' foundational English language skills in speaking, listening, reading, and writing. By covering essential grammar and vocabulary within practical contexts, students will gain confidence in understanding and expressing themselves on familiar topics, preparing them for real-world communication and more advanced language study. By the end of the course, students are expected to: 1.Improved Vocabulary and Grammar Proficiency Students will demonstrate an understanding of essential vocabulary and foundational grammar structures, including present, past, and future tenses, as well as present perfect. They will be able to apply these structures in both spoken and written contexts. 2. Students will be able to read and comprehend medium-length texts, such as articles and narratives, identifying main ideas, specific details, and contextual vocabulary. They will gain confidence in understanding and interpreting English in written form. 3.Students will be able to write short, structured paragraphs and simple narratives, focusing on clear expression of ideas and accurate use of tenses. They will complete written assignments that demonstrate coherence and appropriate use of vocabulary and grammar. 4. Students will participate in group work, developing the ability to plan, communicate, and collaborate on assignments. They will be able to contribute ideas, meet deadlines, and function effectively in a team, applying language skills in a collaborative setting.
Module Learning Outcomes	1. Knowledge - Develop comprehension skills by reading medium-length texts and articles, with a focus on context-based vocabulary. - Enhance writing by constructing coherent paragraphs about past experiences and familiar topics, applying correct tense and grammar structures. -Build understanding of grammar topics such as present, past, future, and present perfect tenses, and comparative adjectives. 2. Skills - Improve oral and written communication skills tailored to various audiences, demonstrating proficiency through role-plays, presentations, and written assignments. 3. Teamwork Skills - Collaborate effectively within teams to plan writing tasks, analyze data, and meet deadlines in English communication contexts.
Indicative Contents	Grammar Vocabulary Everyday English

Learning and Teaching Strategies	
Strategies	Teaching Strategies -Interactive Lectures and Presentations • Use lectures to introduce new grammar points, vocabulary, and contextual topics. Keep sessions interactive by involving students in question-answer rounds, example analysis, and brief discussions to apply new concepts. • Use visuals, realia, or multimedia (e.g., videos, images) to make topics more engaging and relatable for non-native speakers. - Task-Based Learning • Engage students with activities that focus on practical, real-life language tasks, such as ordering food, making plans, or describing a past event. This approach reinforces the use of grammar and vocabulary in real-world contexts -Pair and Group Work • Incorporate pair and small group activities, where students can practice speaking and listening skills through role-play, dialogues, and collaborative tasks. • Assign group projects that require brainstorming, discussion, and team presentations, fostering teamwork and communication. Guided Writing Practice -Regular Assessments and Quizzes • Implement frequent low-stakes assessments, such as quizzes and mini-tests, to reinforce key points and provide regular feedback on student progress. Include a midterm exam and a final exam to assess overall knowledge and language skills.

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	10% (10)	4,6	LO # 2, and 3
	Assignments	2	10% (10)	9, 12	LO # 2
	Projects / Lab.				
	Report	1	10% (10)	13	LO # 1, and 4

Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1 – 3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Levels of language Parts of speech.
Week 2	Chapter one (tenses) Getting to know you
Week 3	Chapter one (tenses) Getting to know you
Week 4	Chapter two (Present tenses) Whatever makes you happy
Week 5	Chapter three (Past tenses) What's in the news?
Week 6	Present continuous tense
Week 7	Past continuous tense
Week 8	Mid exam
Week 9	Inventions -Engine -Sonar
Week 10	Present perfect
Week 11	Past perfect
Week 12	Future
Week 13	*Inventions* *-Servomechanism*
Week 14	-Prepositions -Articles
Week 15	**Presentation tips**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		
Recommended Texts		
Websites	https://www.askoxford.com/betterwriting/succesfulcv/application/?view=uk	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C – Good	70 – 79	Sound work with notable errors
	D - Satisfactory	60 – 69	Fair but with major shortcomings
	E - Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information					
Module Title	Arabic II			**Module Delivery**	
Module Type	**Base**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**NVU16**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	2			**Semester of Delivery**	2
Administering Department				**College**	Electronics Engineering
Module Leader	Abdullah Mohammed Qader			**e-mail**	
Module Leader's Acad. Title	Assistant Lecturer			**Module Leader's Qualification**	MSc
Module Tutor				**e-mail**	
Peer Reviewer Name				**e-mail**	
Scientific Committee Approval Date	Feb. 01, 2025			**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVU16	**Semester**	2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Content	
Module Aims	تهدف هذه الوحدة إلى تعزيز مهارات اللغة وتنمية التفكير وتمكين الطلاب من معرفة القواعد الأساسية للغة العربية ، وكذلك تمكينهم من القدرة على الإلقاء و التحدث باللغة السليمة الخالية من الأخطاء النحوية.
Module Learning Outcomes	1. من المتوقع أن يكون الطلاب قادرين على : 2. التعرف على النواسخ وأنواعها وفهم أثرها على الجملة الاسمية والتمييز بين النواسخ الفعلية والحرفية. 3. الفاعل ونائبه وتمييز الفاعل في الجملة الفعلية ومعرفة نائب الفاعل في المبني للمجهول وإعراب الفاعل ونائبه بدقة. 4. التعرف على الأسماء المذكرة والمؤنثة وتطبيق القواعد النحوية في التذكير والتأنيث واستخدام الأشكال الصحيحة في الجملة. 5. التعرف على شروط جمع المذكر السالم وتكوين الجمع بشكل صحيح وإعراب الجمع في مختلف الحالات. 6. فهم معنى جمع التكسير والتعرف على أوزانه المختلفة واستخدامه في جمل مع إعرابه.
Indicative Contents	يتضمن المحتوى الإرشادي ما يلي: مدخل إلى علوم العربية ، والتعرف على أقسام الكلام في اللغة العربية ، والتعرف على الفعل وعلاماته و الحرف وعلاماته ، وكذلك علامات الإعراب الأصلية و الفرعية ، والتفريق بين الجملتين الاسمية والفعلية ، وكذلك التعرف على شبه الجملة بنوعيها ، والتعرف على المعرب والمبني، والميزان الصرفي والمشتقات في اللغة ، والتفريق بين همزتي الوصل والقطع ، والتعرف على ال الشمسية والقمرية ، والضاد والظاء ، والتاء المبسوطة والمربوطة.

Learning and Teaching Strategies	
Strategies	اتباع طريقة التعليم المباشر من خلال عرض المادة وشرحها والاستعانة بالادوات التعليمية لشرحها من خلال توضيح اليات المفهوم العلمي للغة العربية

Student Workload (SWL)			
Structured SWL (h/sem)	32	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	18	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	25% (10)	3, 10	LO # 1, 2, and 5
	Assignments	2	25% (10)	5, 12	LO # 3, and 4
	Classwork	1	25% (10)	9	LO # 5 and 6
	Report	1	10% (10)	14	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1 – 4
	Final Exam	2hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	النواسخ للجملة في اللغة العربية
Week 2	كان وأخواتها
Week 3	إن وأخواتها
Week 4	الفاعل ونائبه
Week 5	المفاعيل
Week 6	الحال
Week 7	التمييز
Week 8	العدد
Week 9	التذكير والتأنيث
Week 10	المثنى
Week 11	جمع المذكر السالم
Week 12	جمع المؤنث السالم
Week 13	جمع التكسير
Week 14	علامات الترقيم
Week 15	الألف المقصورة والألف المحدودة و الهمزة المتطرفة والهمزة المتوسطة
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1 التحفة السنية في شرح المقدمة الآجرومية ، محمد محيي الدين عبد الحميد 2 البلاغة الواضحة ، علي الجارم و مصطفى أمين 3الصرف الواضح ، عبدالجبار علوان النايلة 4علم العروض والقافية ، عبدالعزيز عتيق	Yes
Recommended Texts		No
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C – Good	70 – 79	Sound work with notable errors
	D - Satisfactory	60 – 69	Fair but with major shortcomings
	E - Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information			
Module Title	**Power Electronics**	**Module Delivery**	
Module Type	**Core**	☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**NVEESC318**		
ECTS Credits	**4**		
SWL (hr/sem)	**100**		
Module Level	3	**Semester of Delivery**	6
Administering Department	SCE	**College**	EE
Module Leader	Mr. Salam Ibrahim	**e-mail**	salam.khather@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	/	**e-mail**	/
Peer Reviewer Name	/	**e-mail**	/
Scientific Committee Approval Date	/	**Version Number**	/

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	87. To understand the concepts, basic operation, steady state operation of efficient switched- mode power conversion techniques, including basic circuit operation. 88. Modeling, analysis, and control techniques. 89. design of power circuits including inverters, rectifiers, and DC-DC converters. 90. Numerous application examples will be presented such as motion control systems and power supplies.
Module Learning Outcomes	1. Describe the applications of power electronic converters. Explain the operation of half and full bridge rectifier circuits with resistive and inductive loads. Draw the circuit diagrams and understand the operation of common single phase rectifier circuits. 2. Draw the circuit diagrams and understand the operation of common three phase rectifier circuits. 3. Draw the circuit diagrams and understand the operation of common single phase cycloconverter circuits. 4. Draw the circuit diagrams and understand the operation of common Three phase cycloconverter circuits. 5. Explain the operation and design simple SMPS circuits, including buck and boost DC-DC converters. 6. Draw the circuit diagrams and understand the operation of common buck converter, common boost converter, common buck-boost converter, and common single-phase inverter

Learning and Teaching Strategies	
Strategies	The teacher explains the fundamental theoretical principles of the converter and solves numerical problems relating to the converter in the theory class. While in the laboratory, students use Matlab simulation software to verify the converters' reactions. Improve the technical understanding of the power electronics circuits and applications. Numerous application examples will be presented such as motion control systems, power supplies, and others.

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	38	**Unstructured SWL (h/w)**	2.5
Total SWL (h/sem)	100		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction - Power Electronics Applications. Power Electronics Devices. Power Electronics Converter.
Week 2	Single-Phase Half -Wave Uncontrolled Rectifier and Single-Phase Full Wave Uncontrolled Rectifier. The Waveform Ripple Factor (R.F) & Form Factor (FF).
Week 3	A Single-Phase Half Wave Controlled Rectifier with Resistive (R) Load. The Efficiency of the Rectification and the Input Power Factor (PF).
Week 4	A Single-Phase Half Wave Controlled Rectifier with Inductive (RL) Load. A Single-Phase Half Wave Controlled Rectifier with Inductive (RL) Load and Free Wheeling Diode.
Week 5	A Single-Phase Full Wave Controlled Rectifier with Inductive (RL) Load
Week 6	A Single-Phase Full Wave Controlled Rectifier with Inductive (RL) Load and Free Wheeling Diode
Week 7	A Single-Phase Full Wave Controlled Rectifier with highly Inductive (RL) Load and Free Wheeling Diode.
Week 8	Three Phase Half Wave Controlled Rectifier with Resistive Load. Three Phase Half Wave Controlled Rectifier with Load Highly Inductive load.
Week 9	The Relationship Between Line Voltage and Phase voltage of the Three Phase Balanced Supply Voltage. Three Phase Full Wave Controlled Rectifier with Load Highly Inductive load.
Week 10	A Single-Phase AC Controller (Cycloconverter). The On-Off Cycloconverter with Resistive Load. The Phase type Cycloconverter.
Week 11	DC-DC Switch-Mode Converters. Step-Down DC-DC Converter (BUCK).

Week 12	Step-Up DC-DC Converter (BOOST). Step-Down/Up DC-DC Converter (BUCK - BOOST).
Week 13	Switch-Mode DC-AC Inverters. Pulse-width-modulated inverters and Square-wave inverters. Single-phase inverters with voltage cancellation.
Week 14	Single-phase switch-mode inverter, four quadrants of operation.
Week 15	Preparatory week before the final Exam.
Week 16	Exam.

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction - Power Electronics Applications using Matlab.
Week 2	Lab 2: Single-Phase Half -Wave Uncontrolled Rectifier and Single-Phase Full Wave Uncontrolled Rectifier.
Week 3	Lab 3: A Single-Phase Half Wave Controlled Rectifier with Resistive (R) Load. The Efficiency of the Rectification and the Input Power Factor (PF).
Week 4	Lab 4: A Single-Phase Half Wave Controlled Rectifier with Inductive (RL) Load.
Week 5	Lab 5: A Single-Phase Full Wave Controlled Rectifier with Inductive (RL) Load
Week 6	Lab 6: A Single-Phase Full Wave Controlled Rectifier with Inductive (RL) Load and Free Wheeling Diode.
Week 7	Lab 7: A Single-Phase Full Wave Controlled Rectifier with highly Inductive (RL) Load and Free Wheeling Diode.
Week 8	Lab 8: Three Phase Half Wave Controlled Rectifier with Load Highly Inductive load.
Week 9	Lab 9: Three Phase Full Wave Controlled Rectifier with Load Highly Inductive load.
Week 10	Lab 10: The Phase type Cycloconverter.
Week 11	Lab 11: Step-Down DC-DC Converter (BUCK).
Week 12	Lab 12: Step-Up DC-DC Converter (BOOST).
Week 13	Lab 13: Step-Down/Up DC-DC Converter (BUCK - BOOST).
Week 14	Lab 14: Single-phase switch-mode inverter.
Week 15	Lab 15: Preparatory week before the final Exam.
Week 16	Lab 16: Exam.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Power electronics handbook: devices, circuits, and applications handbook” edited by Muhammad H. Rashid, 3rd ed.	Yes
Recommended Texts	/	/
Websites	/	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Statistics and Probability**	**Module Delivery**
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVEE**	
ECTS Credits	**5**	
SWL (hr/sem)	**125**	

Module Level	3	**Semester of Delivery**	6
Administering Department	SCE	**College**	EE
Module Leader	Abdurahman Basil AYOUB	**e-mail**	abdulrahman.ayoub@uoninevah.edu.iq
Module Leader's Acad. Title	Asst. Lecturer	**Module Leader's Qualification**	MSc
Module Tutor		**e-mail**	E-mail
Peer Reviewer Name	Abdulallah I.	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	99. Introduce students to the basic concepts of statistics, including data types, data collection methods, and the role of statistics in engineering analysis and decision-making. 100. Develop students' skills in analyzing and interpreting data using appropriate statistical techniques, such as descriptive statistics, graphical methods, and summary measures. 101. Provide an understanding of probability theory, including probability distributions, random variables, and their applications in modeling and analyzing engineering systems. 102. Introduce students to the concept of discrete random variables and their importance in modeling and analyzing engineering systems. 103. Introduce and analyze common discrete probability distributions, such as the binomial distribution, and Poisson distribution, and their applications in modeling real-world engineering problems. 104. Introduce students to the concept of continuous random variables and their significance in modeling and analyzing continuous phenomena encountered in system and control engineering. 105. Introduce and analyze common continuous probability distributions, such as the uniform distribution, normal distribution, and exponential distribution, and their applications in modeling real-world engineering problems. 106. Introduce students to the fundamental concepts and principles of numerical analysis, emphasizing the importance of numerical methods in solving engineering problems. 107. Introduce and analyze numerical methods for solving equations, including root-finding algorithms, such as Newton-Raphson, and their applications in engineering analysis. 108. Introduce numerical methods for solving ordinary and partial differential equations, such as Euler's method, Runge-Kutta methods, and finite difference methods, providing tools for analyzing dynamic systems in engineering. 109. Develop skills in numerical differentiation and integration techniques, including finite difference approximations, Simpson's rule, and numerical integration methods, to approximate derivatives and integrals of functions encountered in engineering analysis.
Module Learning Outcomes	1. Understanding of fundamental statistical concepts: Demonstrate an understanding of basic statistical concepts, including population, sample, variable, data types, and levels of measurement. Also, knowledge of data collection methods: Identify and describe different methods of data collection, such as surveys, experiments, and observational studies, and understand their strengths and limitations.

	2. Interpretation of statistical measures: Interpret and analyze statistical measures, such as mean, median, mode, variance, and standard deviation, to gain insights into the characteristics of a dataset. 3. Understanding of probability: Comprehend the fundamental concepts of probability theory, including basic probability rules, conditional probability, and the concept of independence. 4. Application of probability distributions: Apply probability distributions, such as the binomial distribution, Poisson distribution, and normal distribution, to model and analyze real-world engineering problems. 5. Ability to conduct basic statistical analyses: Apply appropriate statistical techniques to analyze and draw conclusions from sample data, including hypothesis testing, confidence intervals, and correlation analysis. 6. Critical thinking and data interpretation: Develop critical thinking skills to evaluate and interpret statistical results, identify patterns or trends in data, and make informed decisions based on statistical analysis.

Indicative Contents	**Introduction to Basic Statistical Concepts (32)** Descriptive Statistics, Inferential Statistics, Statistics Definitions (Sample space, Events, Venn diagram, Classical Probability), Conditional Probabilities, Counting Rules: Permutation, Combination, Probability Calculations using Combinations / Permutations) **Discrete Random Variables (r.v.) (32)** Discrete Probability Distributions, Cumulative Distribution Function (cdf), Mean or Expected Value, Variance and Standard Deviation, Binomial Distribution, Poisson Distribution. **Continuous Random Variables (r.v.) (32)** Continuous Probability Distributions, Cumulative Distribution, Mean or Expected Value, Normal Distribution, Standard Normal Distribution, Continuous Uniform Distribution, Exponential Distribution

Learning and Teaching Strategies	
Strategies	1. Lectures: Traditional lectures are delivered by the instructor to introduce and explain key concepts, theories, and methodologies related to mathematical engineering analysis. These lectures provide a foundation for students to understand the theoretical aspects of the course. 2. Problem-solving sessions: Dedicated problem-solving sessions are conducted to allow students to practice applying mathematical concepts and techniques to solve engineering problems. These sessions may involve group discussions, guided exercises, and example problems. 3. Tutorials: Tutorials are interactive sessions where students can clarify doubts, ask questions, and receive additional guidance on course materials. Tutorials may involve solving challenging problems, discussing case studies, or reviewing specific topics based on student needs. 4. Assignments and projects: Assignments and projects are assigned to students to reinforce their learning and apply mathematical engineering analysis techniques to real-world problems. These assignments may involve data analysis, modeling, simulation, or optimization tasks. 5. Group discussions and presentations: Group discussions and presentations are organized to encourage active participation and foster collaborative learning among students. Students may be assigned specific topics or problems to research, analyze, and present to their peers, promoting deeper understanding and knowledge sharing. 6. Formative and summative assessments: Regular formative assessments, such as quizzes, tests, or in-class exercises, are conducted to assess students' understanding and progress. Summative assessments, such as exams or project evaluations, are used to evaluate students' overall performance in the course.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	3, 9, 13	LO #1-6
	Assignments	2	10% (10)	2, 8	LO # 3
	Seminar	1	10% (10)	Continuous	
	Report	1	10% (10)	11	LO # 4, 5, and 6
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-6
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Basic Statistical Concepts
Week 2	Introduction to Basic Statistical Concepts
Week 3	Introduction to Basic Statistical Concepts
Week 4	Discrete Random Variables (r.v.)
Week 5	Discrete Random Variables (r.v.)
Week 6	Discrete Random Variables (r.v.)
Week 7	Discrete Random Variables (r.v.)
Week 8	Discrete Random Variables (r.v.)
Week 9	**Mid-Exam**
Week 10	Continuous Random Variables (r.v.)
Week 11	Continuous Random Variables (r.v.)
Week 12	Continuous Random Variables (r.v.)
Week 13	Continuous Random Variables (r.v.)
Week 14	Continuous Random Variables (r.v.)
Week 15	Continuous Random Variables (r.v.)
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	**Probability and Statistics for Engineers:** By Ronald Johnson, Miller & Freund's 7th Ed. Prentice Hall, 2005	No
Recommended Texts	Book - 2009 - Probability and Statistics - Schaums Outlines	No
Websites		

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Fluid Mechanics**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVEESC319**	
ECTS Credits	**4**	
SWL (hr/sem)	**100**	

Module Level	3		**Semester of Delivery**		6
Administering Department	SCE		**College**	EE	
Module Leader	Ismael Khudhair Abdullah Al-Jobury		**e-mail**	Ismael.abdullah@uoninevah.edu.iq	
Module Leader's Acad. Title	Lecturer Assistant		**Module Leader's Qualification**		M.Sc.
Module Tutor			**e-mail**	E-mail	
Peer Reviewer Name			**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	NVEESC314	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	• **Understanding Fluid Properties:** Develop a foundational grasp of compressibility, viscosity, and Newtonian vs. non-Newtonian fluids. • **Fluid Statics:** Explore pressure measurement techniques, Pascal's Law, and hydrostatic forces on submerged surfaces. • **Fluid Dynamics:** Analyze flow classification, equations of motion (Newton's second law, Euler's equation, Bernoulli's equation), and flow rate calculations. • **Measurement Techniques:** Learn practical applications of fluid mechanics in engineering, including flow rate measurements using Venturimeters and Pitot tubes. • **Engineering Applications:** Apply fluid mechanics principles to real-world problems in robotics, aerospace, hydraulics, and mechanical systems.
Module Learning Outcomes	• **Comprehend Fundamental Fluid Properties:** Gain a clear understanding of compressibility, bulk modulus, viscosity, and the distinction between Newtonian and non-Newtonian fluids. • **Analyze Fluid Statics:** Apply Pascal's Law and hydrostatic pressure principles to solve engineering problems related to submerged surfaces and pressure measurements. • **Solve Fluid Dynamics Problems:** Use equations of motion, including **Newton's Second Law, Euler's Equation, and Bernoulli's Equation**, to analyze fluid behavior in dynamic conditions.

	• **Evaluate Flow Rate Measurement Techniques:** Apply concepts like **Venturimeter and Pitot Tube** to measure fluid velocity and flow rate accurately. • **Apply Engineering Mechanics to Real-World Scenarios:** Utilize fluid mechanics principles in disciplines such as robotics, aerospace, hydraulics, and control systems.

Indicative Contents	**1. Fundamental Fluid Properties** • Introduction to Fluid Mechanics: Basic definitions and significance in engineering • Compressibility and Bulk Modulus: Understanding fluid response under pressure • Fluid Viscosity: Effects on flow behavior and industrial applications • Newtonian vs. Non-Newtonian Fluids: How fluids behave under different stress conditions **2. Fluid Statics** • Pascal's Law and Hydrostatic Pressure: Principles of pressure transmission in fluids • Fluid Pressure Types: Gauge, absolute, and atmospheric pressure • Pressure Measurement Techniques: Devices such as manometers and barometers • Hydrostatic Force on Submerged Surfaces: Applications in engineering and fluid containment **3. Fluid Dynamics** • Flow Classification: Laminar vs. turbulent flow regimes • Equations of Motion: Newton's Second Law, Euler's Equation, and Bernoulli's Equation • Flow Rate Calculations: Quantifying movement of fluids in pipelines • Applications of Bernoulli's Equation: Engineering uses in aerodynamics and hydraulics **4. Flow Rate Measurement Techniques** • Venturimeter: Principle, design, and applications in flow measurement • Pitot Tube: Functionality and use in velocity determination • Experimental and Computational Approaches: Using numerical methods to model fluid systems

Learning and Teaching Strategies	
Strategies	**1. Build a Strong Conceptual Foundation** • Deeply understand the principles behind **compressibility, viscosity, and Newtonian vs. non-Newtonian fluids** before diving into calculations. • Compare different approaches to **fluid statics and dynamics**, focusing on equations like **Bernoulli's equation and Euler's equation**. **2. Apply Theory to Real-World Problems**

	• Solve engineering **case studies** involving hydrostatic forces, pressure measurements, and flow rate calculations. • Explore practical applications in **robotics and control systems**, such as fluid motion in hydraulic actuators. **3. Computational & Numerical Techniques** • Implement **fluid mechanics simulations** using software like MATLAB or Python. • Use **numerical methods** to approximate solutions for fluid dynamics problems, linking back to your expertise in differential equations and integration. **4. Error Analysis & Experimental Validation** • Investigate **accuracy and limitations** of measurement tools like **Venturimeters and Pitot tubes**. • Conduct small-scale experiments or simulations to visualize **laminar vs. turbulent flow behaviors**. **5. Cross-Disciplinary Learning** • Connect fluid mechanics with other areas of engineering mechanics, **numerical analysis**, and robotics. • Study how fluid properties impact **automated systems**, such as hydraulic controls in assistive technologies.

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	67	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	5, 11	LO #
	Assignments	2	10% (10)	2, 10	LO #
	Online Assignments	1	5% (5)	7, 9	LO #
	Report	1	5% (5)	13	LO #
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO #
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Fluid Mechanics
Week 2	Compressibility and bulk Modules
Week 3	Fluid Viscosity
Week 4	Newtonian and non-Newtonian fluids
Week 5	Fluid Static - (Pascal's Law – hydrostatic pressure law)
Week 6	Fluid Static - Fluid Pressure (gauge, absolute and atmospheric)
Week 7	Fluid Static - Measurement of Pressure
Week 8	Fluid Static - Hydrostatic Force on Submerged Surface
Week 9	**Mid-Exam**
Week 10	Fluid Dynamics – Flow Classification
Week 11	Fluid Dynamics – Questions of motions (Newton 2nd law , Euler equation, Bernoulli equation)
Week 12	Fluid Dynamics – Flow Rate
Week 13	Fluid Dynamics – Application on Bernoulli Equations
Week 14	Fluid Dynamics – Flow Rate Measurement (Venturimeter)
Week 15	Fluid Dynamics – Flow Rate Measurement (Pitot tube)
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Fluid Mechanics and Hydraulic Machines R.K. Bansaf	No
Recommended Texts	Fundamentals of Fluid Mechanics 4th edition	No
Websites		

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** – Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Microprocessors**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☐ **Lecture** ☒ **Lab**
Module Code	**NVEESC320**	
ECTS Credits	**4**	
SWL (hr/sem)	**100**	

		☐ **Tutorial** ☐ **Practical** ☐ **Seminar**

Module Level	3	**Semester of Delivery**	6
Administering Department		**College**	EEC
Module Leader	Zeyad Tariq Shareef	**e-mail**	Zeyad.tariq@uoninevah.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	None	**e-mail**	None
Peer Reviewer Name	Mohammad Abdulrazzaq	**e-mail**	mohammed.alsayed@uoninevah.edu.iq
Scientific Committee Approval Date	01/09/2025	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To introduce the Structure of Intel microprocessors. 2. To overview the fundamental concepts of instruction types and execution with respect to CISC, RISC and modern architectures. 3. To understand how memories and I/O devices are addressed and interfaced to microprocessors. 4. To simulate basic to advanced Microprocessor instructions and interfacing Devices.
Module Learning Outcomes	1- Demonstrate advanced knowledge and understanding of Assembly and Mixed language, Microprocessors Architecture. 2- Gain skills and facility in the use of Microprocessor hardware/software in conducting experiments on the interface of Microprocessor with external peripherals using Assembly Language. 3- Analyze and evaluate the performance of a Microprocessor in terms of BUS Latching/Buffering/Timing, Memory Interfacing, I/O Mapping, Interrupts, and other applications. 4- Synthesize program control instructions to communicate between Memory and I/O devices and Microprocessor. 5- Express and communicate ideas in written and oral form.
Indicative Contents	Indicative content includes the following. Part A – Interfacing: Interrupts –directives - pin diagram – buffering system. [15 hrs] Input/Output device interfacing and examples. [15 hrs] Part B – Peripherals: Peripherals interfacing to microprocessor. [30 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	38	**Unstructured SWL (h/w)**	2
Total SWL (h/sem)	**100**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (20)	5 and 10	All
	Assignments	2	10% (10)	4 and 12	All
	Projects / Lab.	1	10% (10)	Continuous	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	All
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Basic Structure of Computers: Introduction about Processors, Memory and Input/output units
Week 2	Basic Structure of Computers: Basic processor concepts, Integer Numbers Representation & Arithmetic Operations
Week 3	The programming model of the 16-, 32- and 64-bits microprocessor architecture
Week 4	Instruction Set Architecture: Memory Locations and addressing
Week 5	Instruction Set Architecture: Memory operations, RISC and CISC computer systems, Introduction to RISC instruction sets
Week 6	Instruction Set Architecture: Addressing Modes
Week 7	Basic Processing Unit: Instruction execution, Hardware components
Week 8	Basic Processing Unit: Instruction fetch and execution steps, microprogramming
Week 9	Arithmetic and logic instructions
Week 10	Pipelining: Basic concept, Pipeline organization
Week 11	8086 Microprocessor Pin-Out Diagram
Week 12	Multiplexing and buffering in 8086 Microprocessor
Week 13	8255 PPI
Week 14	Interrupt Controller
Week 15	**Preparatory week before the final Exam**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Assembly language programming (use of MOV instruction and get familiar with registers and memory locations).
Week 2	Lab 2: Assembly language programming (use of INC, DEC, ADD and CMP commands).
Week 3	Lab 3: Assembly language programming (use of SUB, PUSH and POP commands).
Week 4	Lab 4: Assembly language programming (use of MUL, DIV and logic commands).
Week 5	Lab 5: Disassembling and demonstrating the main computer components and explaining each part individually.
Week 6	Lab 6: Interrupt 21h – part 1
Week 7	Lab 7: Interrupt 21h – part 2

Learning and Teaching Resources		
	Text	**Available in the Library?**

Required Texts	"Intel Microprocessors: Architecture, Programming and Interfacing", By: Barry B. Brey	Yes
Recommended Texts	"The 8088 and 8086 Microprocessors Programming, Interfacing and Hardware", by: Walter A. Triebel and Avtar Singh	No
Websites	https://www.uobabylon.edu.iq/eprints/publication_1_26408_35.pdf	

Grading Scheme			
Group	**Grade**	**Marks %**	**Definition**
Success Group (50 - 100)	**A** – Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C – Good	70 – 79	Sound work with notable errors
	D – Satisfactory	60 – 69	Fair but with major shortcomings
	E – Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Robotics I**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVEESC321**	
ECTS Credits	**6**	
SWL (hr/sem)	**150**	

Module Level	4	**Semester of Delivery**	7
Administering Department	SCE	**College**	EE
Module Leader	Yazen Hudhaifa Shakir	**e-mail**	yazen.shakir@uoninevah.edu.iq
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	Ph.D.

Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Mohanad Nihad N.	**e-mail**	mohanad.noaman@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The aim of teaching Introduction to Robotics Manipulator for undergraduate students is to provide them with a fundamental understanding of robotics and its applications in manipulating objects. This course aims to lay the groundwork for students to explore and excel in the field of robotics. Through this course, students will: 1- Gain foundational knowledge: Students will be introduced to the basic concepts, principles, and terminology of robotics manipulators. They will learn about the components of a robotic system, including robot arms, grippers, sensors, and actuators. Additionally, they will understand key topics such as kinematics, dynamics, and control as applied to robotic manipulators. 2- Understand robotic systems design: Students will explore the design process of robotic systems, including the considerations for selecting appropriate components, designing effective kinematic structures, and integrating sensors and actuators. They will learn about different types of robotic manipulators and their applications in various industries. 3- Foster problem-solving and critical thinking: Through project-based assignments and problem-solving exercises, students will develop their ability to analyze and solve robotics-related challenges. They will learn to think critically about robotic system design, optimization, and performance evaluation.
Module Learning Outcomes	1. Represent the position and orientation of objects in spaced, and determine the kinematic model of a robot arm based on its links and points of articulation. Also, compute the position of pose of a robot's body and gripper based on its joint angles (Forward kinematics) and also compute the joint angles necessary to position the robot gripper at a target (Inverse Kinematics). 2. Understanding inverse kinematics allows you to plan and control the motion of robotic manipulators more effectively. You can determine the joint angles required to achieve a desired end-effector position and orientation, enabling precise control over the robot's movement. 3. Inverse kinematics helps in executing specific tasks and achieving desired configurations or poses for the manipulator. It enables the robot to accurately position and orient its end-effector for various applications, such as pick-and-place operations, assembly tasks, or reaching specific points in space. 4. Implement robotic motion trajectories using different control techniques, including joint vs. task space and position vs. velocity control. Understand the principles of dynamic modelling and force / torque control (this may not be implemented on the physical robot due to hardware limitations). Use SolidWorks software to design a simple robot gripper for manipulation of specific objects (e.g. a ping-pong ball, a soda can, a toy car, a 6-sided dice). The gripper will be 3D printed for physical testing in labs. 5. Understanding the Jacobian matrix allows you to perform kinematic analysis of robotic manipulators more effectively. You gain insights into the relationship between joint velocities and end-effector velocities, which is crucial for studying the manipulator's motion and behavior. 6. Velocity Control: The Jacobian matrix is instrumental in velocity control of robotic manipulators. By computing the Jacobian, you can map the desired end-effector velocities to the corresponding joint velocities, enabling precise control over the manipulator's motion and speed.

Indicative Contents	Indicative content includes the following. **Part A Introduction to Robotics:** Definition of robotics and its significance in various fields. Historical background and evolution of robotics. Overview of different types of robots and their applications. Robot Components and Architecture: Study of the basic components of a robot system (e.g., actuators, sensors, controllers). Understanding the architecture of a typical robot system. Overview of robot programming languages and software tools. **[25 Hrs.]** **Part B Kinematics and Dynamics of Robots:** Introduction to robot kinematics: coordinate systems, frames of reference, transformations. Forward kinematics: calculating the end-effector position and orientation. Inverse kinematics: determining joint angles for a desired end-effector position. Robot dynamics: analyzing forces, torques, and motion equations. Overview of common robot sensors (e.g., proximity sensors, vision systems, force/torque sensors). Perception and environment modeling for robots. Sensor fusion techniques for improving perception capabilities. **[80 Hrs]** Robot Control: Introduction to Linear Control: Overview of control systems and their importance in robotics. Introduction to linear control theory and its application in robot arm manipulation. Types of control systems: open-loop and closed-loop control. Mathematical Modeling of Robot Manipulators: Kinematic modeling of robot arms: forward and inverse kinematics. Dynamic modeling of robot arms: Euler-Lagrange equations, Newton-Euler equations. Linearization of robot arm models for control design. **[70 Hrs]**

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 5 and 6
	Assignments	2	10% (10)	2, 12	LO # 1, 2 and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Poster presentation	1	10% (10)	13	LO # 3, 4 and 5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-4
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Industrial Robotics Fundamentals & Introduction to the Lab** ✓ What is a Robot? Classification of Robots. ✓ What is Robotics? History of Robotics. ✓ Advantages and Disadvantages of Robots. ✓ Main Robot Components. ✓ Robot Degrees of Freedom. Robot Joints.
Week 2	Spatial Description Part I (Position , Orientation and Frames) ✓ Robot Coordinates. Robot Reference Frames. ✓ Robot Characteristics. ✓ Robot Workspace. ✓ Robot Languages. ✓ Robot Applications. ✓ Other Robots and Applications.
Week 3	Spatial Description Part II (Transformation and Representation) ✓ Robots as Mechanisms. ✓ Matrix Representation. ✓ Homogeneous Transformation Matrices. ✓ Representation of Transformations
Week 4	Solving some Exercises on spatial description
Week 5	Manipulator Forward kinematics-1 ✓ Denavit-Hartenberg (DH) Parameters: ✓ DH convention for parameterizing robot kinematics.

	✓ Assigning coordinate frames and joint variables using DH parameters. ✓ DH parameter tables and their interpretation.
Week 6	Manipulator Forward kinematics-2 + solving some exercises
Week 7	Mid-term exam
Week 8	Inverse manipulator (robotic arm) kinematics part 1
Week 9	Inverse manipulator (robotic arm) kinematics part 2
Week 10	Jacobians: Velocities , Explicit Form and Static Forces –Part 1 ✓ Differential Forward Kinematics: ✓ Computing linear and angular velocities of the end-effector based on joint velocities. ✓ Jacobian matrices and their relationship to differential forward kinematics. ✓ Applications of differential forward kinematics in robot control and motion planning.
Week 11	Jacobians: Velocities , Explicit Form and Static Forces- Part 2
Week 12	Jacobians: Velocities , Explicit Form and Static Forces- Part 3
Week 13	Trajectory generation
Week 14	Introduction to Linear Control of Manipulator-1
Week 15	Introduction to Linear Control of Manipulator-2
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	**Lab 1:** Introduction to CoppeliaSim (CoppeliaSim, formerly known as V-REP, is a robot simulator used in industry, education and research.) software and its features. Setting up the CoppeliaSim environment.
Week 2	**Lab 2:** Coordinate Systems: CoppeliaSim uses a hierarchical structure of coordinate systems to define the position and orientation of objects. Each object in the simulation has its own local coordinate system, which can be linked to parent coordinate systems to form a hierarchical relationship. This allows for accurate positioning and orientation of objects within the simulation environment. • Transformation Matrices: CoppeliaSim utilizes transformation matrices to represent the spatial relationship between objects and coordinate systems. These matrices encode translation, rotation, and scaling information. By applying transformation matrices, objects can be moved, rotated, and scaled relative to their parent coordinate systems. • Object Properties: Objects in CoppeliaSim have various properties that define their spatial characteristics. These properties include position, orientation, dimensions, mass, inertia, and collision properties. By specifying these properties, users can accurately model and simulate the spatial behavior of objects in the virtual environment.
Week 3	**Lab 3: Lua Programming Language Introduction** • Syntax and Variables: • Data Types: • Control Structures: Lua provides control structures like if-else statements, loops, and switch-like constructs. The "if-else" statement allows conditional execution of code based on logical conditions. Loops include "while" and "for" loops, enabling repeated execution of code blocks. Lua does not have a built-in switch statement, but it can be simulated using if-else constructs or tables. • Functions and Modules:

	Functions are defined using the "function" keyword, followed by the function name and parameters. Functions in Lua can return multiple values. Lua supports first-class functions, allowing functions to be assigned to variables or passed as arguments. Modules provide a way to organize and encapsulate code in Lua, facilitating code reuse and modularity. • Metatables and Metamethods: Metatables are Lua's mechanism for defining custom behaviors of tables. Metamethods are special functions associated with metatables that allow overriding default operations on tables, such as arithmetic operations or indexing. Metatables and metamethods provide powerful metaprogramming capabilities in Lua.
Week 4	**Lab 4:** • Parent-Child Relationships: Objects in CoppeliaSim can be linked together in a parent-child relationship, forming a hierarchical structure. The position and orientation of child objects are defined relative to their parent objects. This hierarchical structure allows for the representation of complex systems, such as robot arms with multiple joints and links. • Object Hierarchy: CoppeliaSim provides a graphical user interface and an object hierarchy view that enables users to organize and manage the spatial relationships between objects. The hierarchy view allows for easy navigation and manipulation of objects, making it convenient to set up and modify the spatial description of a simulation scene.
Week 5	. **Lab 5:** **Module 1: Joint Types and Properties** • Classification of joints: revolute, prismatic, spherical, etc. • Understanding joint properties such as limits, ranges, and velocities. • Configuring joint parameters in CoppeliaSim. **Module 2: Joint Modeling and Simulation** • Creating and configuring joint objects in CoppeliaSim. • Assigning joint types and properties to model realistic joint behavior. • Simulating joint movements and interactions in the simulation environment. **Module 3: Joint Control and Actuation** • Joint control methods in CoppeliaSim: position control, velocity control, etc. • Implementing joint control using scripting and API functions. • Integrating joint control with other simulation components (e.g., sensors, actuators).
Week 6	**Lab 6: Concept of Forward and Inverse Kinematics –part 1** In particular, explains how to compute homogeneous transformation matrices from Denavit-Hartenberg parameters
Week 7	**Lab 7: Mid- Term**
Week 8	**Lab 6: Kinematics Plugin**
Week 9	**Lab 9 :** Working with FK and IK plugins in CoppelliaSim
Week 10	**Review**
Week 11-week 15	**Self- Study**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1- ''Introduction to Robotics: Mechanics and Control (3rd Edition) '' 3rd Edition – 4th Edition 2- An Introduction to Robotics Analysis, Systems, Applications by Saeed Benjamin Niku	Online
Recommended Texts	Asada, H., and J. J. Slotine. *Robot Analysis and Control*. New York, NY: Wiley, 1986. ISBN: 9780471830290.	Online
Websites	https://www.youtube.com/playlist?list=PLJqRpPcJQ_g0aqeZy7lYJv5fHF0fOhnG- https://www.youtube.com/playlist?list=PL64324A3B147B5578 https://www.youtube.com/playlist?list=PLyqSpQzTE6M_XM9cvjLLO_Azt1FkgPhpH https://www.youtube.com/playlist?list=PLggLP4f-rq02vX0OQQ5vrCxbJrzamYDfx	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** – Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D – Satisfactory	60 - 69	Fair but with major shortcomings
	E – Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Optimal Control I**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☐ **Lecture**
Module Code	**NVEESC322**	
ECTS Credits	**6**	

SWL (hr/sem)	**150**	☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**

Module Level	4	**Semester of Delivery**	7
Administering Department	SCE	**College**	EE
Module Leader	Name: Ibrahim Khalaf Mohammed	**e-mail**	ibrahim.mohammed@uoninevah.edu.iq
Module Leader's Acad. Title	Assistance Professor	**Module Leader's Qualification**	Ph.D.
Module Tutor	Ibrahim Khalaf Mohammed	**e-mail**	ibrahim.mohammed@uoninevah.edu.iq
Peer Reviewer Name	Abdulla I. Abdulla	**e-mail**	Abdulla.abdulla@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	110. To provide a knowledge and clear idea about differences between the control systems strategies. 111. This course should provide basic understanding, and learn motivation and applications of optimal control systems. 112. This course provides a clear idea about theoretical foundations of optimal control system. 113. The student should have a clear idea about optimal control techniques and their functions. 114. The student should be able to posses detailed knowledge about development of optimal control systems. 115. This course provides the student a clear knowledge about the differences between the ideal and realised systems. 116. Provide the student information about systems noise types. 117. To provide a clear knowledge about the full and partial-order state estimation techniques. 118. To provide an information about noise rejection of realise systems and develop their stability. 119. To provide details about state estimator design methods. 120. The student should be able to design, analysis and implement LQG controller systems.
Module Learning Outcomes	91. Recognize the difference between the ideal and realized systems, and describe the terminologies, basic concepts and fundamentals of optimal control systems. 92. Apply fundamental knowledge and principles of optimal control systems. 93. Recognize the role of Kalman filter in noise rejection and state estimation of practical systems. 94. Design and implementation of LQR controller. 95. Design approaches of state observer system. 96. Evaluate the response of optimal control systems using performance parameters. Analysis and discuss the performance of LQG control systems using Matlab software accessories.

Indicative Contents	Indicative content includes the following. Part A – Optimal Systems Theory Definitions, Concepts, Fundementals, Motivation and applications of optimal control, Types of optimal control problems, Performance index types. **[14 hrs]** Part B – LQR Control Systems -LQR systems in continous-time, Fundementals and principles of LQR controller, Riccati equation, characteritics equation, Damping ratio, gain matrix, control effort , LQR controller design, Practical aspects and controller implementation ,response analysis. **[15 hrs]** -LQR systems in discrete-time, Hermitain matrix, discrete objective function, Iteration principles, Riccati equation, characteritics equation, LQR controller design, Practical aspects and controller implementation, Response analysis. **[15 hrs]** Part C – LQG Control Techniques Fundementals and working principles, Noises types, State estimation, Observability matrix, Kalman filter, Observation techniques, Direct comparsion method, Observable canonical form method, Ackermann's formula method, LQG design, Practical aspects and controller implementation. **[30 hrs]**

Learning and Teaching Strategies	
Strategies	Create class subgroups to achieve unstructured assignments, activation the interaction between lecturer and students in the class, fast class assignment, blended education, clarify the practical applications of the studing materials, clarify a connection between studing material, organizing scientific visits to related facilities, interactive tutorials by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	8% (10)	5, 13	LO #2, 3, and 4
	Assignments	2	5% (10)	2, 12	LO # 1 and 5
	Lab.	1	15% (15)	Continuous	
	Report	1	2% (2)	13	LO # 5 and 6
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-5
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction, principles, concept and general aspects of optimal control
Week 2	Types of optimal control problems, definition and types of performance index
Week 3	Linear Quadratic Regulator (LQR) technique, basics, principles, theory
Week 4	LQR controller design in continuous-time
Week 5	LQR-continous time system design (Example)
Week 6	LQR controller design in discrete time
Week 7	LQR-discrete time system design (Example)
Week 8	Servo optimal control system, definition, principles and theory
Week 9	Servo optimal control system design
Week 10	Linear Quadratic Gaussian (LQG) system, introduction, definition, basics, principle and theory
Week 11	Kalman filter, definition, motivation and principle
Week 12	Full-order state estimator design using direct comparison method
Week 13	Full-order state estimator design using Observable Canonical method
Week 14	Full-order state estimator design using Ackermann's formula method
Week 15	LQG controller design and implementation
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to systems representation (transfer function, state space), Systems realization
Week 2	Lab 2: Interaction between Matlab script and Simulink (response display approaches)
Week 3	Lab 3: LQR design and implementation of 2nd order system in continous time
Week 4	Lab 4: LQR design and implementation of 3nd order system in continous time
Week 5	Lab 5: Estimator design and implementation (direct method)
Week 6	Lab 6: Estimator design and implementation (Observable canonical form method)
Week 7	Lab 7: Estimator design and implementation (Ackermann's formula method)
Week 8	Lab 8: LQG design and implementation of 2nd order system in continous time
Week 9	Lab 9: LQG design and implementation of 3nd order system in continous time

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	K. Ogata, "Designing Linear Control Systems With Matlab," Prentice-Hall, International Upper Saddle River, NJ, 1997.	Yes
Recommended Texts	Roland S. Burns, "Advanced Control Engineering," Linacre House Jordan Hill Oxford 2011.	No
Websites	https://www.youtube.com/watch?v=OK0ZN9PwraQ	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information

Module Title	**Mathematical Modelling**	**Module Delivery**
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVEESC323**	
ECTS Credits	**6**	
SWL (hr/sem)	**150**	

Module Level	4	**Semester of Delivery**	7
Administering Department	SCE	**College**	EE
Module Leader	Mohanad Nihad Noaman	**e-mail**	mohanad.noaman@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Ibrahim K. Mohammed	**e-mail**	ibrahim.mohammed@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	121. To develop problem solving skills and understanding of circuit theory through the application of techniques. 122. To familiarize students with the concept of modelling, and analysis of electrical, mechanical, and electromechanical systems. 123. To understand fundamentals of system dynamics. 124. To obtain a mathematical Model of different physical systems. 125. To know how to linearize of nonlinear systems.
Module Learning Outcomes	97. Knowledge and Understanding the fundamental concepts and principles of system modeling. 98. Modeling Skills: Develop the ability to formulate mathematical models to represent the behavior and relationships within a system. 99. Be familiar with modeling methods for electrical, mechanical, and electromechanical systems. 100. Identify various system representations. 101. Applying linearization on nonlinear systems.
Indicative Contents	Indicative content includes the following. Introduction to system, types of systems, Model, dynamic system investigation, modeling cycle, Differential Equations, The Laplace Transform Method, Laplace Transforms of Derivatives and Integrals, the initial value theorem, final value theorem, Transfer Function [12 hrs] Mechanical Elements, Mass Elements, Spring Elements, Damper Elements, Equivalence, Translational Systems, Rotational Systems, Mixed Systems: Translational and Rotational, Gear–Train Systems, System Modeling with Simulink and Simscape, Electrical Elements, Electric Circuits, Operational Amplifiers, Electromechanical Systems, DC Motor, Impedance Methods, Liquid-Level Systems, Hydraulic Capacitance, Hydraulic Resistance, Modeling of Liquid-Level Systems [15 hrs] Model Forms, Transfer Functions and Block Diagram Models, Signal Flow Graphs, State-Space Form, State Variables, State-Variable Equations, and State Equation, Relations between State-Space Form, Input–Output Equation, and Transfer Matrix, Linear and nonlinear system, linearization methods [15 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	102	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	4, 11	LO #3,5
	Assignments	2	0% (10)		LO # 1, 4, and 5
	Projects / Lab.	1	0% (10)	C	
	Report	1	5% (5)	10	LO # 5
Summative assessment	**Midterm Exam**	2 hr	25% (25)	9	LO # 1-4
	Final Exam	2hr	60% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to System Modeling
Week 2	Differential Equations and Laplace Transform
Week 3	Basic System Models: Mechanical system
Week 4	Basic System Models: Mechanical system – case study
Week 5	Basic System Models: Electrical Systems
Week 6	Basic System Models: Electrical Systems – case study
Week 7	Basic System Models: Op-Amps Modeling
Week 8	Potentiometer and DC Motor Modeling
Week 9	Mid-term Exam
Week 10	Basic System Models: Fluid Modeling
Week 11	Block Diagrams and Signal Flow Graphs
Week 12	State-Space Representation
Week 13	State Space and Transfer Function Transformation
Week 14	Linearization of nonlinear systems
Week 15	Linearization of nonlinear systems: case study
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	System Dynamics **By: William J. Palm III**	No
Recommended Texts	Modeling and Analysis of Dynamic Systems **By: Ramin S. Esfandiari and Bei Lu**	No
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information		
Module Title	**Process Control**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**NVEESC324**	
ECTS Credits	**5**	
SWL (hr/sem)	**125**	

Module Level	4	**Semester of Delivery**	7
Administering Department	SCE	**College**	EE
Module Leader	Omar Yaseen Ismael	**e-mail**	omar.ismael@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	M.Sc.
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Yazen Hudhaifa Sh.	**e-mail**	yazen.shakir@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. To introduce students to the fundamental concepts and principles of process control. 2. To develop students' skills in designing and analyzing control systems. 3. To familiarize students with various control strategies and techniques. 4. To enable students to apply their knowledge to solve real-world process control problems. 5. To promote critical thinking, teamwork, and effective communication skills.
Module Learning Outcomes	1- Explain the fundamental concepts and principles of process control and apply mathematical modeling techniques to represent and analyze dynamic systems in process control. 2- Identify and describe the roles and functions of sensors, transducers, actuators, and control valves in control systems. Furthermore, design and tune controllers, including proportional, integral, and derivative controllers, using various tuning methods. 3- Analyze the stability of control systems and apply stability criteria to determine system stability, and evaluate the performance of control systems in terms of transient response, steady-state error, and frequency response. 4- Design and implement feedback control systems, understanding the advantages of closed-loop control, and apply advanced control techniques such as feedforward control, cascade control, ratio control, and adaptive control in appropriate scenarios. Moreover, analyze and manage interactions and coupling effects in multivariable control systems. 5- Consider design considerations and criteria for control system design, including stability, response time, and optimization, and apply control system optimization techniques to improve control system performance. 6- Apply process control principles to real-world applications in various industries. Utilize simulation software and control system design tools for analysis and design purposes. Finally, demonstrate critical thinking, problem-solving skills, and effective communication in the field of process control.

Indicative Contents	1- Introduction to Process Control • Definition and significance of process control • Basic components of a control system • Classification of control systems 2- Piping and Instrumentation Diagram (P&ID) 3- Mathematical Modeling of Processes • Modeling techniques for dynamic systems • Dynamic Behavior of Typical Process Systems • Empirical Model Identification 4- Feedback Control Systems • Feedback controllers: proportional, integral, derivative • Controller tuning methods: Ziegler-Nichols, Cohen-Coon, and others • Performance of Feedback Control Systems 5- Advanced Control Techniques • Feedforward control • Cascade control • Ratio control • Adapting Single-loop Control Systems for Non-linear Processes • Inferential Control • Level and Inventory Control • Internal Model Control 6- Multivariable Control Systems • Introduction to multivariable systems • Decoupling and interaction analysis • Strategies for multivariable control • Variable Structure and Constraint Control • Centralized Multivariable Control 7- Control System Design and Optimization • Control system design considerations • Performance criteria: stability, robustness, response time • Optimization techniques: model-based and trial-and-error methods 8- Introduction to control system design software (e.g., MATLAB, Simulink)

Learning and Teaching Strategies	
Strategies	1- Lectures: Instructor-led lectures provide students with a theoretical foundation and an overview of key concepts, principles, and techniques in process control. Lectures may incorporate multimedia presentations, visual aids, and real-world examples to enhance understanding. 2- Practical Demonstrations: Hands-on practical demonstrations allow students to observe and understand the operation of control system components, sensors, actuators, and controllers. Demonstrations can help bridge the gap between theory and practice, enhancing students' understanding of the course material. 3- Laboratory Experiments: Practical laboratory experiments provide students with opportunities to apply their theoretical knowledge to real-world scenarios. These experiments involve designing, implementing, and analyzing control systems, allowing students to gain practical experience and develop critical thinking skills. 4- Case Studies: The use of case studies enables students to analyze and solve real-world process control problems encountered in various industries. Case studies encourage students to apply their knowledge to practical situations, promoting problem-solving skills and critical thinking. 5- Group Discussions: Group discussions facilitate peer-to-peer learning and collaboration. Students can discuss complex topics, exchange ideas, and solve problems together, fostering a deeper understanding of process control concepts and principles. 6- Simulation and Modeling: The use of simulation software and modeling tools allows students to simulate control system behavior, perform virtual experiments, and analyze system responses. This approach helps students visualize and comprehend the effects of different control strategies and system parameters. 7- Assignments and Projects: Assignments and projects enable students to apply their learning independently. They may involve designing control systems, analyzing system performance, troubleshooting issues, or conducting research on advanced topics. Assignments and projects foster critical thinking, problem-solving skills, and research abilities. 8- Online Resources: Supplemental online resources, such as interactive simulations, video tutorials, and e-learning platforms, can be used to enhance students' understanding and provide additional self-study materials. These resources offer flexibility and accessibility, allowing students to review and reinforce their learning outside of class. 9- Assessments: Various forms of assessments, including quizzes, tests, laboratory reports, and project evaluations, are used to gauge students' understanding and progress. Assessments provide feedback to students and help instructors evaluate the effectiveness of their teaching methods.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1,5 and 6
	Assignments	2	10% (10)	2, 12	LO # 2, 3 and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 3, 4 and 5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-5
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Process Control
Week 2	Piping and Instrumentation Diagram (P&ID)
Week 3	Mathematical Modeling of Processes
Week 4	Feedback controllers: proportional, integral, derivative
Week 5	Controller tuning methods: Ziegler-Nichols, Cohen-Coon, and others
Week 6	Advanced Control Techniques: Cascade control
Week 7	Advanced Control Techniques: Feedforward control
Week 8	Advanced Control Techniques: Ratio control
Week 9	Advanced Control Techniques: Adapting Single-loop Control Systems for Non-linear Processes
Week 10	Advanced Control Techniques: Inferential Control
Week 11	Advanced Control Techniques: Level and Inventory Control
Week 12	Advanced Control Techniques: Internal Model Control
Week 13	Multivariable Control Systems: • Introduction to multivariable systems • Decoupling and interaction analysis
Week 14	Multivariable Control Systems: • Strategies for multivariable control • Variable Structure and Constraint Control
Week 15	Multivariable Control Systems: Centralized Multivariable Control
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Study and use of Scientech 2476 Pressure Control Workbench hardware and software
Week 2	Lab 2: Study and use of ON/OFF Controller using Scientech 2476 Pressure Control Workbench
Week 3	Lab 3: Study and use of Proportional-Integral-Derivative using Scientech 2476 Pressure Control Workbench
Week 4	Lab 4: Building the MATLAB Simulink Model for the Two Coupled-Tanks Plant
Week 5	Lab 5: Building the MATLAB Simulink Model for PID control of Two Coupled-Tanks Plant with tunning
Week 6	Lab 6: Applying feedforward plus feedback control to the Quanser coupled tanks device
Week 7-16	Independent projects

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Process Dynamics and Control, 4th Edition, 2016 By: Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III ISBN: 978-1-119-28591-5	No
Recommended Texts	Process Control: Designing processes and Control Systems for Dynamic Performance, 2nd Edition, 2000 by T. Marlin	No
Websites	1- http://www.pc-education.mcmaster.ca/LearningSupport%20Page.htm 2- https://ocw.mit.edu/courses/10-450-process-dynamics-operations-and-control-spring-2006/ 3-	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information				
Module Title	**Embedded Systems**		**Module Delivery**	
Module Type	**Core**		☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVEESC325**			
ECTS Credits	**5**			
SWL (hr/sem)	**125**			
Module Level	4		**Semester of Delivery**	7
Administering Department	SCE		**College**	EE
Module Leader	Ahmed M.Basheer		**e-mail**	ahmed.basheer@uoninevah.edu.iq
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail
Peer Reviewer Name	Mohammad A.Thanoon		**e-mail**	mohammed.alsayed@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVEESC320	**Semester**	6
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Introduction to Embedded Systems: Introduce students to the concept of embedded systems, their characteristics, and their applications in various industries. 2. Fundamentals of Hardware and Software Integration: Familiarize students with the integration of hardware and software components in embedded systems, including microcontrollers, microprocessors, sensors, actuators, and communication interfaces. 3. Real-Time Systems: Provide an understanding of real-time constraints and considerations in embedded systems, including real-time operating systems (RTOS), task scheduling, and response time analysis.

	4. Embedded Software Development: Develop skills in programming embedded systems using languages like C or C++, understanding software development methodologies, and implementing efficient and optimized code. 5. System-Level Design: Introduce students to system-level design principles, including architecture selection, partitioning of functionality, hardware-software co-design, and trade-offs in embedded system design. 6. Interface Design and Communication: Teach students about different communication protocols and interfaces used in embedded systems, such as UART, SPI, I2C, Ethernet, and USB, and how to design interfaces for connecting peripherals and external devices. 7. Testing and Debugging: Provide knowledge of testing and debugging techniques specific to embedded systems, including simulation, emulation, hardware debugging tools, and troubleshooting common issues. 8. Power Management and Energy Optimization: Explore power management techniques, energy-efficient design strategies, and considerations for maximizing battery life in embedded systems. 9. Safety, Security, and Reliability: Discuss safety-critical aspects of embedded systems, security vulnerabilities, and techniques for ensuring system reliability and dependability. 10. Project Work: Provide opportunities for students to apply their knowledge and skills in the development of real-world embedded system projects, fostering practical problem-solving abilities and teamwork
Module Learning Outcomes	102. Understand the fundamental concepts and principles of embedded systems, including hardware and software integration, real-time operation, resource constraints, and system-level design. 103. Demonstrate proficiency in programming languages commonly used in embedded systems development, such as C or C++, and understand their role in developing embedded software. Acquire knowledge of microcontrollers or microprocessors commonly used in embedded systems and understand their architecture, features, and programming interfaces. 104. Develop skills in designing and implementing embedded software for specific applications, considering factors such as real-time requirements, power efficiency, and resource constraints. Also, Gain hands-on experience in working with development tools, software development kits (SDKs), integrated development environments (IDEs), and debugging techniques specific to embedded systems. 105. Learn about different communication protocols and interfaces used in embedded systems, such as serial communication (UART, SPI, I2C), networking protocols (Ethernet, Wi-Fi), and bus protocols (CAN, USB). Understand the concepts of system-level integration, including sensor

	interfacing, actuator control, and data acquisition in embedded systems. 106. Explore techniques for testing, debugging, and troubleshooting embedded systems, including simulation, emulation, and hardware debugging tools. Also, Gain an understanding of the challenges and considerations related to power management, energy optimization, and battery life in embedded systems. 107. Develop an awareness of safety, security, and reliability issues in embedded systems and learn strategies for mitigating risks and ensuring system dependability. Apply problem-solving and critical-thinking skills to analyze and solve real-world problems in embedded systems design and implementation. Furthermore, work effectively as part of a team to develop embedded system projects, demonstrating effective communication, collaboration, and project management skills.
Indicative Contents	Indicative content includes the following. Introduction to Embedded Systems Definition and characteristics of embedded systems Embedded system applications and examples Hardware-software co-design in embedded systems Microcontrollers and Processors Overview of microcontrollers and microprocessors Architecture and features of popular microcontroller families Memory organization and addressing modes Embedded Programming Programming languages for embedded systems (e.g., C, C++) Embedded software development tools and environments Compilation, linking, and debugging techniques Real-Time Operating Systems (RTOS) Introduction to real-time systems and their requirements Role and features of RTOS in embedded systems Task scheduling algorithms and real-time constraints Peripherals and Interfaces Input and output devices (e.g., sensors, actuators) Communication interfaces (e.g., UART, SPI, I2C, Ethernet) Interfacing techniques and protocols for data exchange Embedded System Design Methodologies System-level design and specification techniques Hardware-software partitioning and co-design strategies Trade-offs in embedded system design (performance, power, cost) Embedded System Testing and Debugging

	Techniques for testing embedded systems Emulation, simulation, and prototyping tools Debugging strategies and methodologies Power Management in Embedded Systems Power-aware design techniques Low-power modes and sleep states Energy optimization and power budgeting Safety, Security, and Reliability Safety-critical aspects in embedded systems Security vulnerabilities and countermeasures Techniques for ensuring system reliability and fault tolerance Case Studies and Project Work Analysis of real-world embedded system applications Design and implementation of embedded system projects Integration, testing, and documentation of the project work

Learning and Teaching Strategies	
Strategies	Practical Hands-On Experience: Provide students with opportunities for practical, hands-on experience with embedded systems. This can include lab exercises, projects, or programming assignments where students get to work with actual hardware or simulation tools to implement and test embedded systems. Project-Based Learning: Incorporate project-based learning activities where students work on real-world embedded system projects. This allows them to apply their knowledge and skills to solve practical problems and encourages creativity and critical thinking. Use of Development Boards and Tools: Introduce students to popular development boards and tools used in embedded systems development, such as Arduino, Raspberry Pi, or specific microcontroller development kits. This familiarity with industry-standard tools helps students gain practical skills that are valuable in the job market. Collaborative Learning: Encourage collaborative learning by promoting group work or team projects. Embedded systems often involve interdisciplinary collaboration, so creating opportunities for students to work in teams and share their expertise can enhance their understanding of complex system integration. Industry Guest Lectures: Invite professionals from the industry to deliver guest lectures or workshops. They can share their practical experiences, industry trends, and challenges faced in embedded systems development, providing students with valuable insights and real-world perspectives.

	Simulations and Virtual Labs: Utilize simulation tools or virtual labs to allow students to experiment and simulate the behavior of embedded systems. This can be particularly useful when access to physical hardware is limited or costly. Regular Assessment and Feedback: Implement regular assessments, such as quizzes, assignments, or exams, to assess students' understanding of the concepts taught. Provide constructive feedback to help students identify areas for improvement and reinforce their learning. Continuous Learning Resources: Curate and provide supplementary learning resources, such as textbooks, online tutorials, or reference materials, to support students' self-directed learning and exploration of embedded systems beyond the classroom. Industry Connections and Internship Opportunities: Establish connections with industry partners to provide students with internship or industry placement opportunities. This exposure to real-world embedded system development environments can enhance their skills and career prospects. Stay Updated with Emerging Technologies: Keep the module content up-to-date with the latest trends and advancements in embedded systems. This could include topics like Internet of Things (IoT), edge computing, machine learning on embedded devices, or cybersecurity in embedded systems.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, and 5
	Assignments	2	10% (10)	2, 12	LO # 2, 3 and 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 3, 4 and 5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-5
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Embedded Systems • Definition and characteristics of embedded systems • Overview of hardware and software components in embedded systems • Embedded system design methodologies
Week 2	Microcontrollers and Microprocessors • Introduction to microcontrollers and microprocessors • Architecture and features of popular microcontrollers • Programming languages and development tools for embedded systems
Week 3	Embedded System Programming • Basics of embedded C programming • Data types, operators, and control structures • Input/output operations and memory management
Week 4	Real-Time Operating Systems (RTOS) • Introduction to real-time operating systems • Features and benefits of using an RTOS in embedded systems

	• Task scheduling and inter-task communication
Week 5	Embedded System Interfacing • Interfacing techniques for input and output devices • Serial communication protocols (UART, SPI, I2C) • Analog and digital sensor interfacing
Week 6	Interrupts and Timers • Introduction to interrupts and their importance in embedded systems • Timer modules and their applications • Interrupt service routines and interrupt handling techniques
Week 7	Mid-term Exam
Week 8	Sinusoidal Forcing, Complex Forcing, Phasors, and Complex Impedance, Sinusoidal Steady State Response Embedded System Networking • Introduction to networking protocols for embedded systems • Ethernet and TCP/IP protocols • IoT connectivity and wireless communication (Wi-Fi, Bluetooth)
Week 9	Embedded System Design and Testing • Design considerations for embedded systems • Design methodologies and techniques • Testing and debugging strategies for embedded systems
Week 10	Embedded System Security • Introduction to embedded system security challenges • Security threats and vulnerabilities in embedded systems •
Week 11	• Techniques for securing embedded systems
Week 12	Embedded System Project
Week 13	• Implementation of a small-scale embedded system project
Week 14	• Integration of hardware and software components
Week 15	• Testing and evaluation of the project
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to Embedded Systems Lab • Familiarization with the lab equipment and tools • Introduction to microcontrollers and development boards • Basic programming and debugging techniques
Week 2	Microcontroller Programming Lab • Setting up the development environment • Writing and debugging simple programs for the microcontroller • GPIO interfacing and basic input/output operations
Week 3	Interrupts and Timers Lab • Implementing interrupt-driven routines • Timer module configuration and usage • Interrupt-based timing and event handling
Week 4	Sensor Interfacing Lab • Interfacing analog and digital sensors with the microcontroller • Data acquisition and sensor calibration techniques • Implementing sensor-driven applications
Week 5	Serial Communication Lab • UART communication between microcontrollers or with a computer • Serial data transmission and reception • Interfacing with peripherals using serial protocols
Week 6	Real-Time Operating Systems (RTOS) Lab • Introduction to an RTOS and its features • Task scheduling and management using an RTOS • Implementing multi-tasking applications on the microcontroller
Week 7	Networking and Wireless Communication Lab • Ethernet connectivity and TCP/IP communication • Wireless communication protocols (Wi-Fi, Bluetooth)

	• Implementing IoT-based applications
Week 8	Mid exam
Week 9	Embedded System Testing and Debugging Lab • Testing and debugging techniques for embedded systems • Use of debugging tools and techniques
Week 10	Error handling and troubleshooting in embedded systems
Week 11	Embedded System Interfacing Lab • Interfacing with external devices and modules (LCD, keypad, motors, etc.) • • Implementing device drivers for peripherals
Week 12	Integration of hardware and software components
Week 13	Embedded System Project Lab • Working on a small-scale embedded system project
Week 14	• Integration of hardware, software, and peripherals
Week 15	Final exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	"Embedded Systems: Introduction to Arm® Cortex™-M Microcontrollers" by Jonathan W. Valvano • This book provides a comprehensive introduction to embedded systems using Arm Cortex-M microcontrollers. It covers topics such as programming, interfacing, and real-time operating systems	Yes
Recommended Texts	Embedded Systems: Real-Time Operating Systems for Arm Cortex-M Microcontrollers" by Jonathan W. Valvano • This book focuses on real-time operating systems (RTOS) for embedded systems using Arm Cortex-M microcontrollers. It covers the fundamentals of RTOS, task scheduling, synchronization, and communication.	No
Websites	1. Embedded.com (www.embedded.com) • This website provides a wealth of information on embedded systems, including articles, tutorials, industry news, and product reviews. It covers	

	various topics such as embedded software development, hardware design, real-time operating systems, and system integration. 2. Embedded Systems Academy (www.esacademy.com) • The Embedded Systems Academy offers a range of resources for embedded systems developers, including tutorials, white papers, and training materials. It covers topics such as microcontroller programming, communication protocols, and software development tools. 3. Texas Instruments Embedded Systems Wiki (processors.wiki.ti.com) • Texas Instruments (TI) provides an embedded systems wiki that offers technical documentation, application notes, and development resources for TI microcontrollers and processors. It covers topics related to hardware design, software development, and system integration. 4. ARM Developer (developer.arm.com) • ARM Developer is a comprehensive resource for developers working with ARM-based embedded systems. It offers documentation, software development tools, and technical articles covering topics such as microcontroller architectures, programming techniques, and system optimization. 5. Microchip Technology Inc. - Embedded Systems (www.microchip.com/design-centers/embedded-systems) • Microchip Technology provides resources for embedded systems development, including product documentation, application notes, and software libraries. It covers topics such as microcontroller programming, peripheral interfacing, and system design considerations. 6. Stack Overflow (stackoverflow.com

Grading Scheme

Group	Grade	Marks (%)	Definition
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Project Design</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☐ Theory
☐ Lecture
☒ Lab and Meetings
☐ Tutorial
☐ Practical
☒ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC332</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">2</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">50</td></tr>
<tr><td colspan="2">Module Level</td><td>4</td><td colspan="2">Semester of Delivery</td><td>7</td></tr>
<tr><td colspan="2">Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td colspan="2">Project Committee</td><td>e-mail</td><td colspan="2">Yazen.shakir@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>MSc</td></tr>
<tr><td>Module Tutor</td><td colspan="2">All supervisors</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Mohanad Al-Rekany</td><td>e-mail</td><td colspan="2">mohanad.noaman@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The BSc Systems and Control Engineer program provides undergraduate students with the chance to select a project from a range of options within the control department. This allows them to engage in research and enhance their skills in line with fundamental engineering principles and design. Students will undertake a substantial project that necessitates the utilization of professional competencies such as project planning, risk assessment, and management. Presenting a final project report and delivering a presentation will enable students to apply critical analysis, thorough research, and enhance their communication abilities. - prepare for a comprehensive literature review that can plan for an appropriate project for a certain group to add new knowledge - attempt to find an engineering problem or industry problem and use a blend of theoretical plus practical skills and knowledge to solve it - define clear objectives, plan and execute a schedule of work; - employ the critical thinking to assess and find the gap from previous literature - draw a conclusion based on evaluation and analyses results relevant to the aims and objective for this project
Module Learning Outcomes	On completion of this module, the student will be able to: 1. apply engineering reasoning, critical thinking and problem solving; 2. Building up vs Breaking down via performing design and system thinking processes; 3. demonstrate professional skills and attitudes; 4. utilize project and risk management; 5. employ detailed research skills for instance how to use citation and bibliography
Indicative Contents	Indicative content includes the following. Semester 1 (Duration: Approximately 4 months) Month 1: Project Selection and Proposal • Identify potential project topics and areas of interest. • Consult with faculty advisors to finalize the project proposal. Months 2-3: Project Planning and Research • Conduct an in-depth literature review on the chosen topic. • Identify research gaps and define research objectives. • Develop a detailed project plan, including methodologies and timelines. Month 4: Interim Progress Report • Submit an interim progress report outlining the completed research and project plan. • Present the progress to faculty advisors for feedback and suggestions**. [150 Hrs.]**

Learning and Teaching Strategies	
Strategies	1- Clear Project Guidelines: Provide clear and detailed guidelines for the project, including its objectives, scope, deliverables, and evaluation criteria 2- Mentorship and Supervision: Assign experienced mentors or supervisors to guide and support students throughout the project. These mentors can provide valuable insights, offer guidance, and provide constructive feedback to help students navigate the project successfully. 3- Research and Literature Review: Emphasize the importance of conducting thorough research and literature reviews related to the project topic. Teach students effective strategies for finding and critically evaluating relevant sources of information. 4- Workshops and Training Sessions: Conduct workshops or training sessions to enhance students' skills and knowledge related to the project. This can include research methodologies, data analysis techniques, technical skills, project management, and communication skills. 5- Regular Progress Reviews: Schedule regular progress reviews to assess students' progress, identify any challenges they may be facing, and provide timely feedback. These reviews can be conducted individually or in a group setting, depending on the nature of the project. 6- Presentation and Communication Skills 7- Reflection and Critical Thinking: Encourage students to engage in reflection and critical thinking throughout the project. This can involve analyzing and evaluating different perspectives, identifying strengths and weaknesses in their work, and making informed decisions based on evidence and reasoning. 8- Time Management and Planning: Teach students effective time management and planning strategies to help them stay organized and meet project deadlines. Emphasize the importance of setting realistic goals, breaking down the project into manageable tasks, and maintaining a schedule.

Student Workload (SWL)			
Structured SWL (h/sem)	32	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	18	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time / Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Specify Objectives and Aim**	1	10% (10)	4	LO#1 -2
	Project Scope and Plan Report	1	10% (10)	6	
Summative assessment	**Interim Progress Report**	1	20% (20)	14	All
	Interim Progress presentation	1	10% (10)	16	All
Total assessment			50% (50 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Project Title and abstract announcements**
Week 2	**Meeting with supervisors for each project**
Week 3	**Allocating Students Groups to each project title**
Week 4	**Specify Objectives and Aim**
Week 5	Self –Study
Week 6	**Project Scope and Plan Report**
Week 7	**Assigning Literature Review Draft**
Week 8	**Literature Review Corrections**
Week 9	**Literature Review Corrections**
Week 10	Self –Study
Week 11	**Final Submission of Literature Review**
Week 12	Self –Study
Week 13	Self –Study
Week 14	**Interim Progress Report**
Week 15	Self –Study
Week 16	**Interim Progress presentation**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Meeting 1 (0.5 hrs.)
Week 2	Self –Study
Week 3	Self –Study
Week 4	Self –Study
Week 5	Meeting 2 (0.5 hrs.)
Week 6	Meeting 3 (0.5 hrs.)+ health and safety Lecture
Week 7	Meeting 4 (0.5 hrs.)+ risk management
Week 8	Seminar with all groups to listen each other
Week 9	Engineering and research ethics

Week 10	Meeting 4 (0.5 hrs.)
Week 11	Meeting 5 (0.5 hrs.)
Week 12	Meeting 6 (0.5 hrs.)
Week 13	
Week 14	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		
Recommended Texts	**Writing for Engineering and Science Students** *Staking Your Claim* *By Gerald Rau* **Academic Writing for Engineering Publications** *A Guide for Non-native English Speakers* ISBN: 978-3-030-99364-1 *By Zhongchao Tan* **Guide to research projects for engineering students**: **planning, writing and presenting** Author : Heah, Carmel Lee Hsia; Leong, E. C.; Ong, Kenneth Keng Wee publisher = Taylor & Francis ISBN: 978-1-4822-3878-5,1482238780 Year: 2016.	Available online
Websites	https://youtu.be/QAg3GPMUO84 https://www.youtube.com/watch?v=kcPFnOP6Cyw&t=2s https://youtu.be/qMYkpvU-e0c	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information				
Module Title	**Robotics II**		**Module Delivery**	
Module Type	**Core**		☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVEESC327**			
ECTS Credits	**6**			
SWL (hr/sem)	**150**			
Module Level	4		**Semester of Delivery**	8
Administering Department	SCE		**College**	EE
Module Leader	Mohanad Nihad Noaman		**e-mail**	mohanad.noaman@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	MSc
Module Tutor			**e-mail**	E-mail
Peer Reviewer Name	Yazen H Shakir		**e-mail**	Yazen.shakir@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVEESC321	**Semester**	7
Co-requisites module	None	**Semester**	

MODULE DESCRIPTION FORM

Module Information			
Module Title	**Optimal Control II**	**Module Delivery**	
Module Type	**Core**	☒ **Theory** ☐ **Lecture** ☒ **Lab**	
Module Code	**NVEESC322**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		

		☒ Tutorial ☐ Practical ☐ Seminar

Module Level	4	**Semester of Delivery**	8
Administering Department	SCE	**College**	EE
Module Leader	Name: Ibrahim Khalaf Mohammed	**e-mail**	ibrahim.mohammed@uoninevah.edu.iq
Module Leader's Acad. Title	Assistance Professor	**Module Leader's Qualification**	Ph.D.
Module Tutor	Ibrahim Khalaf Mohammed	**e-mail**	ibrahim.mohammed@uoninevah.edu.iq
Peer Reviewer Name	Abdulla I. Abdulla	**e-mail**	Abdulla.abdulla@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	NVEESC322	**Semester**	7
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	❖ learn the basis of optimal control in different applications. ❖ Implement a quadratic controller to stabilize a linear system and to track a state trajectory both in the deterministic case and in the stochastic one. ❖ Apply control techniques that achieve a compromise between the performance and control effort. ❖ Learn suitable optimal control methods for nonlinear systems and uncertain ones.
Module Learning Outcomes	❖ Recognize the difference between the ideal and realized systems. ❖ Formulate mathematical models of practical dynamic systems. ❖ Develop optimal control techniques like LQR, LQT and LQG based on the minimization of cost functional to achieve best performance with minimal control law. ❖ Learn design methods of states estimator systems and apply the estimator techniques to unknown and non-measurable systems. ❖ Design of LQG control system based on Kalman filter for realistic systems subject to noise and disturbances.

Indicative Contents	<u>Part A – Realistics Systems</u> Definition, Concepts, Fundamentals, Noise types, Noise sources, Realistic modeling aspects, State space representation of realistic control problems. **[8 hrs]** <u>Part B – LQG Control Technique</u> LQR control background, Fundamentals and principles of LQR controller, Definition, fundamentals and working principles of LQG, LQG structure, Kalman Filter theory, State estimation definition, fundamentals and principles, **[10 hrs].** <u>Part C – LQG Control Design</u> State estimation techniques, State observer design methods, Direct Comparison method, Observable Canonical method, Ackermann's Formula method, LQR control design, LQG control design, Practical aspects and controller implementation, response analysis **[32 hrs]** <u>Part D – Adaptive Control Systems</u> Definition, Concepts, Fundamentals, Classification, Types of adaptive control techniques, MRAC control technique fundamentals, concept and structure, MRAC design methods, MRAC design using MIT rule, MRAC design using Lyapunnov Theorem method, Practical aspects and controller implementation, Response analysis. **[24 hrs]**

Learning and Teaching Strategies	
Strategies	Create class subgroups to achieve unstructured assignments, activation the interaction between lecturer and students in the class, fast class assignment, blended education, clarify the practical applications of the studying materials, clarify a connection between studying material, organizing scientific visits to related facilities, interactive tutorials by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	8% (10)	5, 13	LO #
	Assignments	2	5% (10)	2, 12	LO #
	Lab.	1	15% (15)	Continuous	
	Report	1	2% (2)	13	LO #
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO #
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to practical systems
Week 2	State space plant representation of noisy systems
Week 3	Introduction to Linear Quadratic Gaussian (LQG) technique
Week 4	LQG optimal control theory
Week 5	State estimation techniques and theory
Week 6	Estimator design methods
Week 7	Estimator design methods
Week 8	LQG optimal control design for noiseless systems
Week 9	LQG optimal control design for noisy systems
Week 10	Introduction to adaptive control system
Week 11	Adaptive control techniques
Week 12	Model Reference Adaptive Control (MRAC) theory
Week 13	MRAC design using MIT rule method – scalar controller
Week 14	MRAC design using MIT rule method – vector controller
Week 15	MRAC design using MIT rule method – scalar and vector controller
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	State space model simulation
Week 2	Interaction between Simulink and Matlab script file
Week 3	Estimator design in Matlab script using observable canonical method
Week 4	Estimator design in Matlab script using Ackermann's formula method
Week 5	Simulation of LQG optimal control system design for second order noiseless system
Week 6	Simulation of LQG optimal control system design for second order noisy system
Week 7	Simulation of LQG optimal control system design for third order noisy system
Week 8	Simulation of MRAC control system design using MIT rule method
Week 9	Simulation of MRAC control system design using Lyapunov Theorem method

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		
Recommended Texts	❖ Robert L. Williams II, Douglas A. Lawrence, " Linear state space Control", JOHN WILEY & SONS, INC, 2007. ❖ Donald E. Krik "Optimal Control Theory An Introduction" Prentice Hall, Inc., New York, 1971. ❖ Desineni S. Naidu, " Optimal Control Systems", *CRC Press*, 2018. ❖ System," John Wiley & Sons. 2A07. P. A. Ioannou and B. Fidan, Adaptive Control Tutorial, SIAM, 2006. ❖ Katsuhiko Ogata, "Modem control engineering", Prentice-Hall, 2010.	
Websites	❖ https://staff.uz.zgora.pl/wpaszke/materialy/kss/lqrnotes.pdf ❖ https://www.eng.newcastle.edu.au/~jhb519/teaching/elec4410/lectures/Lec23.pdf ❖ https://www.google.com/search?sca_esv=5b7f46631c8e9f6c&sxsrf=AHTn8zoNDVzeYSEHJKAjywcWYgk3CduOAA:1745062826790&q=mrac+design&udm=7&fbs=ABzOT_C7w0l20qZ3t7bvFWFnGDtqTJvilJr0_GETQ07emuCG9IrJvWF5gMciulep5BMvljnGBIakyHeQpHqZy3HKj6M01jOq_D5cNebBZvFOXtu90gVZfU1TB74mYGuelD0EG7voEkQ_mvlslQe361opTQew1L0hzB3IqvpNWp3NqVtJPnbfqeMKE8OOPjXCgpOjckIxBbOnCFRAT2d4-aWbpPWdBAcC-3h7RlQ2JwXG81-GuEPhRhYdiTGUeJXHAOOZKwhK-2qP&sa=X&ved=2ahUKEwjX9prPgeSMAxVq_rsIHTSwOu0QtKgLegQIERAB&biw=1536&bih=703&dpr=1.25#fpstate=ive&vld=cid:b0fed46a,vid:qTbN58cmdKY,st:0	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information			
Module Title	Soft Computing	**Module Delivery**	
Module Type	**Basic**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**NVEESC329**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		
Module Level	4	**Semester of Delivery**	8
Administering Department	SCE	**College**	EE
Module Leader	Ahmed M.Basheer	**e-mail**	ahmed.basheer@uoninevah.edu.iq
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	
Module Tutor	Name (if available)	**e-mail**	
Peer Reviewer Name	Mohammad A.Thanoon	**e-mail**	mohammed.alsayed@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Introduction to Soft Computing: The module aims to provide an understanding of the fundamental concepts, principles, and techniques of Soft Computing. It introduces the basic components and characteristics of Soft Computing approaches, such as fuzzy logic, neural networks, evolutionary computing, and probabilistic reasoning. 2. Fuzzy Logic: The module aims to explain the principles and applications of fuzzy logic. It covers topics such as fuzzy sets, fuzzy membership functions, fuzzy rules, fuzzy reasoning, and fuzzy inference systems. The aim is to enable students to apply fuzzy logic techniques to real-world problems and make decisions based on uncertain or imprecise information. 3. Neural Networks: The module aims to introduce the principles and applications of neural networks. It covers topics such as artificial neurons, feedforward and recurrent neural networks, learning algorithms (e.g., backpropagation), and network architectures. The aim is to provide students with the knowledge and skills to design, train, and use neural networks for pattern recognition, prediction, and classification tasks. 4. Evolutionary Computing: The module aims to provide an understanding of evolutionary computing algorithms, such as genetic algorithms, genetic programming, and evolutionary strategies. It covers topics such as encoding schemes, fitness evaluation, selection, crossover, and mutation operators. The aim is to equip students with the ability to apply evolutionary computing techniques to solve optimization and search problems. 5. Probabilistic Reasoning: The module aims to introduce the principles and techniques of probabilistic reasoning, including Bayesian networks and probabilistic graphical models. It covers topics such as probability theory, conditional probability, Bayes' theorem, and inference algorithms. The aim is to enable students to model and reason under uncertainty using probabilistic graphical models. 6. Genetic algorithm : The module aims to introduce the principles and techniques of Genetic algorithm including encoding type and main operation in genetic algorithm .The aim is to enable students to learn different type from research algorithm.
Module Learning Outcomes	1. Knowledge and Understanding: a. Understand the fundamental concepts, principles, and techniques of Soft Computing. b. Explain the characteristics and applications of fuzzy logic, neural networks, evolutionary computing, and probabilistic reasoning. c. Describe the

	advantages and limitations of Soft Computing approaches in solving complex problems. 2. Application and Analysis: a. Apply fuzzy logic techniques to handle uncertain or imprecise information and make decisions. b. Design, train, and utilize neural networks for pattern recognition, prediction, and classification tasks. c. Apply evolutionary computing algorithms to solve optimization and search problems. d. Model and reason under uncertainty using probabilistic graphical models. 3. Problem Solving: a. Identify real-world problems that can be effectively addressed using Soft Computing techniques. b. Select appropriate Soft Computing approaches based on problem requirements and characteristics. c. Implement and evaluate Soft Computing algorithms to solve specific problem instances. d. Interpret and analyze the results obtained from Soft Computing models and algorithms. 4. Critical Thinking: a. Evaluate the strengths and weaknesses of different Soft Computing approaches. b. Critically assess the suitability of Soft Computing techniques for specific problem domains. c. Analyze and compare the performance of different Soft Computing algorithms in solving complex problems. d. Formulate innovative solutions by combining multiple Soft Computing techniques or integrating them with other computational methods. Communication and Collaboration: a. Present and communicate the principles, methodologies, and results of Soft Computing techniques effectively. b. Collaborate with peers to solve problems using Soft Computing approaches in group projects. c. Participate in discussions and debates on the ethical, social, and legal implications of Soft Computing technologies.

Indicative Contents	Indicative content includes the following. 1. Introduction to Soft Computing: • Definition and characteristics of Soft Computing • Comparison with traditional computing approaches • Advantages and limitations of Soft Computing 2. Fuzzy Logic: • Introduction to fuzzy sets and fuzzy logic • Fuzzy membership functions and linguistic variables • Fuzzy logic operations and fuzzy rules • Fuzzy inference systems and Mamdani/ Sugeno models • Applications of fuzzy logic in decision-making and control 3. Neural Networks: • Introduction to artificial neural networks (ANN) • Perceptron model and multilayer feedforward networks • Backpropagation algorithm for training neural networks • Activation functions and network architectures • Applications of neural networks in pattern recognition and prediction 4. Evolutionary Computing: • Introduction to evolutionary computing algorithms • Genetic algorithms and genetic programming • Evolutionary strategies and evolutionary programming • Swarm intelligence and particle swarm optimization • Applications of evolutionary computing in optimization and search problems 5. Probabilistic Reasoning: • Introduction to probabilistic graphical models (PGM) • Bayesian networks and Markov networks • Inference algorithms: variable elimination, belief propagation • Learning in PGMs: parameter estimation and structure learning • Applications of probabilistic reasoning in decision support and uncertainty modeling 6. Hybrid Soft Computing Techniques:

	• Integration of fuzzy logic, neural networks, and evolutionary computing • Fuzzy-neural systems and neuro-fuzzy modeling • Genetic fuzzy systems and fuzzy evolutionary algorithms • Applications of hybrid soft computing techniques in complex problem domains 7. Real-world Applications and Case Studies: • Application examples of Soft Computing techniques in various domains • Case studies illustrating the practical implementation of Soft Computing models • Evaluation and performance assessment of Soft Computing approaches • Ethical, social, and legal considerations in the use of Soft Computing technologies 8. Practical Implementation and Tools: • Software tools and frameworks for implementing Soft Computing techniques • Hands-on exercises and programming assignments using relevant tools • Design and implementation of Soft Computing models for specific problems • Analysis and interpretation of results obtained from Soft Computing experiments.

Learning and Teaching Strategies	
Strategies	1. Conceptual Framework: Start by providing a conceptual framework that explains the principles, theories, and methodologies of Soft Computing. This helps students understand the underlying concepts and develop a solid foundation. 2. Active Learning: Incorporate active learning techniques such as problem-solving exercises, case studies, group discussions, and hands-on projects. This encourages students to actively engage with the material, apply the concepts in practical scenarios, and develop problem-solving skills. 3. Practical Implementation: Emphasize the practical implementation of Soft Computing techniques. Provide opportunities for students to

	implement algorithms, develop models, and analyze real-world datasets using appropriate software tools. This hands-on experience enhances their understanding and reinforces their learning. 4. Real-world Applications: Highlight the diverse applications of Soft Computing in various fields such as pattern recognition, data mining, optimization, control systems, and decision support. Showcase real-world examples and case studies to demonstrate the relevance and effectiveness of Soft Computing techniques. 5. Multimodal Learning Resources: Provide a variety of learning resources including textbooks, lecture notes, research papers, online tutorials, and multimedia materials. This caters to different learning styles and allows students to explore the topic from different perspectives. 6. Assessment Methods: Use a combination of assessment methods to evaluate student learning. This may include quizzes, assignments, projects, presentations, and exams. Incorporate both theoretical understanding and practical implementation aspects in the assessments. 7. Collaborative Learning: Encourage collaborative learning by assigning group projects or problem-solving tasks. This promotes teamwork, communication skills, and the exchange of ideas among students. 8. Guest Lectures and Industry Experts: Invite guest speakers, experts, or practitioners from the industry or academia to share their knowledge and experiences. This provides valuable insights, real-world perspectives, and networking opportunities for students. 9. Feedback and Reflection: Provide timely feedback on student progress and performance. Encourage students to reflect on their learning, identify areas of improvement, and set goals for further development. 10. Continuous Improvement: Continuously evaluate and update the course content and teaching methodologies based on student feedback, emerging trends, and advancements in Soft Computing. This ensures that the module remains relevant and up-to-date.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	8% (10)	5, 13	LO # 1 – 2
	Assignments	2	5% (10)	2, 12	LO # 2 – 3
	Lab.	1	15% (15)	Continuous	
	Report	1	2% (2)	13	LO # 3 – 4
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Soft Computing • Overview of Soft Computing techniques • Comparison with traditional computing methods Fuzzy logic and fuzzy systems
Week 2	Fuzzy Logic and Fuzzy Systems • Fuzzy sets and membership functions • Fuzzy logic operations and inference systems Applications of fuzzy logic
Week 3	Neural Networks • Introduction to artificial neural networks • Perceptron model and learning algorithms Multilayer feedforward networks and backpropagation

Week 4	Neural Networks (continued) • Radial basis function networks • Self-organizing maps Applications of neural networks
Week 5	Genetic Algorithms • Introduction to genetic algorithms • Genetic representation and operators (selection, crossover, mutation) • Fitness evaluation and selection strategies Applications of genetic algorithms
Week 6	Evolutionary Computation • Overview of evolutionary computation • Genetic programming • Evolutionary strategies Particle swarm optimization
Week 7	Mid-term Exam
Week 8	Hybrid Soft Computing Techniques • Integration of fuzzy logic, neural networks, and genetic algorithms • Neuro-fuzzy systems • Fuzzy genetic algorithms Applications of hybrid soft computing techniques
Week 9	Support Vector Machines (SVM), Introduction to Support Vector Machines
Week 10	SVM classification
Week 11	SVM regression
Week 12	Kernel functions
Week 13	Case Studies and Applications Real-world case studies applying soft computing techniques
Week 14	Discussion on current research and trends in soft computing
Week 15	Project work and presentations
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. "Soft Computing: Techniques and Applications" by S. N. Sivanandam and S. N. Deepa • This book provides an introduction to various soft computing techniques such as fuzzy logic, neural networks, and genetic algorithms. It covers their principles, algorithms, and applications.	Yes
Recommended Texts	Soft Computing and Intelligent Systems: Theory and Applications" by Madan M. Gupta and Naresh K. Jain • This book offers a comprehensive overview of soft computing techniques, including fuzzy logic, neural networks, genetic algorithms, and hybrid systems. It covers theoretical concepts and practical applications.	No
Websites	1. IEEE Computational Intelligence Society (www.ieee-cis.org): The Computational Intelligence Society of the Institute of Electrical and Electronics Engineers (IEEE) provides resources, publications, and conferences related to soft computing, neural networks, fuzzy logic, and evolutionary computation. 2. Soft Computing Journal (www.springer.com/journal/500): The Soft Computing journal published by Springer is dedicated to the field of soft computing and its applications. It contains research papers, reviews, and case studies on various soft computing techniques. 3. Fuzzy Logic Toolbox Documentation (www.mathworks.com/help/fuzzy): The MathWorks website provides documentation and examples for the Fuzzy Logic Toolbox, which is a software tool for implementing fuzzy	

	logic systems. It includes tutorials, function references, and application examples. 4. Neurocomputing Journal (www.journals.elsevier.com/neurocomputing): The Neurocomputing journal covers research on neural networks, machine learning, and computational intelligence. It publishes articles related to both theoretical and practical aspects of soft computing. 5. Genetic and Evolutionary Computation Conference (GECCO) (www.sigevo.org/gecco-2022): GECCO is a leading conference in the field of genetic and evolutionary computation. The conference website provides access to research papers, tutorials, and other resources related to evolutionary algorithms and genetic programming. 6. Soft Computing Research Group at UC Berkeley (softcomputing.berkeley.edu): The Soft Computing Research Group at UC Berkeley focuses on research and development of soft computing techniques, including neural networks, fuzzy systems, and evolutionary algorithms. Their website provides information on their projects, publications, and resources.

Grading Scheme

Group	Grade	Marks (%)	Definition
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	108. Enable students to develop capabilities and skills for problem-solving and critical thinking in mobile robot design. 109. To provide an understanding of the fundamental principles of mobile robotics and related concepts. 110. To have knowledge about the different types of locomotion. 111. To understand the kinematics of different mobile robots. 112. To understand common sensors used in mobile robotics. 113. To understand basic control strategies for mobile robots. 114. The module aims to foster teamwork and collaboration skills among students. It includes group projects and activities that require students to work together, communicate effectively, and leverage each other's strengths to achieve common objectives.
Module Learning Outcomes	1. Understand the basic concepts and terminology related to mobile robotics. 2. Skills in the mathematical abstraction and modeling of mobile robots. 3. Identify types of robot locomotion, and drive kinematic models for several kinds of mobile robot. 4. Exploring a broad wide of sensors in many mobile robot applications. 5. Knowledge of how to choose a proper sensor for a certain task. 6. An ability to formulate and apply a control technique on mobile robot motion. Practicing all aforementioned knowledge by delivering assignments.
Indicative Contents	Indicative content includes the following. Definition and scope of mobile robotics, Historical developments and current trends in mobile robotics, Applications of mobile robots in various fields, components of mobile robots, applications. Locomotion, standard wheels, Coordinate frames and transformations, Forward and inverse kinematics of mobile robots, Differential drive and holonomic robots, Exercises No.1 [20 hrs] General form of mobile robot kinematic, Omnidirectional robot case study, Degree of mobility, Degree of steerability, Degree of maneuverability, Exercises No.2, Macnuum mobile robot case study, Classification of Sensors, Characterizing Sensor Performance, Dead reckoning, Time of flight measurements, Active Ranging [20 hrs] Feedback control basics, Proportional-Integral-Derivative (PID) control, Trajectory planning and path following, localization concepts, localization process, localization techniques, Odometry-based localization, Trilateration Localization (Particle Filter), Extended Kalman Filter (EKF) for localization [20 hrs]

Learning and Teaching Strategies	
Strategies	1. Hands-on Projects: Mobile robotics is a field that heavily relies on practical implementation. Incorporate hands-on projects throughout the course to give students the opportunity to design, build, and program their own robots. This approach enhances their understanding of concepts and allows them to apply theoretical knowledge in a real-world context. 2. Simulation and Virtual Labs: Utilize robotics simulation software and virtual labs to provide students with a virtual environment where they can experiment with various robotic systems and algorithms. This strategy allows students to practice without the need for physical hardware and provides a safe space for testing and debugging. 3. Collaborative Learning: Encourage students to work in teams or pairs on robotics projects. 4. Use of Multimedia: Incorporate multimedia resources such as videos, animations, and interactive online materials to supplement lectures and readings. Visual aids can help students better understand complex concepts and algorithms, making the learning experience more engaging and effective. 5. Continuous Assessment and Feedback: Provide regular assessments and feedback to gauge students' understanding and progress. This can be done through quizzes, practical assignments, and project evaluations. Prompt feedback helps students identify areas for improvement and reinforces their learning. 6. Encourage Self-Learning: Provide students with additional resources such as research papers, online tutorials, and books to encourage self-learning. Mobile robotics is a multidisciplinary field, and self-learning allows students to explore specific areas of interest and develop their expertise.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	73	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO # 4
	Assignments	1	10% (10)	10	LO # 3, 1, 5
	Projects / Lab.	1	10% (10)	Continuous	LO # 2
	Report	1	10% (10)	13	LO # 5
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO # 1-5
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Robotics
Week 2	Locomotion: Basics and concepts
Week 3	Locomotion: Wheeled-mobile robot
Week 4	Kinematics of wheeled robots: differential mobile robot
Week 5	Practicing exercises sheet 1
Week 6	Kinematics of wheeled robots: Omni-directional mobile robot
Week 7	Practicing exercises sheet 2
Week 8	Midterm exam
Week 9	Kinematics of wheeled robots: Mecanum mobile robot
Week 10	Sensors: concepts and classifications
Week 11	Sensors: applications
Week 12	Control techniques: basics and formulation
Week 13	Mobile robot feedback control
Week 14	Introduction to Localization
Week 15	Localization techniques
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	**Lab 1:** Introduction to CoppeliaSim Simulation Environment • Installing the open-source software platform • Import objects • Dummy • Move objects • Coordinate system
Week 2	**Lab 2:** Introduction to Differential Drive Robots • Overview of differential drive robot architecture and characteristics

	• Applications and use cases of differential drive robots • Introduction to the mathematical model of differential drive robots
Week 3	**Lab 3:** Robot Modeling in CoppeliaSim • Creating a differential drive robot model in CoppeliaSim • Configuring wheel properties and dimensions • Implementing robot kinematics in the model
Week 4	**Lab 4:** Robot Control for Differential Drive Robots • Introduction to robot control for differential drive robots • Implementing motion control algorithms in CoppeliaSim • Velocity control and wheel synchronization techniques
Week 5	**Lab 5:** Odometry and Localization • Understanding odometry and its importance for differential drive robots • Implementing odometry calculations in CoppeliaSim • Localization techniques for differential drive robots
Week 6	**Lab 6:** Robot Control for Omni-Wheels Robots
Week 7	**Lab 7:** Sensor Integration • Simulation of sensors commonly used in differential drive robots • Integrating sensors such as proximity sensors, wheel encoders, and IMU • Implementing sensor data processing and fusion techniques
Week8	Independent projects

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Introduction to Autonomous Mobile Robots **R. Siegwart, I. R. Nourbakhsh, MIT Press, 2004.**	No
Recommended Texts	Embedded robotics: mobile robot design and applications with embedded systems **Thomas Bräunl, Springer, 2003.**	No
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** – Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D – Satisfactory	60 - 69	Fair but with major shortcomings
	E – Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="4">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Computer Control Systems</td><td>Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td rowspan="4">☒ Theory
☐ Lecture
☐ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEESC330</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">125</td></tr>
</table>

Module Level	4	**Semester of Delivery**	8
Administering Department	SCE	**College**	EE
Module Leader	Omar Yaseen Ismael	**e-mail**	omar.ismael@uoninevah.edu.iq
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	Ph.D.
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Yazen Hudhaifa Sh.	**e-mail**	yazen.shakir@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The Computer Control Systems module aims to provide students with a comprehensive understanding of computer-based control systems and their applications in various industries. Through theoretical study, and simulation exercises, the module aims to achieve the following objectives: • Explore case studies and real-world examples of computer control systems in various industries, such as manufacturing, process control, and robotics. • Gain hands-on experience through projects involving computer control systems. • Develop critical thinking and problem-solving skills: • Apply theoretical knowledge to analyze and solve complex problems related to computer control systems. • Develop the ability to evaluate the performance and efficiency of computer control systems. • Enhance troubleshooting skills for diagnosing and resolving issues in computer control systems.
Module Learning Outcomes	1- Understand the fundamentals of computer control systems: • Define computer control systems and their role in industrial automation. • Explain the advantages and limitations of computer control systems. • Describe the components and architecture of computer control systems. 2- Apply digital control algorithms and techniques: • Implement and tune digital control algorithms, such as PID, MPC, and adaptive control. • Analyze the effects of discretization and quantization on control system performance. • Evaluate the suitability of different control algorithms for specific applications. 3- Implement communication protocols and networks in computer control systems: • Configure and utilize communication protocols like CAN bus, Modbus, Profibus, and Ethernet/IP. 4- Design and implement distributed control systems (DCS): • Understand the principles and advantages of distributed control systems. • Configure and integrate controllers, I/O modules, and HMIs within a DCS. • Develop distributed control strategies and ensure coordinated system operation. 5- Integrate computer control systems with other industrial automation systems: • Integrate control systems with supervisory control and data acquisition (SCADA) systems. • Interact with other automation systems, such as robotics and machine vision systems. • Incorporate control systems into enterprise-level systems for data analysis and decision-making. 6- Address safety and cybersecurity considerations in computer control systems:

	- Apply safety standards and practices, including risk assessment and functional safety. - Implement cybersecurity measures to protect computer control systems from threats. - Identify potential safety and cybersecurity vulnerabilities and propose mitigation strategies. 7- Apply computer control systems in practical applications: - Analyze and apply computer control systems to real-world industrial applications. - Design and configure control systems for specific processes or systems. 8- Demonstrate critical thinking and problem-solving skills: - Analyze complex problems related to computer control systems and propose effective solutions. - Evaluate the performance and efficiency of computer control systems. - Apply troubleshooting techniques to diagnose and resolve issues in computer control systems. 9- Communicate effectively: - Present technical information related to computer control systems clearly and concisely. - Collaborate with peers in group projects and discussions. - Prepare comprehensive reports documenting control system design, implementation, and analysis.
Indicative Contents	

Learning and Teaching Strategies	
Strategies	1- Lectures: Instructor-led lectures provide students with a theoretical foundation and an overview of key concepts, principles, and techniques in process control. Lectures may incorporate multimedia presentations, visual aids, and real-world examples to enhance understanding. 2- Practical Demonstrations: Hands-on practical demonstrations allow students to observe and understand the operation of control system components, sensors, actuators, and controllers. Demonstrations can help bridge the gap between theory and practice, enhancing students' understanding of the course material. 3- Case Studies: The use of case studies enables students to analyze and solve real-world process control problems encountered in various industries. Case studies encourage students to apply their knowledge to practical situations, promoting problem-solving skills and critical thinking. 4- Group Discussions: Group discussions facilitate peer-to-peer learning and collaboration. Students can discuss complex topics, exchange ideas, and solve problems together, fostering a deeper understanding of process control concepts and principles. 5- Assignments and Projects: Assignments and projects enable students to apply their learning independently. They may involve designing control systems, analyzing system performance, troubleshooting issues, or conducting research on advanced topics. Assignments and projects foster critical thinking, problem-solving skills, and research abilities.

	6- Online Resources: Supplemental online resources, such as interactive simulations, video tutorials, and e-learning platforms, can be used to enhance students' understanding and provide additional self-study materials. These resources offer flexibility and accessibility, allowing students to review and reinforce their learning outside of class. 7- Assessments: Various forms of assessments, including quizzes, tests, laboratory reports, and project evaluations, are used to gauge students' understanding and progress. Assessments provide feedback to students and help instructors evaluate the effectiveness of their teaching methods.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	77	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Computer Control Systems • Definition and significance of computer control systems • Comparison of computer systems to traditional control systems • Components and architecture of computer control systems
Week 2	Sensors and Actuators • Identify and describe the roles and functions of sensors, transducers, actuators, and control valves in control systems.
Week 3	Digital Control Algorithms: • Overview of digital control algorithms (PID) • Implementation and tuning
Week 4	• System Integration and Interfacing • Interfacing control systems with sensors, actuators, and peripheral devices

	• Data acquisition and signal conditioning techniques • Integration of external devices and subsystems with control systems
Week 5	Communication Protocols and Networks • Communication protocols in computer control systems (Modbus, Profibus, Ethernet/IP) CAN Bus
Week 6	Industrial Networking and Communication • Fieldbus systems (Profibus, Foundation Fieldbus) • Industrial Ethernet protocols (Ethernet/IP, PROFINET) • Configuration and troubleshooting of industrial network
Week 7	Distributed Control Systems (DCS) • Principles and advantages of distributed control systems • Configuration and integration of controllers, I/O modules, and HMIs within a DCS • Development of distributed control strategies and coordinated system operation
Week 8	Integration with Other Automation Systems • Integration of control systems with supervisory control and data acquisition (SCADA) systems • Integration with enterprise-level systems for data analysis and decision-making
Week 9	Human-Machine Interface (HMI) Design and Implementation • Principles of HMI design for control systems • Visualization and interaction with control system data • Configuration and implementation of HMIs using industry-standard software
Week 10	Advanced Control Techniques • Model predictive control (MPC) principles and implementation
Week 11	Advanced Control Techniques: • Optimization and advanced algorithms for control system performance improvement
Week 12	Safety and Cybersecurity in Computer Control Systems • Safety standards and practices in computer control systems • Risk assessment and functional safety considerations • Cybersecurity measures to protect computer control systems
Week 13	Fault Diagnosis and Failure Analysis • Techniques for fault detection and diagnosis in control systems • Failure analysis and troubleshooting methodologies • Maintenance strategies for computer control systems
Week 14	Practical Applications and Case Studies • Case studies of computer control system applications in various industries • Analysis of real-world scenarios and implementation challenges • Evaluation of control system performance and optimization techniques
Week 15	Project Work and Presentations • Group projects applying computer control systems to practical scenarios • Preparation and delivery of presentations on project outcomes • Final assessment and review of module content
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Multiple books	No
Recommended Texts	Multiple books	No
Websites	https://www.uio.no/studier/emner/matnat/fys/FYS3240/v22/lectures_pdf/	

Grading Scheme			
Group	Grade	Marks (%)	Definition
Success Group (50 - 100)	**A** – Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C – Good	70 – 79	Sound work with notable errors
	D – Satisfactory	60 – 69	Fair but with major shortcomings
	E – Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Modern Control Systems</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☒ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC322</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td colspan="2">Module Level</td><td>4</td><td colspan="2">Semester of Delivery</td><td>8</td></tr>
<tr><td colspan="2">Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td colspan="2">Abdullah Ibrahim Abdullah</td><td>e-mail</td><td colspan="2">Abdullah.abdullah@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Assistant Professor</td><td colspan="2">Module Leader’s Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">/</td><td>e-mail</td><td colspan="2">/</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>/</td><td>e-mail</td><td colspan="2">/</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC315</td><td>Semester</td><td>5</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	➢ To explain the concepts of state variables analysis. To explain the concepts of basic and modern control system for the real time analysis and design of control systems.
Module Learning Outcomes	**Upon completion of this course, students should be able to:** 1. Various terms of basic and modern control system for the real time analysis and design of control systems. 2. To perform state variables analysis for any real time system. 3. Apply the concept of optimal control to any system. 4. Able to examine a system for its stability, controllability, and observability. 5. Implement basic principles and techniques in designing linear control systems. 6. Formulate and solve deterministic optimal control problems in terms of performance indices. Apply knowledge of control theory for practical implementations in engineering and network analysis.

Indicative Contents	**Indicative content includes the following.** **1- State Variable Analysis: [12 hours]** Introduction, concept of state, state variables and state model, State Variable Models from differential equation, Simulation Diagrams, State-Variable Models from Transfer Function, State space representation using physical variables, phase variables & canonical variables, Transfer Functions from State-Variable Models **2-Solution of State Equation: [10 hours]** Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method **3- Diagonal Canonical Form: [10 hours]** Distinct Real Roots, Complex Conjugate Roots, Multiple Real Roots (Jordan canonical form, **4- Similarity Transformation: [12 hours]** Similarity Transformation, Characteristic Equations, Diagonal Canonical from a State Model, Similarity Transformation of the Control Canonical Form Controllability, Similarity Transformation of the Observer Canonical Form, Controllability Tests, Observability, Observability Tests, Frequency Domain Tests. **5-State Feedback Controllers and Observers: [12 hours]** Stability, Stability in State Space. State feedback controller design through Pole Assignment, using Ackerman's formula– State observers: Full order and Reduced order observers.

Learning and Teaching Strategies	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	8% (10)	5, 13	LO #1, 2, 6,7
	Assignments	2	5% (10)	2, 12	LO # 3, 4, 6 and 7
	Lab.	1	15% (15)	Continuous	
	Report	1	2% (2)	13	LO # 5, 6 and 7
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-5
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**State Variable Analysis** Introduction, concept of state, state variables and state model
Week 2	State Variable Models from differential equation, Simulation Diagrams
Week 3	State-Variable Models from Transfer Function, State space representation using physical variables, phase variables
Week 4	Canonical variables, Transfer Functions from State-Variable Models
Week 5	**Solution of State Equation:** Solution of state equation, state transition matrix
Week 6	computation using Laplace transformation, power series method
Week 7	**Diagonal Canonical Form** Distinct Real Roots
Week 8	Mid Exam
Week 9	Multiple Real Roots, Complex Conjugate Roots (Jordan canonical form)
Week 10	**Similarity Transformation** Similarity Transformation, Characteristic Equations (Eigen value & Eigenvector)
Week 11	Diagonal Canonical from a State Model, Similarity Transformation of the Control Canonical Form
Week 12	Similarity Transformation of the Observer Canonical Form, Controllability Tests, Observability, Observability Tests, Frequency Domain Tests
Week 13	**State Feedback Controllers and Observers**

	Frequency Domain Tests, Stability, Stability in State Space, Pole Assignment, using Ackerman’s formula
Week 14	State observers: Full order
Week 15	Reduced order observers.
Week 16	**Final exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to ACS Lab.
Week 2	Lab 2: State Variable Models from Differential Equation
Week 3	Lab 3: Simulation Diagram of Control Canonical Form
Week 4	Lab 4: Simulation Diagram of Observable Control (OCF)
Week 5	Lab 5: Diagonal Canonical Form
Week 6	Lab 6: Jordan Canonical Form
Week 7	Lab 7: Similarity Transformation Control Canonical Form
Week 8	Lab 8: Similarity Transformation Observable Canonical Form
Week 9	Mid Exam
Week 10	Lab 10: Diagonalization based on Vander-monde Matrix
Week 11	Lab 11: Jordan Canonical Form based on Vander monde Matrix
Week 12	Lab 12: Determination of Eigen Values from State Model & Stability Analysis
Week 13	Lab 13: Pole Assignment, using Direct Substitution Method
Week 14	Lab 14: Pole Assignment, using Ackerman's Formula
Week 15	Lab 15: Pole Assignment, using Transformation Matrix
Week 16	Final exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	**Modern Control Engineering,** By Katsuhiko Ogata, University of Minnesota, 5th Edition, 2010.	Yes
Recommended Texts	**Automatic Control Systems**, By Farid Golnaraghi, Benjamin C. Kuo, 9th Edition, 2010.	Yes
Websites		

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** – Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C – Good	70 – 79	Sound work with notable errors
	D – Satisfactory	60 – 69	Fair but with major shortcomings
	E – Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

Module Information			
Module Title	**Project Implementation**	**Module Delivery**	
Module Type	**Core**	☐ Theory ☐ Lecture ☒ Lab and Meetings ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	**NVEESC333**		
ECTS Credits	**2**		
SWL (hr/sem)	**50**		
Module Level	4	**Semester of Delivery**	8
Administering Department	SCE	**College**	EE
Module Leader	Project Committee	**e-mail**	Yazen.shakir@uoninevah.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	All supervisors	**e-mail**	E-mail
Peer Reviewer Name	Mohanad Al-Rekany	**e-mail**	mohanad.noaman@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The BSc Systems and Control Engineer program provides undergraduate students with the chance to select a project from a range of options within the control department. This allows them to engage in research and enhance their skills in line with fundamental engineering principles and design. Students will undertake a substantial project that necessitates the utilization of professional competencies such as project planning, risk assessment, and management. Presenting a final project report and delivering a presentation will enable students to apply critical analysis, thorough research, and enhance their communication abilities. - prepare for a comprehensive literature review that can plan for an appropriate project for a certain group to add new knowledge - attempt to find an engineering problem or industry problem and use a blend of theoretical plus practical skills and knowledge to solve it - define clear objectives, plan and execute a schedule of work; - employ the critical thinking to assess and find the gap from previous literature - draw a conclusion based on evaluation and analyses results relevant to the aims and objective for this project
Module Learning Outcomes	On completion of this module, the student will be able to: 1. apply engineering reasoning, critical thinking and problem solving; 2. Building up vs Breaking down via performing design and system thinking processes; 3. demonstrate professional skills and attitudes; 4. utilize project and risk management; 5. employ detailed research skills for instance how to use citation and bibliography
Indicative Contents	Indicative content includes the following. Semester 1 (Duration: Approximately 4 months) Month 1: Project Selection and Proposal • Identify potential project topics and areas of interest. • Consult with faculty advisors to finalize the project proposal. Months 2-3: Project Planning and Research • Conduct an in-depth literature review on the chosen topic. • Identify research gaps and define research objectives. • Develop a detailed project plan, including methodologies and timelines. Month 4: Interim Progress Report • Submit an interim progress report outlining the completed research and project plan. • Present the progress to faculty advisors for feedback and suggestions**. [150 Hrs.]**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	9- Clear Project Guidelines: Provide clear and detailed guidelines for the project, including its objectives, scope, deliverables, and evaluation criteria 10- Mentorship and Supervision: Assign experienced mentors or supervisors to guide and support students throughout the project. These mentors can provide valuable insights, offer guidance, and provide constructive feedback to help students navigate the project successfully. 11- Research and Literature Review: Emphasize the importance of conducting thorough research and literature reviews related to the project topic. Teach students effective strategies for finding and critically evaluating relevant sources of information. 12- Workshops and Training Sessions: Conduct workshops or training sessions to enhance students' skills and knowledge related to the project. This can include research methodologies, data analysis techniques, technical skills, project management, and communication skills. 13- Regular Progress Reviews: Schedule regular progress reviews to assess students' progress, identify any challenges they may be facing, and provide timely feedback. These reviews can be conducted individually or in a group setting, depending on the nature of the project. 14- Presentation and Communication Skills 15- Reflection and Critical Thinking: Encourage students to engage in reflection and critical thinking throughout the project. This can involve analyzing and evaluating different perspectives, identifying strengths and weaknesses in their work, and making informed decisions based on evidence and reasoning. 16- Time Management and Planning: Teach students effective time management and planning strategies to help them stay organized and meet project deadlines. Emphasize the importance of setting realistic goals, breaking down the project into manageable tasks, and maintaining a schedule.

Student Workload (SWL)			
Structured SWL (h/sem)	32	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	18	**Unstructured SWL (h/w)**	1
Total SWL (h/sem)	50		

Module Evaluation					
		Time / Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Specify Objectives and Aim**	1	10% (10)	4	LO#1 -2
	Project Scope and Plan Report	1	10% (10)	6	
Summative assessment	**Interim Progress Report**	1	20% (20)	14	All
	Interim Progress presentation	1	10% (10)	16	All
Total assessment			50% (50 Marks)		

Delivery Plan (Weekly Syllabus)m,msj	
cxscacx	**Material Covered**
Week 1	**Project Title and abstract announcements**
Week 2	**Meeting with supervisors for each project**
Week 3	**Allocating Students Groups to each project title**
Week 4	**Specify Objectives and Aim**
Week 5	Self –Study
Week 6	**Project Scope and Plan Report**
Week 7	**Assigning Literature Review Draft**
Week 8	**Literature Review Corrections**
Week 9	**Literature Review Corrections**
Week 10	Self –Study
Week 11	**Final Submission of Literature Review**
Week 12	Self –Study
Week 13	Self –Study
Week 14	**Interim Progress Report**
Week 15	Self –Study
Week 16	**Interim Progress presentation**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Meeting 1 (0.5 hrs.)
Week 2	Self –Study
Week 3	Self –Study
Week 4	Self –Study
Week 5	Meeting 2 (0.5 hrs.)
Week 6	Meeting 3 (0.5 hrs.)+ health and safety Lecture
Week 7	Meeting 4 (0.5 hrs.)+ risk management
Week 8	Seminar with all groups to listen each other

Week 9	Engineering and research ethics
Week 10	Meeting 4 (0.5 hrs.)
Week 11	Meeting 5 (0.5 hrs.)
Week 12	Meeting 6 (0.5 hrs.)
Week 13	
Week 14	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		
Recommended Texts	**Writing for Engineering and Science Students** *Staking Your Claim* *By Gerald Rau* **Academic Writing for Engineering Publications** *A Guide for Non-native English Speakers* ISBN: 978-3-030-99364-1 *By Zhongchao Tan* **Guide to research projects for engineering students: planning, writing and presenting** Author : Heah, Carmel Lee Hsia; Leong, E. C.; Ong, Kenneth Keng Wee publisher = Taylor & Francis ISBN: 978-1-4822-3878-5,1482238780 Year: 2016.	Available online
Websites	https://youtu.be/QAg3GPMUO84 https://www.youtube.com/watch?v=kcPFnOP6Cyw&t=2s https://youtu.be/qMYkpvU-e0c	

Grading Scheme			
Group	**Grade**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.