MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	**Mathematics I**	**Module Delivery**	
Module Type	**Basic**	☒**Theory** ☐**Lecture** ☐**Lab** ☒**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	**NVEE206**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		
Module Level	1	**Semester of Delivery**	1
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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	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. 3. Solve optimization problems, including finding maxima and minima, using differentiation. 4. Differentiate trigonometric, exponential, logarithmic, and inverse trigonometric functions accurately and efficiently. 5. Apply definite integration to find areas, volumes, and lengths in engineering applications. 6. Analyze functions and curves using differentiation and integration, including determining concavity, points of inflection, and intervals of increase and decrease. 7. Solve engineering problems involving differential equations, including first-order linear equations. 8. Apply calculus concepts and techniques to model and solve real-world engineering problems.

	9. Develop critical thinking and problem-solving skills by applying calculus principles to practical engineering scenarios. 10. Communicate mathematical ideas and solutions clearly and effectively, both orally and in written form.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Review of Vectors:</u> i) Representation of vectors in space (i;j;k) unit vectors. ii) Scalar product iii) Vector product. [4 hrs] <u>Review of Complex Numbers:</u> i) The Argand diagram. ii) Addition; Subtraction; Product; Quotient; power and roots. Iv) Demoiver's Theorem. [4hrs] <u>MATRICES AND DETERMINANTS:</u> i) Definitions ii) Properties. iii) Inverse of a matrix iv) Solution of Equations (Cramer's rule) and Elementary Row Operation. [12hrs] <u>DIFFERENTIATION:</u> Techniques of differentiation; Chain rule; Implicit differentiation; Higher order differentiation; Applications of differentiation; maxima and minima; Curve plotting; Differentiation of trigonometric functions. [12hrs] <u>TRANSCENDENTAL FUNCTIONS:</u> 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] <u>Review and Applications of Integral:</u> i) Volumes of revolution. ii) Length of the curve. iii) Surface area of revolution. [12hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	58	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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 7
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 7, 8, 9 and 10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-3,6-10
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</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">Basic</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">6</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">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">System and Control Eng.</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>
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<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</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>

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims
أهداف المادة الدراسية</td><td>1. To develop problem solving skills and understanding of circuit theory through the application of techniques.
2. To understand voltage, current and power from a given circuit.
3. This course deals with the basic concept of electrical circuits.
4. To understand Kirchhoff's current and voltage Laws problems.
5. To perform mesh and Nodal analysis.
6. To perform Thevenin's and Norton theorems).</td></tr>
<tr><td>Module Learning Outcomes

مخرجات التعلم للمادة الدراسية</td><td>1. Recognize how electricity works in electrical circuits.
2. List the various terms associated with electrical circuits.
3. Summarize what is meant by a basic electric circuit.
4. Discuss the reaction and involvement of atoms in electric circuits.
5. Describe electrical power, charge, and current.
6. Define Ohm's law.
7. Identify the basic circuit elements and their applications.
8. Explain the two Kirchoff's laws used in circuit analysis.</td></tr>
<tr><td>Indicative Contents
المحتويات الإرشادية</td><td>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]</td></tr>
</table>

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	88	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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
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	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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 (Voltage and Current division)
Week 5	Resistors in series, parallel and Delta-Star conversion
Week 6	Review of Kirchhoff's Laws: Kirchhoff's current law, Kirchhoff's voltage law
Week 7	Methods of Analysis:(Mesh Circuit analysis and super mesh)
Week 8	Methods of Analysis:(Nodal Circuit analysis and super node)
Week 9	Mid-term Exam
Week 10	D.C. Circuit Theorems (Linearity and Superposition)
Week 11	D.C. Circuit Theorems (Thevenin's theorems)
Week 12	D.C. Circuit Theorems (Norton theorems)
Week 13	D.C. Circuit Theorems (source transformation and Maximum power transfer)
Week 14	Thevenin's Special Case (Depended Sources)
Week 15	Norton Special Case (Depended Sources)
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction to Agilent VEE and PSPICE
Week 2	Lab 2: Kirchhoff's Laws D.C. Circuit Theorems
Week 3	Lab 3: Mesh D.C. Circuit Theorem
Week 4	Lab 4: Nodal D.C. Circuit Theorem
Week 5	Lab 5: Linearity and Superposition
Week 6	Lab 6: Thévenin's / Norton's D.C. Circuit Theorems
Week 7	Lab 7: Maximum power transfer D.C. Circuit Theorems

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات				
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<tr><td>Module Title</td><td colspan="3">Physics of Semiconductors</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">NVEE219</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><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>Azam Adnan Al-kubaa</td><td>e-mail</td><td colspan="3">azam6706@gmail.com</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>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Mohammed A.Thanoon</td><td>e-mail</td><td colspan="3">mohammed.alsayed@uoninevah.edu.iq</td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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.

مخرجات التعلم للمادة الدراسية	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. 7. Communication and Collaboration: Students will effectively communicate their ideas, analysis, and design solutions related to electronic circuits. They will be able to present their findings and conclusions in a clear and concise manner. Students will also demonstrate the ability to collaborate with peers in group projects and effectively contribute to the team's goals
Indicative Contents المحتويات الإرشادية	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. Field-Effect Transistors (FETs): • MOSFET and JFET structure and operation • FET modes: cutoff, triode, and saturation • FET models and characteristics • Common source, common gate, and common drain configurations 5. Electronic Circuits Analysis: • Circuit analysis techniques: Kirchhoff's laws and nodal analysis • Amplifier circuits: common emitter, common collector, and common base configurations 6. 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 7. Principle of operation and characteristics of Photoconductive • Solar cell construction and characteristics and applications

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	76	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	• Introduction to Semiconductor Physics • Atomic structure and energy bands • Doping in semiconductor • Charged particles
Week 2	• Intrinsic and extrinsic semiconductors • Carrier generation, recombination, and transport • Field effect intensity • Potential energy
Week 3	• PN junction in equilibrium

	• PN Junction characteristics
Week 4	• Basic theory and analysis of simple diode circuit • Diode operation and characteristics • Diode models and equivalent circuits • Types of diodes
Week 5	• Diode applications • Circuit analysis of half wave and full wave rectifiers • Bridge rectifier
Week 6	• Types of filters; C filters , L filter ,L .C. filter, PIE filter; Analysis of filter • Calculation of ripple and regulation • DC power supply
Week 7	• Clippers and clamping circuits analysis and applications • limiters circuits analysis and applications • Diode logic gates
Week 8	• Mid-term Exam
Week 9	• Special Diodes • Zener diodes: characteristics and applications • Light-emitting diodes (LEDs): working principles and applications
Week 10	• Bipolar Junction Transistors (BJTs) • BJT structure and operation • Current and voltage analysis
Week 11	• Collector characteristic curves • BJT modes: active, cutoff, and saturation • DC load line
Week 12	• BJT models and amplification principles • Diode transistor logic gate (DTL)
Week 13	• Field-Effect Transistors (FETs) • MOSFET and JFET structure and operation
Week 14	• FET modes: cutoff, triode, and saturation • FET models and characteristics
Week 15	• Principle of operation and characteristics of Photoconductive • Solar cell construction and characteristics and applications
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	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	• Mid-term Exam
Week 9	• Clipping and Clamping circuits
Week 10	• Zener diode characterization and measurements: breakdown voltage and regulation • Verification of Zener diode behavior
Week 11	• Design regulation circuits using Zener diode
Week 12	• (BJT) Transistor characterization and measurements
Week 13	• Final project: Design and implementation of a simple electronic system
Week 14	• Integration of various electronic components and circuits into a functional system

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. "Principles of Electronics" by V. K. Mehta and Rohit Mehta - This comprehensive textbook covers the fundamental principles of electronics, including electronic components, circuits, and applications.	
Recommended Texts	1. 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. 2. "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. 3. "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, as well as MOSFETs and bipolar junction transistors. 4. "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. 4. YouTube - Numerous YouTube channels, such as "ElectroBOOM" and "GreatScott!", offer educational videos on electronics, providing practical demonstrations, explanations, and DIY projects.	

Grading Scheme
مخطط الدرجات

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

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية				
Module Title	**Computer Science and Programming**		**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	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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Introduction to Computers: Introduce students to the basic components of a computer system, including hardware, and software. 2. Computer Architecture: Provide an overview of the internal structure of a computer, including the CPU, memory, storage devices, and input/output devices. 3. Operating Systems: Familiarize students with different types of operating systems, their functions, and how they manage computer resources. 4. Software Applications: Explore common software applications, such as word processors, presentation and spreadsheets software, and their practical uses. 5. Computer Security: Introduce students to the basics of computer security, including common threats, vulnerabilities, and best practices for securing computer systems. 6. Internet and Web Browsers: Understanding the Internet and its components, Web browsers and their features, navigating websites, and using search engines effectively. 7. Programming and Programming Languages: Introduction to Programming, Programming Languages history, program development steps, and classification of programming languages.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Introduction to Computers: • Identify and describe the basic components of a computer system, including hardware and software. 2- Computer Architecture: • Explain the internal structure of a computer, including the CPU, memory, storage devices, and input/output devices. • Understand the function and operation of each component in the computer architecture. • Analyze the relationship between hardware and software in a computer system. 3- Operating Systems: • Define the concept of an operating system and its role in managing computer resources. • Compare and contrast different types of operating systems, such as Windows, macOS, Linux, and mobile operating systems. 4- Software Applications: • Identify and describe common software applications used in various domains, such as word processors, presentation software, and spreadsheets. • Demonstrate proficiency in using software applications to perform practical tasks, such as creating documents, presentations, and spreadsheets.

	5- Computer Security: • Recognize common computer security threats and vulnerabilities, such as malware, phishing, and social engineering. • Explain basic principles and best practices for securing computer systems and data. • Apply appropriate security measures to protect computer systems from unauthorized access and attacks. 6- Internet and Web Browsers: • Understanding the Internet and its components • Web browsers and their features • Navigating websites and using search engines effectively 7- Programming and Programming Languages: • Understand the fundamentals of programming and its importance in solving problems and creating software. • Trace the history and evolution of programming languages and their impact on software development. • Identify and classify programming languages based on their characteristics and paradigms.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Basics of Computers Fundamentals - Introduction to the basic components of a computer system, including hardware, and software. Computer Architecture: an overview of the internal structure of a computer, including the CPU, memory, storage devices, and input/output devices. [8 hrs] Computer Operating Systems - Introduction to operating systems, their functions, types, and how to manage computer resources, MSDOS operating system, Windows operating system, Windows desktop, changing settings, starting programs, Using the Windows control panel. [16 hrs] Part B – Application Software Introduction to word processing software (Microsoft Word, Google Docs), Creating and formatting documents, Managing text, fonts, and styles. Introduction to presentation software (Microsoft PowerPoint, Google Slides), Creating and formatting slides, Adding multimedia elements. Introduction to spreadsheet software (Microsoft Excel, Google Sheets), Working with cells, rows, and columns, Formulas and functions. [20 hrs]

	<u>Part C – Computer Security and Internet</u> Overview of common security threats: Password management and best practices, Protecting personal information online. Internet and Web Browsers: Understanding the Internet and its components, Web browsers and their features, navigating websites and using search engines effectively. [8 hrs] <u>Part D – Introduction to Programming</u> Introduction to Programming, Programming Languages History, program development steps, and Classification of programming languages. [4 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	76	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 12	LO #1-7
	Assignments	1	10% (10)	14	LO # 3, 4, 6 and 7
	Projects / Lab	14	15% (15)	Continuous	
	Report	1	5% (5)	13	LO # 3,4,5,6 and7
Summative assessment	**Midterm Exam**	4 hr	10% (10)	8	LO # 1-7
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to the basic components of a computer system
Week 2	overview of the internal structure of a computer
Week 3	Introduction to operating systems
Week 4	Overview of MSDOS operating system, MSDOS internal commands
Week 5	Overview of Windows operating system
Week 6	Windows desktop, changing settings, starting programs
Week 7	Using the Windows control panel
Week 8	**Midterm Exam**
Week 9	Introduction to word processing software (Microsoft Word, Google Docs)
Week 10	Introduction to presentation software (Microsoft PowerPoint, Google Slides)
Week 11	Introduction to spreadsheet software (Microsoft Excel, Google Sheets) 1
Week 12	Introduction to spreadsheet software (Microsoft Excel, Google Sheets) 2
Week 13	Computer Security and Privacy
Week 14	Internet and Web Browsers
Week 15	Introduction to the Programming
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: The Components of a computer system 1
Week 2	Lab 2: The Components of a computer system 2
Week 3	Lab 3: Computer operating systems
Week 4	Lab 4: MS-DOS Commands
Week 5	Lab 5: Installation of Windows operating system
Week 6	Lab 6: Windows Desktop
Week 7	Lab 7: Windows control panel
Week 8	**Midterm Exam**
Week 9	Lab 8: Using Microsoft Word 1
Week 10	Lab 9: Using Microsoft Word 2
Week 11	Lab 10: Using Microsoft PowerPoint
Week 12	Lab 11: Using Microsoft Excel 1
Week 13	Lab 12: Using Microsoft Excel 2
Week 14	Lab 13: Using Internet and Web Browsers
Week 15	**Preparatory week before the final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1- Fundamentals of Computers by Reema Thareja, Second edition 2- "Computer Science: An Overview" by J. Glenn Brookshear and Dennis Brylow	No
Recommended Texts	"Computer Fundamentals and Office Applications" by Gary B. Shelly, Misty E. Vermaat, and Susan L. Sebok	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering.	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</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="4">☒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">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</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">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>

<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</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>

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims

أهداف المادة الدراسية</td><td>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.</td></tr>
<tr><td>Module Learning Outcomes

مخرجات التعلم للمادة الدراسية</td><td>1. Knowing of Newton's laws of motion and gravitation and their universal applications and their applications in public life and industrial life.
2. Knowing of coordinate systems and how to use them in force analysis.
3. Knowing of unit systems used globally and how to convert from one system to another.
4. 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.
5. 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.
6. 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.</td></tr>
</table>

	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, and solve some of the related problems to it to enable understanding of the subject. 8. Learn how to find the centers of bodies (masses, weights, lengths, areas and volumes), know its importance and applications, and know the centers of common geometric shapes, and solve some of the related problems to it to enable understanding of the subject. 9. Learn how to find the moment of inertia for areas and masses, know their properties, types, forms and units of measurement, how to find the radius of gyration of th bodies, how to transfer the moment of inertia from one axis to another, and know the moment of inertia for some planer and solid shapes and some homogeneous masses, and solve some of the related problems to it to enable understanding of the subject.
Indicative Contents المحتويات الإرشادية	- **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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	58	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	67	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.78
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	10% (20)	3, 6, 9,12 ,13	LO #4, 5, 6, 7 and 8
	Assignments	2	10% (10)	1, 9	LO # 1 and 6
	Projects / Lab.				
	Report	1	10% (10)	15	LO # 9
Summative assessment	**Midterm Exam**	2 hr	10% (10)	10	LO # 1-6
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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MODULE DESCRIPTION FORM

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<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="2">Democracy and Human Rights</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Support</td><td colspan="3" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NV12</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">1</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">25</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">Husham swadi hashim</td><td>e-mail</td><td colspan="2">Husham.hashim@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>PHD</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>
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<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 حفيقي 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 مخرجات التعلم للمادة الدراسية	1 – ترسيخ قيم الحرية والمساواة في اسس المشاركة الفعلية في بناء المجتمع 2 – العمل على بناء بيءة حقيبية مستقرة من خلال تطبيق القوانين ضمن مجتمع ديمقراطي 3 – والسعي لتوفير اسس لحماية الافراد ضمن المجتمعات الديمقراطية
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	16	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	1
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	9	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	0.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	25		

Module Evaluation
تقييم المادة الدراسية

		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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 الدبمقراطية
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts		Yes
Recommended Texts		No
Websites		

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Mathematics II</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Basic</td><td colspan="2" rowspan="5">☒Theory
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☐Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEE207</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>
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<tr><td>Module Level</td><td colspan="2">1</td><td colspan="2">Semester of Delivery</td><td>2</td></tr>
<tr><td>Administering Department</td><td colspan="2">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>Module Leader’s Acad. Title</td><td colspan="2">Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</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>Peer Reviewer Name</td><td colspan="2">Ismael Khudhair Abdullah</td><td>e-mail</td><td colspan="2">ismael.abdullah@uoninevah.edu.iq</td></tr>
<tr><td>Scientific Committee Approval Date</td><td colspan="2">01/06/2023</td><td colspan="2">Version Number</td><td>1.0</td></tr>
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العلاقة مع المواد الدراسية الأخرى</th></tr>
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<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Develop a deep understanding of advanced integration techniques, including trigonometric substitutions, partial fractions, integration by parts, and further substitutions. 2. Comprehend the principles of vector calculus, including the del operator, gradient, divergence, and curl, and their applications in system and control engineering. 3. Familiarize students with polar and cylindrical coordinate systems and their graphical representations. 4. Explore the convergence of sequences and series, including tests for monotonicity and convergence, and the analysis of alternating series. 5. Introduce power series and Taylor series expansions for functions, enabling students to approximate functions and study their properties. 6. 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 مخرجات التعلم للمادة الدراسية	1. Demonstrate a comprehensive understanding of advanced integration techniques and apply them effectively to solve a variety of integrals. 2. Apply vector calculus principles, such as the del operator, gradient, divergence, and curl, to analyze vector fields in system and control engineering applications. 3. Interpret and manipulate equations in polar and cylindrical coordinates, and graphically represent functions in these coordinate systems. 4. Analyze the convergence properties of sequences and determine convergence or divergence using appropriate tests. 5. Apply various tests for series convergence and divergence, including geometric series, nth partial sum, and alternating series tests. 6. Construct power series representations and Taylor series expansions for functions, enabling accurate function approximation and analysis. 7. Solve engineering problems involving advanced integration techniques, vector calculus, sequences, and series. 8. Utilize mathematical reasoning and critical thinking skills to analyze and interpret mathematical concepts and their applications in system and control

	engineering. 9. Develop proficiency in mathematical problem-solving, both independently and collaboratively, and communicate solutions effectively. 10. Demonstrate an awareness of the limitations and assumptions involved in using mathematical models and methods in system and control engineering. 11. Reflect on the ethical and professional implications of applying calculus concepts and techniques in engineering contexts.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	58	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 9, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 5, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 8, 9 and 11
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1,2,9-11
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">AC Circuits Analysis</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">NVEE216</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><td>Module Level</td><td>1</td><td colspan="3">Semester of Delivery</td><td>2</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>Nashwan Z. Hero</td><td>e-mail</td><td colspan="3">Nashwan.hero@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="3">Module Leader’s Qualification</td><td></td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Thakwan Akram jawad</td><td>e-mail</td><td colspan="3">thakwan.jawad@uoninevah.edu.iq</td></tr>
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<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To develop problem solving skills and understanding of circuit theory through the application of techniques. 2. To understand voltage, current and power from a given circuit. 3. This course deals with the basic concept of electrical circuits. 4. This is the basic subject for all electrical and electronic circuits. 5. To understand Kirchhoff's current and voltage Laws problems. 6. To perform mesh and Nodal analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Recognize how electricity works in electrical circuits. 2. List the various terms associated with electrical circuits. 3. Summarize what is meant by a basic electric circuit. 4. Discuss the reaction and involvement of atoms in electric circuits. 5. Describe electrical power, charge, and current. 6. Define Ohm's law. 7. Identify the basic circuit elements and their applications. 8. Discuss the operations of sinusoid and phasors in an electric circuit. 9. Discuss the various properties of resistors, capacitors, and inductors. 10. Explain the two Kirchoff's laws used in circuit analysis. 11. Identify the capacitor and inductor phasor relationship with respect to voltage and current.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	88	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</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">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">150</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>

<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC302</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	1. Knowing the science of engineering mechanics and its basic vocabulary, as it is the origin of the dynamics science. 2. Studying dynamics and its applications and related problems, and knowing its main branches, kinematics and kinetics, and what is the difference between them. 3. 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. 4. 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. 5. 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. 6. 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. 7. 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. 8. Knowing the dependent motion between two bodies and how to analyze it, and solve some related problems to enable understanding of the subject. 9. 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. 10. Knowing the 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. 11. Knowing how to derive momentum and impulse forces, knowing their applications, and solve some problems related to them to enable understanding of the subject. 12. Knowing how to derive impact forces, knowing their applications, and solve some problems related to them to enable understanding of the subject.

Indicative Contents
المحتويات الإرشادية
	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 استراتيجيات التعلم والتعليم	
Strategies الاستراتيجيات	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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	58	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	67	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.67
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري		
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="4">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="2">Computer Programming</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">NVEESC304</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>
</table>

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

<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC301</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. The module covers the basic concepts of programming in C++ language. 2. The concept of algorithms and flowcharts also covered in this module. 3. Structured Programming (Variables, Input, Memory), is another important topic in this module, students will learn how to declare and use variables in C++ programs. 4. The module covers various types of operators in C++. Students will learn how to use these operators effectively in their programs. 5. Selection statements are also covered in this module. Students will learn about if single-selection statements and if-else statements. They will also explore nested if-else statements and the switch multiple-selection statement. 6. Repetition statements are another important topic in this module. Students will learn about different types of loops, including the while repetition statement, the for-repetition statement, and the do-while statement. They will also explore the use of break and continue statements to control loop execution. 7. The module introduces one-dimensional arrays, which are collections of elements of the same data type. Students will learn about array initialization approaches and how to work with arrays effectively. 8. The module introduces students to multidimensional arrays, which are arrays with multiple dimensions or indices 9. Finally, the module introduces the basics of using functions in C++ programming. Students will learn about function syntax, function parameters and return types, defining functions within programs, Using and invoking functions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Introduction to C++ programming: Understand the basic concepts of programming languages, Identify the features and advantages of C++ programming language, Write and execute simple C++ programs, Understand the basic syntax and structure of C++ programs, differentiate between different data types in C++, Use variables, constants, and data types in C++ programs. 2- Introduction to algorithms and flowchart: Define the concept of an algorithm and its importance in programming, Understand the steps involved in designing an algorithm, create flowcharts to represent algorithms visually, Analyze and evaluate algorithms for efficiency and correctness, apply problem-solving techniques using algorithms and flowcharts. 3- Structured Programming (Variables, Input, Memory): Declare and use variables in C++ programs, Understand the concept of data types and their memory allocation, perform input and output operations in C++, use standard input/output functions to interact with the user, Apply proper memory management techniques. 4- Operators: Assignment operators, Arithmetic operators, Increment and decrement operators, Decision-making operators, Conditional operator: Understand and use assignment operators to assign values to variables, Perform arithmetic operations

	using arithmetic operators, Utilize increment and decrement operators to modify variable values, Implement decision-making operators (logical, relational) to make decisions in programs, Use the conditional operator to write concise conditional expressions. 5- Selection statements-1: if single-selection statement, if..else: Understand the if statement and its usage in decision making, Write and use if statements to execute code based on a condition, Incorporate else statements to handle alternative conditions, Apply logical operators within if and else statements. 6- Selection statements-2: Nested if..else, switch multiple-selection statement: Construct nested if...else statements for complex decision making, Implement switch statements for multiple-selection decision making, Compare and choose between if...else and switch statements based on the requirements of a problem. 7- Repetition Statements: while repetition statement, for repetition statement, do..while, break and continue statements: Use the while loop to repeat a block of code based on a condition, Apply the for loop to iterate over a specific range or sequence, Implement the do...while loop to ensure code execution at least once, Utilize the break statement to exit a loop prematurely, Use the continue statement to skip the current iteration and proceed to the next iteration. 8- One-dimensional Arrays: Array elements, approaches to initialize arrays, Array of characters: Define and declare one-dimensional arrays in C++, Access and manipulate array elements using indexing, understand different approaches to initialize arrays. 9- Multidimensional Arrays: Array elements, approaches to initialize arrays, Array of characters: Define and declare multidimensional arrays in C++, Access and manipulate elements in multidimensional arrays, understand different approaches to initialize multidimensional arrays. 10- Functions: Function syntax, Function parameters and return types, defining functions within programs, Using and invoking functions.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A - Basics of Programming in C++</u> Introduction to the C++ Language – Algorithms, Flow chart, C++ Programs, Identifiers, Data Types, Variables, Constants, Input / Output, operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associatively, Expression Evaluation. [20 hrs] Statements- Selection Statements (making decisions) – if and switch statements. Repetition statements (loops)- while, for, do-while statements, Loop examples, other statements related to looping – break, continue. [20 hrs]

	<u>Part B – Arrays and Functions</u> Basic concepts of Arrays - one-dimensional arrays, multidimensional arrays, C++ programming examples. [8 hrs] Functions - Function basics, Function syntax, Function parameters and return types, defining functions within programs, Using and invoking functions. [8 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	76	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, and10
	Assignments	1	10% (10)	12	LO # 3, 4, 6 and 7
	Projects / Lab	14	15% (15)	Continuous	
	Report	1	5% (5)	13	LO # 3,5, 8 and 10
Summative assessment	**Midterm Exam**	4 hr	10% (10)	8	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to C++ programming.
Week 2	Introduction to Algorithms and Flowchart.
Week 3	Structured Programming (Variables, Input, Memory).
Week 4	Operators in C++ 1: Assignment operators, and Arithmetic operators.
Week 5	Operators in C++ 2: Increment and decrement operators, Decision making operators, and Conditional operator.
Week 6	Selection statements-1: if single-selection statement, if..else.
Week 7	Selection statements-2: Nested if..else, switch multiple-selection statement.
Week 8	**Midterm Exam**
Week 9	Repetition Statements: while repetition statement, and do..while repetition statement.
Week 10	Repetition Statements: for repetition statement.
Week 11	Repetition Statements: break and continue statements.
Week 12	One-dimensional Arrays.
Week 13	Multidimensional Arrays.
Week 14	C++ Functions 1: Function parameters and return types.
Week 15	C++ Functions 2: defining functions within programs, using and invoking functions.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to Code:: Blocks software as a C++ compiler.
Week 2	Examples of: Algorithms and Flowcharts.
Week 3	Executing C++ programs of: Variables, Input, Memory.
Week 4	Executing C++ programs of: Assignment operators, Arithmetic operators.
Week 5	Executing C++ programs of: Increment and decrement operators, Decision making operators, and Conditional operator.
Week 6	Executing C++ programs of: if single-selection statement, and if..else.
Week 7	Executing C++ programs of: Nested if..else, and switch multiple-selection statement.
Week 8	**Midterm Exam**
Week 9	Executing C++ programs of: while repetition statement and do..while statement.
Week 10	Executing C++ programs of: for repetition statement.
Week 11	Executing C++ programs of: break and continue statement.
Week 12	Executing C++ programs using One-dimensional arrays.
Week 13	Executing C++ programs using Multidimensional -dimensional arrays.
Week 14	Executing C++ programs using Functions 1.
Week 15	Executing C++ programs using Functions 2.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	The C++ Programming Language (4th Edition) By: Bjarne Stroustrup.	No
Recommended Texts	Programming: Principles and Practice Using C++ (2nd Edition) By: Bjarne Stroustrup	No
Websites	https://cplusplus.com/doc/tutorial/	

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

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Digital Design		Module Delivery		
Module Type	Basic		☒Theory ☐Lecture ☒Lab ☐Tutorial ☐Practical ☐Seminar		
Module Code	NVEE223				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	1		Semester of Delivery	2	
Administering Department	SCE		College	EE	
Module Leader	Mohammed A.Thanoon		e-mail	mohammed.alsayed@uoninevah.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	MSc	
Module Tutor			e-mail		
Peer Reviewer Name	Mohammed N.Younus		e-mail	mohammed.younus@uoninevah.edu.iq	
Scientific Committee Approval Date	01/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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.

مخرجات التعلم للمادة الدراسية	3. Design and implement digital circuits using appropriate software and hardware tools. 4. Evaluate and troubleshoot digital circuits for correct functionality and performance. 5. Utilize multiplexers, decoders, encoders, and other digital components in circuit design. 6. Explain the principles and techniques of data transmission in digital communication systems. 7. Analyze and evaluate the performance of digital systems, considering factors such as speed, reliability, and power consumption. 8. Apply critical thinking and problem-solving skills to address challenges in digital circuit design and implementation. 9. Collaborate effectively in team projects, demonstrating good communication and teamwork skills. 10. Stay updated with the latest advancements and trends in digital techniques and apply them to real-world engineering problems.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	76	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 theoretical concepts with practical applications of digital electronics. It covers topics such as logic gates, Boolean algebra, combinational and	No

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

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="4">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="2">The crimes of the defunct Baath Party</td><td>Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Support</td><td rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NV13</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">1</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">25</td></tr>
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Module Level	UGIII	**Semester of Delivery**	5
Administering Department	SCE	**College**	EE
Module Leader		**e-mail**	
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

<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NESC2322</td><td>Semester</td><td>4</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	16	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	1
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	9	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	0.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	25		

Module Evaluation تقييم المادة الدراسية				
	Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**

Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 9 and 10
	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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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	

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts		Yes
Recommended Texts		Yes
Websites	/	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Engineering Analysis 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">NVEE208</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>2</td><td colspan="2">Semester of Delivery</td><td>3</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">Abdurahman Basil AYOUB</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Asst. 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">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Abdulallah I.</td><td>e-mail</td><td colspan="2">E-mail</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>
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<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEE207</td><td>Semester</td><td>2</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. provide students with a solid understanding of the fundamental concepts and properties of ordinary differential equations. This includes concepts such as order, linearity, solutions, and initial value problems. 2. introduce students to the concept of Laplace transform as a powerful mathematical tool for analyzing and solving linear ordinary differential equations (ODEs) encountered in system and control engineering. 3. equip students with the skills to solve ODEs using the Laplace transform method. Students will learn techniques for transforming ODEs into algebraic equations, solving for the Laplace-transformed function, and applying inverse Laplace transform to obtain the solution in the time domain. 4. introduce students to the fundamental concepts of matrices, including matrix notation, operations (addition, subtraction, multiplication), and properties. 5. introduce students to the concept of eigenvalues and eigenvectors of matrices. Students will learn how to compute eigenvalues and eigenvectors and understand their significance in the analysis of engineering systems. 6. Introduce students to the Cayley-Hamilton Theorem, which is a fundamental result in linear algebra. Students will learn about the statement of the theorem and its significance in the analysis of matrices and linear systems. 7. enable students to evaluate multiple integrals using various techniques such as iterated integrals, change of variables, and application of appropriate integration theorems. Additionally, the module aims to provide students with the skills to apply multiple integrals in the analysis and modeling of engineering systems relevant to the field of system and control engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand the fundamentals of ordinary differential equations. 2. Solve ordinary differential equations analytically: Apply various solution methods to solve ordinary differential equations analytically, such as separation of variables, integrating factors, and homogeneous equations. 3. Understand the concept and properties of the Laplace transform: Demonstrate a clear understanding of the Laplace transform, its definition, properties, and theorems associated with it. 4. Utilize Laplace transform methods: Apply Laplace transform techniques to solve ordinary differential equations, including initial value problems and systems of differential equations. 5. Demonstrate a clear understanding of basic matrix operations, including addition, subtraction, scalar multiplication, matrix multiplication, and transposition. 6. Module Learning Outcomes of Multiple Integrals of Mathematical

	Engineering Analysis I course for system and control department. 7. clear understanding of multiple integrals, including double and triple integrals, and their geometric interpretations. 8. Develop the skills to evaluate multiple integrals using various techniques, such as iterated integrals, change of variables, and integration in different coordinate systems (e.g., Cartesian, polar, cylindrical, and spherical coordinates).
Indicative Contents المحتويات الإرشادية	**Ordinary Differential Equations (34)** Definition of Ordinary Differential Equations, First Order D. Eq. (Variable Separable, Homogeneous, Linear, Exact.) Second Order Differential Equations (Undetermined coefficients, Variation of parameters.) **Laplace Transform (34)** Definition of Laplace Transform, Laplace Transform of Simple Functions, Properties of Laplace Transform, Inverse Laplace Transform, Applied to Solve Differential Equations. **Matrix Theory (25)** Basic operations, Rank, Eigen values, Eigenvectors, Cayley-Hamilton Theorem. **Multiple Integrals (32)** Definition of double integral (Integration Limits are Constants, Integration Limits are Variables, Reversing the order of Integration, Change to Polar Coordinates), Triple Integrals, Surface Area.

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	1. Understand the importance of effective learning and teaching strategies: Recognize the significance of employing appropriate learning and teaching strategies in the process of acquiring mathematical engineering analysis skills and knowledge. 2. Evaluate different learning and teaching approaches: Evaluate and analyze various learning and teaching approaches used in the course, such as lectures, tutorials, practical exercises, group work, and self-directed learning, to determine their effectiveness in promoting understanding and mastery of mathematical engineering analysis concepts. 3. Apply active learning techniques: Engage in active learning techniques, such as problem-solving activities, case studies, discussions, and real-world applications, to enhance understanding, critical thinking, and problem-solving skills in mathematical engineering analysis.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	44	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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	Second Order Differential Equations(Undetermined coefficients, Variation of parameters.) (Tutorial)
Week 4	Second Order Differential Equations(Undetermined coefficients, Variation of parameters.) (Tutorial)
Week 5	Definition of Laplace Transform, Laplace Transform of Simple Functions. (Tutorial)
Week 6	Properties of Laplace Transform. (Tutorial)

Week 7	Inverse Laplace Transform. (Tutorial)
Week 8	Applied Laplace Transform to Solve Differential Equations (Tutorial)
Week 9	Matrix Theory Basic operations. (Tutorial)
Week 10	Rank, Eigen values, Eigenvectors. (Tutorial)
Week 11	Cayley-Hamilton Theorem. (Tutorial)
Week 12	Definition of double integral (Integration Limits are Constants, Integration Limits are Variables, Reversing the order of Integration). (Tutorial)
Week 13	Change to Polar Coordinates (Tutorial)
Week 14	Triple Integrals (Tutorial)
Week 15	Surface Area (Tutorial)
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	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		

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

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

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية				
Module Title	**Signals and Systems**		**Module Delivery**	
Module Type	**Basic**		☒Theory ☐ Lecture ☒Lab ☐Tutorial ☐Practical ☐Seminar	
Module Code	**NVEE210**			
ECTS Credits	**6**			
SWL (hr/sem)	**150**			
Module Level	2		**Semester of Delivery**	3
Administering Department	SCE		**College**	EEC
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	Abdulrahman Aouyb		**e-mail**	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NVEE207	**Semester**	2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To introduce the fundamentals of signals and systems 2. To support applied modules in areas such as networks, electromagnetic fields and control theory 3. To provide an introduction to the Laplace transform and the Z-transform as tools for linear systems theory and analysis 4. 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 5. To develop skills in the application of applied numeracy and algebraic techniques
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Describe different types of signals and systems. 2. Discuss the limitations of the Laplace transform in the context of engineering problems 3. Explain the implications of sampling signals and the basic theory of the Z-transform 4. Be able to demonstrate an understanding of Fourier Series and Fourier Transform techniques 5. Be able to demonstrate an understanding of Convolution and Correlation techniques 6. Be able to explain and use the theorems associated with Fourier Transform techniques 7. Be able to describe the use of Correlation and Convolution techniques to analyze linear time invariant systems 8. Be able to use the Laplace transform in the analysis and characterization of linear, time-invariant systems 9. Be able to compare and contrast the Laplace & Fourier transforms in an engineering context 10. Be able to apply Fourier Transform techniques to describe the characteristics of signals

Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	76	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Generation of continuous time signals
Week 2	Lab 2: BASIC SIGNAL OPERATIONS
Week 3	Lab 3: System properties
Week 4	Lab 4: Computation of Convolution
Week 5	Lab 5: Fourier series coefficients calculations
Week 6	Lab 6: Fourier Transform Properties
Week 7	Lab 7: Applications

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Control I</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">NVEESC305</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>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">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 colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
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<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEE207</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	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. 3- Apply block diagram reduction techniques to simplify complex control system diagrams and analyze the overall system behavior. 4- Construct and analyze signal flow graphs to represent and evaluate the behavior of control systems. 5- Analyze the time response of control systems, including transient and steady-state responses, and interpret the results in terms of system stability and performance. 6- Assess the stability of control systems using different methods, such as the Routh-Hurwitz criterion, and determine the stability margins of the system. 7- Perform root locus analysis to analyze and design control systems, and understand the impact of system parameters on stability and performance. 8- Apply theoretical concepts and analytical techniques to practical control system problems. 9- Utilize simulation tools and software to implement and analyze control system designs, and interpret simulation results to validate theoretical predictions.
Indicative Contents المحتويات الإرشادية	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: [6 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: [10 hrs] 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: [12 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: [8 hrs] a. Concepts of stability and instability in control systems. b. Routh-Hurwitz stability criterion. 7- Root Locus Analysis: [12 hrs] a. Root locus plots and their interpretation. b. Root locus design techniques for improving system performance and stability.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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)

المنهاج الاسبوعي للمختبر	
	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.
Week 3	Lab 3: LAB Study of plotting the block diagram reduction By Matlab Programming.
Week 4	Lab 4: LAB study of applying the Mason rule using Matlab Programming
Week 5	Lab 5: LAB study of finding the transient response of 1st order and 2nd order system.
Week 6	Lab 6: LAB study of finding the steady state error.
Week 7	Lab 7: Plotting of the root locus.

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

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Matlab Programming</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">NVEESC306</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>Mohammed Salim Qasim</td><td>e-mail</td><td colspan="3">Mohammed.qasim@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>None</td><td>e-mail</td><td colspan="3">None</td></tr>
<tr><td>Peer Reviewer Name</td><td>Omar Y. Ismael</td><td>e-mail</td><td colspan="3">omar.ismael@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>
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العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC301</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To learn how to use/interact with Matlab GUI effectively and look for help from inside the Matlab. 2. To learn how to create Matlab scripts and make/manipulate Matlab variables. 3. To understand Matlab plot. 4. To learn vector and matrix indexing. 5. To learn how write efficient Matlab code, Vectorization. 6. To learn program flow control. 7. To learn Matlab user-defined functions. 8. To learn how read and write data to txt, excel, etc. 9. To learn cell arrays and structures. 10. To learn symbolic variables.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Undertake arithmetic on scalars, vectors and matrices. 2. Create 2D and 3D plots of mathematical functions and data. 3. Solve mechanical electrical engineering problems using Matlab scripts. 4. Write Matlab functions to solve engineering problems. 5. Read and analyze data from in txt, xls and other formats. 6. Use of symbolic variables to [perform integrals, derivatives and other mathematical operations.
Indicative Contents المحتويات الإرشادية	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 symbolic variables. [4hrs] Symbolic variables to solve integration and differentiation and other problems. [4hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Matlab GUI, 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 symbolic variables.
Week 15	Symbolic variables to solve integration and differentiation and other problems.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction to Matlab GUI, scripts and making variables.
Week 2	Lab 2: Vector and matrix indexing.
Week 3	Lab 3: Using plots.
Week 4	Lab 4: User-defined functions.
Week 5	Lab 5: Reading from txt and excel files.
Week 6	Lab 6: Interacting with cell arrays and structures.
Week 7	Lab 7: Dealing with symbolic variables.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	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.	No
Websites	https://www.mathworks.com/help/matlab/getting-started-with-matlab.html	

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="4">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="2">Analog Electronics I</td><td>Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td rowspan="5">☒Theory
☐Lecture
☒Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEESC307</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	2	**Semester of Delivery**	3
Administering Department	SCE	**College**	EEC
Module Leader	Nashwan Z. Hero	**e-mail**	Nashwan.hero@uoninevah.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	M.Sc.
Module Tutor		**e-mail**	
Peer Reviewer Name	Rafal Alshaker	**e-mail**	rafal.mahmod@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEE216</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Be able to apply the proper biasing to insure operation in the active region. 2. Understand how to measure the important voltage levels of a BJT transistor configuration and use them to determine whether the network is operating properly. 3. Be able to perform a load-line analysis of the most common BJT configurations. 4. Become familiar with the r_e, hybrid, and hybrid π models for the BJT transistor. 5. Understand the effects of a source resistance and load resistor on the overall gain and characteristics of an amplifier. 6. Become acquainted with the frequency response of a BJT amplifier. 7. Be able to find the Miller effect capacitance at the input and output of an amplifier due to a feedback capacitor.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	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 المحتويات الإرشادية	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 C_{Mi} on the high-frequency response. [15 hrs]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction – BJT Transistor
Week 2	BJT 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 emitter-bias configuration
Week 6	D.C analysis of voltage-divider -bias configuration and emitter-follower configuration.
Week 7	D.C analysis of collector feedback -bias configuration and miscellaneous bias
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	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Input and output characteristics
Week 2	Lab 2: D.C load line and Q-point
Week 3	Lab 3: common-emitter Amplifier
Week 4	Lab 4: common- base Amplifier
Week 5	Lab 5: common- collector Amplifier
Week 6	Lab 6: Two stage amplifier
Week 7	Lab 7: Frequency Response

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

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	English			Module Delivery	
Module Type	Support			☒Theory ☐Lecture ☐Lab ☐Tutorial ☐Practical ☐Seminar	
Module Code	NV11				
ECTS Credits	4				
SWL (hr/sem)	100				
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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims
أهداف المادة الدراسية</td><td>1. To develop skills, reading, writing and understanding of English language through the application of teaching techniques.
2. To understand scientific subjects and technical terms through reading and comprehension.
3. This course deals with the basic concepts of scientific subjects.
4. This course handles how to write simple research and how to make a successful presentation.
5. To understand the scientific language in English.</td></tr>
<tr><td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td><td>1. Recognize parts of speech and tenses in English language.
2. List the various terms associated with scientific texts.
3. Summarize what is meant by a basic electric circuit.
4. Discuss Electric currents, series and parallel circuits.
5. Describe electrical power, charge, and current.
6. Discuss computers, communication and the future of computers..
7. Identify the basic circuit elements and their applications.
8. Explain energy types and forms.
9. Discuss the various properties of radio waves and vacuum tubes.
10. Explain modulation.
11. Discuss Electromagnetism.</td></tr>
<tr><td>Indicative Contents
المحتويات الإرشادية</td><td>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</td></tr>
</table>

	_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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	30	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	70	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	10% (10)	4,6	LO #1, 2, 3,4 ,5and 6
	Assignments	2	10% (10)	9, 12	LO # 7,8,9,10,11and 12
	Projects / Lab.				
	Report	1	10% (10)	13	LO # 13,14
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO #
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group	**A -** Excellent	امتياز	90 - 100	Outstanding Performance

(50 - 100)	**B -** Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
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Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Engineering Analysis II</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">NVEE209</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>2</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">Abdulrahman Basil AYOUB</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Asst. Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>MSc</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>Abdulallah I.</td><td>e-mail</td><td colspan="2">E-mail</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>
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<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEE208</td><td>Semester</td><td>3</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. 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. 2. Develop students' skills in analyzing and interpreting data using appropriate statistical techniques, such as descriptive statistics, graphical methods, and summary measures. 3. Provide an understanding of probability theory, including probability distributions, random variables, and their applications in modeling and analyzing engineering systems. 4. Introduce students to the concept of discrete random variables and their importance in modeling and analyzing engineering systems. 5. Introduce and analyze common discrete probability distributions, such as the binomial distribution, and Poisson distribution, and their applications in modeling real-world engineering problems. 6. Introduce students to the concept of continuous random variables and their significance in modeling and analyzing continuous phenomena encountered in system and control engineering. 7. 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. 8. Introduce students to the fundamental concepts and principles of numerical analysis, emphasizing the importance of numerical methods in solving engineering problems. 9. Introduce and analyze numerical methods for solving equations, including root-finding algorithms, such as Newton-Raphson, and their applications in engineering analysis. 10. 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. 11. 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 مخرجات التعلم للمادة الدراسية	1. Understanding of fundamental statistical concepts: Demonstrate an understanding of basic statistical concepts, including population, sample, variable, data types, and levels of measurement. 2. 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. 3. 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. 4. Understanding of probability: Comprehend the fundamental concepts of probability theory, including basic probability rules, conditional probability, and the concept of independence. 5. 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. 6. 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. 7. 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 المحتويات الإرشادية	**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 **Numerical Analysis (29)** Roots of Single Equations (Fixed-Point Iteration Method, Newton-Raphson Method), Numerical Solution of Ordinary Differential Equations (ODE) :(Euler's Method, Runge–Kutta method),Numerical Integration: (Trapezium Rule, Simpson's Rule).

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	44	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.78
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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	Continuous Random Variables (r.v.)
Week 8	Continuous Random Variables (r.v.)
Week 9	Continuous Random Variables (r.v.)
Week 10	Continuous Random Variables (r.v.)
Week 11	Numerical Analysis
Week 12	Numerical Analysis
Week 13	Numerical Analysis
Week 14	Numerical Analysis
Week 15	Numerical Analysis
Week 16	Preparatory week before the final Exam

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Advanced Engineering Mathematics:** By Kreyszig 10th edition, 2011	No
Recommended Texts	**Probability and Statistics for Engineers:** By Ronald Johnson, Miller & Freund's 7th Ed. Prentice Hall, 2005	No
Websites		

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

Note: 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

نموذج وصف المادة الدراسية

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

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NVEESC305	**Semester**	3
Co-requisites module		**Semester**	

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims
أهداف المادة الدراسية</td><td>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.</td></tr>
<tr><td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td><td>1. Recognize the principles of Analog control system analysis.
2. List the various terms associated with frequency response.
3. Summarize what is meant by frequency response analysis.
4. Discuss the reaction and involvement of gain and phase shift in frequency response analysis.
5. Study the methods used to describe the frequency response.
6. Define the Bode plot, its analysis, rules, and sketching steps.
7. Discuss the Bode plot Tabulation method and its plotting steps.
8. Discuss the Bode plot Analytical method and its plotting steps.
9. Discuss the Frequency domain specifications.
10. Explain the stability criteria, find the gain margin, and phase margin.</td></tr>
<tr><td>Indicative Contents
المحتويات الإرشادية</td><td>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</td></tr>
</table>

	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 استراتيجيات التعلم و التعليم	
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 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. 4- 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. 5- 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. 6- 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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية				
Module Title	**Analog Electronics II**		**Module Delivery**	
Module Type	**Core**		☒Theory ☐Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	**NVEESC310**			
ECTS Credits	**5**			
SWL (hr/sem)	**125**			
Module Level	2		**Semester of Delivery**	4
Administering Department	SEC		**College**	EEC
Module Leader	Nashwan Z. Hero		**e-mail**	Nashwan.hero@uoninevah.edu.iq
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	M.Sc.
Module Tutor			**e-mail**	
Peer Reviewer Name	Rafal Alshaker		**e-mail**	rafal.mahmod@uoninevah.edu.iq
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NVEESC307	**Semester**	2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Be able to apply the proper biasing to insure operation in the active region. 2. Understand how to measure the important voltage levels of a FET transistor configuration and use them to determine whether the network is operating properly. 3. Be able to perform a load-line analysis of the most common FET and MosFET configurations. 4. Become familiar with the r_e , hybrid, and hybrid π models for the FET and MosFET transistor. 5. Understand the effects of a source resistance and load resistor on the overall gain and characteristics of an amplifier. 6. Become acquainted with the frequency response of a FET and MosFET amplifier. 7. Be able to find the Miller effect capacitance at the input and output of an amplifier due to a feedback capacitor.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	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 المحتويات الإرشادية	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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
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Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</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="4">☒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">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td colspan="2">Module Level</td><td>2</td><td colspan="2">Semester of Delivery</td><td>4</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 Nussrat Younus</td><td>e-mail</td><td colspan="2">Mohammed.younus@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>Yazen H. Shaker</td><td>e-mail</td><td colspan="2">Yazen.shaker@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
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC307</td><td>Semester</td><td>3</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To develop an awareness of the principles of measurement and instrument characteristics. 2. To become familiar with the operation and use of a variety of filters. 3. To realize the operation principle of several sensors and recognize the key issues in selecting the right instrument. 4. To be acquainted with several types of actuators 5. To understand modern signal transmission techniques and relevant standards. 6. To become aware of the sampling theorem, ADC and DAC.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**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. 2. Familiarity with filtration and op amp circuits 3. Understanding the design concepts and operation of a broad range of electro-mechanical actuator devices. 4. Awareness of modern signal acquisition and transmitting technology 5. Recognize both static and dynamic requirements of instrumentation and measurement systems. 6. Specify and select appropriate sensors for a wide range of systems and applications. 7. Apply acquired knowledge to the design and modelling of measurement systems. 8. Develop and implement data acquisition and signal transmitting strategies using DAQ devises, transmitter and controller.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	3,7,10	LO #3,5,7
	Assignments	1	10% (10)	12	LO # 1,3, 4, 6 and 7
	Lab.	1	10% (10)	Continuous	All
	Report	1	5% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hrs.	15% (10)	11	LO # 1-6
	Final Exam	2 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
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) المنهاج الاسبوعي للمختبر / تدقيق	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">DC Machines</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">NVEESC308</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>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>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>Nashwan Z. Hero</td><td>e-mail</td><td colspan="3">Nashwan.hero@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>
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<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEE216</td><td>Semester</td><td>2</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Understanding DC Machine Principles 2. Analyzing DC Machine Behavior 3. Control Strategies 4. System Integration 5. Practical Applications 6. Problem-Solving Skills 7. Laboratory Skills 8. Teamwork and Communication 9. Professional Development
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand how voltage is induced in a rotating loop 2. Understand how curved pole faces contribute to a constant flux, and thus 3. more constant output voltages. 4. Understand how curved pole faces contribute to a constant flux, and thus more constant output voltages. 5. Understand the power flow diagram for de machines 6. Know the types of de motors in general use. 7. Understand the equivalent circuit of a de motor. 8. Understand how to derive the torque-speed characteristics of separately excited, shunt, series, and compounded de motors. 9. Understand how to control the speed of different types of de motors. 10. Understand the special characteristics of series de motors, and the applications. 11. Understand the methods of starting dc motors safely. 12. Understand the equivalent circuit of a dc generator. 13. Understand the purpose of a transformer in a power system. 14. Understand how real transformers approximate the operation of an ideal transformer. 15. Be able to explain how copper losses, leakage flux, hysteresis, and eddy currents are modeled in transformer equivalent circuits.

Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
Strategies	Visual Aids Problem-Solving Exercises Real-World Applications Group Projects Simulations and Virtual Labs Multimedia Resources Real-Life Examples

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="2">Engineering Drawing</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Basic</td><td colspan="3" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☒Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEE201</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">126</td></tr>
<tr><td colspan="2">Module Level</td><td>2</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">Yazen Hudhaifa Shakir</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"></td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Ismail Khudhair , Ahmed Nidham Mohammed</td><td>e-mail</td><td colspan="2">ismael.Khudhair@uoninevah.ed
Ahmed.Nidham@uonievah.edu</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>
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<table>
<tr><th colspan="4">Relation with other Modules
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<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>
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<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims

أهداف المادة الدراسية</td><td>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</td></tr>
<tr><td>Module Learning Outcomes

مخرجات التعلم للمادة الدراسية</td><td>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.
3- 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.
4- 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.
5- 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.
6- 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.
7- Understanding 3D Concepts: Gain a clear understanding of fundamental 3D concepts, including coordinate systems, viewpoints, and 3D navigation techniques.
8- 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.</td></tr>
</table>

	9- 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. 10- 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. 11- Glance to the basic electrical diagrams in AutoCAD Electrical
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – 2D Drawing</u> 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. **<u>[60 hr.]</u>** <u>Part B – 3D Drawing</u> 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 **<u>[34 hr.]</u>**

	Part C – AutoCAD Electrical Introduction to workspace and main difference in panels Create simple projects inside AutoCAD Electrical [**6 hr.**]

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	58	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	67	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.78
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	3, 9	LO #2, 3, 5 and 6
	Assignments	2	10% (10)	4, 13	LO # 8, 9, 6 and 7
	Projects / Lab.	1	10% (10)	15	LO# 11
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	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

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	150 CAD Exercises Book by Sachidanand JHA	NO
Recommended Texts	1- Fundamentals of Engineering Drawing - أساسيات الرسم الهندسي By : Ahmed Nidham Mohammed Publisher: Dar Al-Waddah For Publishing & Distribution - Amman - Jordan ISBN: 9789923190906 2. 2020 اساسيات اوتوكاد / 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

مخطط الدرجات

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

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**System Modeling**		**Module Delivery**		
Module Type	**Core**		☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar		
Module Code	**NVEESC313**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**		5
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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NVEESC303, NVEESC309	**Semester**	3, 4
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To develop problem solving skills and understanding of circuit theory through the application of techniques. 2. To familiarize students with the concept of modelling, and analysis of electrical, mechanical, and electromechanical systems. 3. To understand fundamentals of system dynamics. 4. To obtain a mathematical Model of different physical systems. 5. To know how to linearize of nonlinear systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Knowledge and Understanding the fundamental concepts and principles of system modeling. 2. Modeling Skills: Develop the ability to formulate mathematical models to represent the behavior and relationships within a system. 3. Be familiar with modeling methods for electrical, mechanical, and electromechanical systems. 4. Identify various system representations. 5. Applying linearization on nonlinear systems.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	44	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.78
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

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

Note: 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

نموذج وصف المادة الدراسية

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<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="2">EE</td></tr>
<tr><td>Module Leader</td><td>Abdullah Ibrahim Abdullah</td><td>e-mail</td><td colspan="2">Abdullah.abdullah@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>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td>/</td><td>e-mail</td><td colspan="2">/</td></tr>
<tr><td>Peer Reviewer Name</td><td>/</td><td>e-mail</td><td colspan="2">/</td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	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 المحتويات الإرشادية	**1-Introduction to discrete time control system [5 hours]** Concepts of discrete control systems, Sampling theory, why digital control quantization, and quantization error, Analog to digital and digital to analo conversion, Examples of 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 th Z-transform, Power series, long division, partial fractions, Residue Method, Z transform method for solving difference equation. **3-Modeling of digital control systems [10 hours]** Discrete-time Block Diagrams, The ZOH Transfer Function, Pulse transfe function, Pulse 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–Hurwit 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 Locu with Zero Order Hold ,Discrete PID controller, Discrete PID Controller Tuning

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
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	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
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<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>Abdulrahman</td><td>e-mail</td><td colspan="3"></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>
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<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To develop problem solving skills and understanding of digital signal processing through the analysis of application techniques. 2. To understand analysis, synthesis and implementation of a given signal and system. 3. This course deals with the basic concept of DSP. 4. This is the basic subject for all digital signal and its application. 5. To perform digital filter design and its analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After successful completion of this module, students will: 1. Be able to apply the discrete Fourier series for analysis of a range of signals. 2. Be able to apply the discrete Fourier transform for analysis of a range of signals. 3. Be able to apply the discrete Z transform for analysis of a range of signals. 4. Be able to design a digital filter based on a given specification. 5. Be able to design and implement a variety of DSP algorithms in MATLAB.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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)	9	LO # 1-8
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
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MODULE DESCRIPTION FORM

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☐Practical
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<tr><td>Module Leader</td><td colspan="2">Yazen Hudhaifa Shakir</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">Abdurrahman Basil</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Mohammed N. Younis</td><td>e-mail</td><td colspan="2">Mohammed.younus@uoninevah.edu.iq</td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	Aims 1. 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. 2. 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. 3. To study the classification of industrial control systems. 4. What they control and how they control 5. Possess knowledge and familiarity with both IEC and NEMA standards. 6. To study the main components of Programmable Logic Controller 7. To study Basic Functions of Ladder Diagram as a Programming language 8. To study the on-off control of industrial applications. 9. To study Programmable Logical Controllers (PLCs) with industrial applications. 10. To study data types and data flow compatibility using PLCs
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding the history, context and components of industrial control systems. 2. Understanding the classical circuits for Motor control (three phase and single phase) 3. Understanding practical on-off control systems with the use of PLCs. 4. Understanding practical PLCs with their application to Solve tasks. 5. Outstanding of PLC programming Languages 6. Reading electrical schematic diagrams 7. 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. 8. 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. 9. 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. 10. 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. 11. 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.

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Part A – Classic Control Industrial Panel Components** [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. **Part B – Schematic Electrical Standards IEC and NEMA** **[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... **Part C- Ladder diagram** **[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 **Part D- Practical examples wiring I/Os** **[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
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	- 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.

	- 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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	***Automating Manufacturing Systems with PLCs*** , Year: 2010 Hugh Jack	Available Online
Recommended Texts	Title ***Programmable Logic 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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	**Control Systems Design**	**Module Delivery**	
Module Type	**Core**	☒Theory ☐Lecture ☒ Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	**NVEESC315**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		

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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NVEESC309	**Semester**	4
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. The objective of control system design is to construct a system that has a desirable response to standard inputs. 2. A desirable transient response is one that is sufficiently fast without excessive oscillations. 3. A desirable steady-state response is one that follows the desired output with sufficient accuracy. 4. Performance Specifications. 5. System Compensation. 6. Design Procedures of control systems. 7. 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. 8. 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. 9. 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 مخرجات التعلم للمادة الدراسية	1. Treats the root-locus method of analysis and design of control systems. 2. The design process, from modeling to specification of the control problem and controller design will be emphasized. 3. Design by Root-Locus Method including design of lead, lag, and lag-lead compensators. 4. Parallel Compensation Technique. 5. Treats the frequency-response method of analysis and design of control systems. 6. Design by the Frequency-Response Method (Bode Diagrams) including design of lead, lag, and lag-lead compensators. 7. Tuning of PID controllers. 8. Discusses PID controllers. 9. Ziegler–Nichols Rules for Tuning PID Controllers 10. Design of PID Controllers with Frequency-Response approach.
Indicative Contents المحتويات الإرشادية	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] The Frequency-Response Method: 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] PID controllers: 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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	88	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 9 and 10
	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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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معلومات المادة الدراسية</th></tr>
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<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>
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<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 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>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 colspan="2">Version Number</td><td colspan="2">1</td></tr>
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العلاقة مع المواد الدراسية الأخرى</th></tr>
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أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims

أهداف المادة الدراسية</td><td>1. التركيز على القضايا المهنية المرتبطة بالتصميم والإنتاج والاستخدام الآمن للتقنية في المنظمة وتأثير الهندسة على المجتمع والبيئة.
2. تعزيز التفكير الأخلاقي لدى الطلاب وتطوير قدراتهم في اتخاذ القرارات الأخلاقية في سياق العمل الهندسي
3. تعزيز الوعي بالمسؤولية الاجتماعية للمهندسين ودورهم في تحقيق التنمية المستدامة وحماية البيئة وتعزيز التكنولوجيا التي تلبي احتياجات المجتمع.
4. 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.
5. 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.</td></tr>
<tr><td>Module Learning Outcomes

مخرجات التعلم للمادة الدراسية</td><td>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.</td></tr>
<tr><td>Indicative Contents
المحتويات الإرشادية</td><td></td></tr>
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	30	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	70	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 9 and 10
	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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><td colspan="6">Module Information
معلومات المادة الدراسية</td></tr>
<tr><td>Module Title</td><td colspan="2">Digital Signal Processing II</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Basic</td><td colspan="3" rowspan="4">☒Theory
☐Lecture
☒Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">NVEE205</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>
<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">Ahmed Jameel Abdulqader</td><td>e-mail</td><td colspan="2">ahmed.abdulqader@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"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Abdulrahman</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>
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<table>
<tr><td colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</td></tr>
<tr><td>Prerequisite module</td><td>NVEE204</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To develop problem solving skills and understanding of digital signal processing through the analysis of application techniques. 2. To understand analysis, synthesis and implementation of a given signal and system. 3. This course deals with the basic concept of DSP. 4. This is the basic subject for all digital signal and its application. 5. To perform digital filter design and its analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	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 المحتويات الإرشادية	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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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☒Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC316</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>3</td><td colspan="2">Semester of Delivery</td><td colspan="2">6</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>Abdulhameed Nabeel Hameed</td><td>e-mail</td><td colspan="3">abdulhamed.hameed@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Ass. Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">M.Sc.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Yazen H. Shakir</td><td>e-mail</td><td colspan="3">Yazen.shakir@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>
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<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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: 1. 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. 2. 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.. 3. Demonstrate knowledge of network architecture, components, and their functionalities, such as routers, switches, and hubs. 4. Evaluate and compare different network architectures, such as client-server and peer-to-peer models, and their advantages and disadvantages. 5. Understand and analyze network addressing, including IPv4 addressing,

	Address Mask, Glassful Addressing (Class A, B, C, and D), and IPv4 types. 6. Explain the fundamental principles and concepts of industrial networks. 7. Identify and compare different types of industrial network topologies and communication protocols. 8. Design and configure industrial networks based on specific requirements and constraints. 9. Integrate industrial networks with IoT and cloud computing platforms.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1-9
	Assignments	1	10% (10)	12	LO # 7, 8, 9
	Lab	7	10% (10)	Continuous	
	Report	1	5% (5)	13	LO # 3, 4, 7 and 8
Summative assessment	Midterm Exam	4 hr	15% (15)	7	LO # 1-7
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
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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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	**PLC II**		**Module Delivery**
Module Type	**Core**		☒**Theory** ☐**Lecture** ☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**
Module Code	**NVEESC317**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
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	Abdulrahman Basil Ayoub	**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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NVEESC314	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The aim of studying PLC Level II for undergraduate control engineers is to provide them with advanced knowledge and skills in programming, system integration, troubleshooting, safety, and integration with HMI and SCADA systems. This equips students with a strong foundation in industrial automation and control systems, preparing them for careers in industries where PLCs are extensively used. Here are some aims of studying PLC Level II for control engineers: 1- Advanced Programming Techniques: PLC Level II courses delve deeper into programming techniques and advanced features of PLCs. Engineers learn about complex ladder logic programming. 2- Real-time System Performance: PLC Level II studies focus on optimizing the real-time performance of PLC-based control systems. Engineers learn about scan time analysis, task scheduling, memory management, and other factors that affect the responsiveness and efficiency of PLC programs. 3- Analog signals scaling and using RTD sensors as analog sensors
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Introduction to Floating point Math Instructions in Ladder and Statement List programming language 2. Understanding Logical Operations Instruction based on ladder diagram such as (Invert Byte, AND Byte, OR Byte, Exclusive OR Byte ...etc.) 3. Play with Move instruction and data type compatibility when moving data between registers. 4. Understanding shift registers and its applications 5. Using Jump , Label, FOR, NEXT and Conditional End instructions as a part of Program control instructions using Ladder diagram 6. Familiarity with Analog Inputs to PLC and the standard voltage and currents used in industry for Analog inputs. 7. Learning how to make analog signal scaling 8. Learn how temperature sensors (Pt100) get wiring with PLC 9. Understanding Data management and Data conversion 10. Practical examples implementation on PLC devices 11. Understating PLC controlling with Factory I/O which is a platform includes many I/O Drivers, each one for a specific technology. You select a driver

	in Factory I/O based on the controller you want to use

Indicative Contents
المحتويات الإرشادية
	Indicative content includes the following.
	<u>Part A – Expanding students' Knowledge with more complex instructions from Ladder diagram</u>[**18 hrs.**]
	- Compare instructions
	- Data Manipulation and Math Functions
	    o Data manipulation instructions (move, compare, convert, etc.)
	    o Math functions (addition, subtraction, multiplication, etc.) in PLC programming
	    o Utilizing data manipulation and math functions in control algorithms
	- Move Instructions
	- Logical operations
	- Floating Point Math
	<u>Part B – Analog Signals with PLC</u> [18 hrs.]
	1- Introduction to Analog Signals:
	    o Overview of analog signals and their characteristics
	    o Comparison between analog and digital signals
	    o Common analog signal types (e.g., voltage, current, temperature, pressure)
	2- Analog Input/ Output (I/O) Modules:
	    o Understanding analog input and output modules in PLC systems
	    o Different types of analog I/O modules (e.g., voltage input, current input, voltage output, current output)
	    o Selection and configuration of analog I/O modules
	3- Signal Conditioning and Scaling:
	    o Concepts of signal conditioning and its importance in analog signal processing
	    o Signal conditioning techniques (e.g., amplification, filtering, isolation)
	    o Scaling analog signals to match the desired range and units
	Analog Input/ Output Programming:
	    o Configuring analog input and output channels in PLC programming software
	    o Assigning addresses and data types for analog I/O
	    o Reading and writing analog values using ladder logic or other programming languages

	PID Control using Analog Signals: ○ Introduction to Proportional-Integral-Derivative (PID) control ○ Introduction on how to Implement PID control algorithms in PLC programming Practical Applications and Case Studies: ○ Practical exercises and projects involving analog signal interfacing with PLCs **Part C- Practical Part [20 hrs.]** Advanced PLC Programming Techniques ○ Program control instructions (jump, subroutine, etc.) ○ Sequential and parallel programming concepts ○ Utilizing advanced programming features (shift registers, data blocks, etc.) Human-Machine Interface (HMI) Integration ○ Introduction to HMIs and their role in control systems ○ Designing HMI screens for visualization and control ○ Integrating HMIs with PLCs for data exchange and system monitoring PLC Applications in Industrial Control ○ Case studies and practical applications of PLCs in industrial control systems ○ Designing and implementing control strategies for specific applications Project Work - Hands-on project work involving PLC programming and control system design - Integration of sensors, actuators, and other components with PLCs - System testing, troubleshooting, and performance evaluation

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	- 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.

	- 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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	50	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Recap and Overview on PLC and Its applications
Week 2	- Compare instructions - Data Manipulation and Math Functions
Week 3	- Move Instructions - Logical operations - Floating Point Math
Week 4	Introduction to Analog Signals: ○ Overview of analog signals and their characteristics ○ Comparison between analog and digital signals ○ Common analog signal types (e.g., voltage, current, temperature, pressure)
Week 5	Analog Input/ Output (I/O) Modules: ○ Understanding analog input and output modules in PLC systems ○ Different types of analog I/O modules (e.g., voltage input, current input, voltage output, current output) ○ Selection and configuration of analog I/O modules ○ Common Analog modules for most popular PLCs in the market
Week 6	Practical exercises and projects involving analog signal interfacing with PLCs
Week 7	Mid-term Exam

Week 8	PID Control using Analog Signals: ○ Introduction to Proportional-Integral-Derivative (PID) control ○ Introduction on how to Implement PID control algorithms in PLC programming
Week 9	Advanced PLC Programming Techniques ○ Program control instructions (jump, subroutine, etc.) ○ Sequential and parallel programming concepts ○ Utilizing advanced programming features (shift registers, data blocks, etc.)
Week 10	Human-Machine Interface (HMI) Integration- Part -1 ○ Introduction to HMIs and their role in control systems ○ Designing HMI screens for visualization and control ○ Integrating HMIs with PLCs for data exchange and system monitoring
Week 11	Human-Machine Interface (HMI) Integration- Part -2 ○ Introduction to HMIs and their role in control systems ○ Designing HMI screens for visualization and control ○ Integrating HMIs with PLCs for data exchange and system monitoring
Week 12	Practical Examples Tutorial
Week 13	PLC Applications in Industrial Control ○ Case studies and practical applications of PLCs in industrial control systems
Week 14	Project Work
Week 15	Project Work
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	- Data Manipulation and Math Functions using one of the following S7-200 , Logo , TIA-Portal or Delta PLCs
Week 2	- Compare instructions using one of the following S7-200 , Logo , TIA-Portal or Delta PLCs

Week 3	Practical Examples on - Move Instructions - Logical operations - Floating Point Math
Week 4	Analog Module configuration and Analog signals Scaling
Week 5	Practical Examples on Analog signals
Week 6	Student Working on their assignments
Week 7	Mid-Term Exam
Week 8	PID Wizard in PLCs or PID blocks- part 1
Week 9	PID Wizard in PLCs or PID blocks- part 2
Week 10	HMI design Basics -1
Week 11	HMI design Basics -2
Week 12	Introduction to SCADA design
Week 13	Students participation as groups for hands on problems
Week 14	Tutorial
Week 15	Student Working on their assignments
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	***Automating Manufacturing Systems with PLCs*** , Year: 2010 Hugh Jack	Available Online
Recommended Texts	Title ***Programmable Logic Controllers: Hardware and Programming*** Author Max Rabiee , Year:2017 ISBN: 1631269348, 9781631269349 - ***Programmable Logic Controllers: Principles and Applications 1st Edition*** by Glen A. Mazur	Available Online
Websites	➢ https://www.youtube.com/@AhmedSalehPLC	

	➢ https://www.udemy.com/share/101EJq3@k4AJbBU0il_tBdDUyxedogbaFpxhvJDQ8-jMd_MRihkkKgkE6N5sVyTGvijDT3_p/ ➢ https://www.youtube.com/watch?v=l5aiEs26WeU&list=PL62FigrKPb92Joup6UoBWyJP-f6vQib9V ➢ https://www.youtube.com/@realpars

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

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Power Electronics**		**Module Delivery**		
Module Type	**Core**		☒Theory ☐Lecture ☒Lab ☐Tutorial ☐Practical ☐Seminar		
Module Code	**NVEESC318**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NVEESC310	**Semester**	4
Co-requisites module	/	**Semester**	/

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To understand the concepts, basic operation, steady state operation of efficient switched- mode power conversion techniques, including basic circuit operation. 2. Modeling, analysis, and control techniques. 3. design of power circuits including inverters, rectifiers, and DC-DC converters. 4. Numerous application examples will be presented such as motion control systems and power supplies.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Describe the applications of power electronic converters. 2. Explain the operation of half and full bridge rectifier circuits with resistive and inductive loads. 3. Draw the circuit diagrams and understand the operation of common single phase rectifier circuits. 4. Draw the circuit diagrams and understand the operation of common three phase rectifier circuits. 5. Draw the circuit diagrams and understand the operation of common single phase cycloconverter circuits. 6. Draw the circuit diagrams and understand the operation of common Three phase cycloconverter circuits. 7. Explain the operation and design simple SMPS circuits, including buck and boost DC-DC converters. 8. Draw the circuit diagrams and understand the operation of common buck converter. 9. Draw the circuit diagrams and understand the operation of common boost converter. 10. Draw the circuit diagrams and understand the operation of common buck-boost converter. 11. Draw the circuit diagrams and understand the operation of common single-phase inverter.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A - AC to DC (Rectifier). AC-DC converter analysis and design (Rectifiers, Controlled Rectifiers) uncontrolled, controlled rectifiers and calculate the input, output and device currents. Draw the waveforms and explain the operation of various modes of AC-DC converters. [26 hrs] Part B - AC to AC (Cycloconverter). AC-AC converter analysis and design and calculate the output voltage. Draw the waveforms and explain the operation of various modes of AC-AC converters [10 hrs]

	Part C - DC to DC (Chopper). DC-DC converter analysis and design (Step-Up, Step-Down, Step-Up and Step-Down). Draw the waveforms and explain the operation of various modes of DC-DC converters. [10 hrs] Part D - DC to AC (Inverter). DC-AC converter analysis and design (Inverters). Basic concepts and Pulse width modulation schemes. [10 hrs]

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

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<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
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<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒Theory
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☐Tutorial
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<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>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>Nashwan Z. Hero</td><td>e-mail</td><td colspan="3">Nashwan.hero@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>
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<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC308</td><td>Semester</td><td>3</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	Understanding AC Machine Principles Analyzing AC Machine Behavior Control Strategies System Integration Practical Applications Problem-Solving Skills Laboratory Skills Teamwork and Communication Professional Development
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Learn how to create a rotating magnetic field from a three-phase stator. 2. Understand the concept of rotor slip and its relationship to rotor frequency. 3. Understand and know how to use the equivalent circuit of an induction motor. 4. Understand power flows and the power flow diagram of an induction motor. 5. Be able to use the equation for the torque-speed characteristic curve. 6. Understand the techniques used for induction motor starting. 7. Understand how the speed of induction motors can be controlled. 8. Understand how to measure induction motor circuit model parameters. 9. Understand how to start single-phase induction motors. 10. Understand the characteristics of the different single-phase induction motor classes: split-phase, capacitor-type, and shaded pole. 11. Understand the equivalent circuit of a synchronous generator. 12. Be able to sketch phasor diagrams for a synchronous generator. 13. Know the equations for power and torque in a synchronous generator. 14. Know how to derive the characteristics of a synchronous machine from measurements (OCC and SCC). 15. Understand the conditions required to parallel two or more synchronous generators.

Indicative Contents المحتويات الإرشادية	AC Machines Fundamentals Introduction, emf equation, mmf of three phase AC winding, production of rotating magnetic field.(2 hrs.). Polyphone Induction Motor Introduction. Construction, cage and wound rotors, principal.(2 hrs.). Torque-slip characteristics, losses and efficiency.(2 hrs.). Problem-Solving Exercises.(2 hrs.). Three phase induction motor starting .(2 hrs.). Speed control of three phase induction motors .(2 hrs.). Mid-term Exam .(2 hrs.). Measure induction motor circuit model parameters.(2 hrs.). Principle of starting single-phase induction motors.(2 hrs.). Characteristics of the different single-phase induction motor classes: split-phase, capacitor-type, and shaded pole.(2 hrs.). The equivalent circuit of a synchronous generator.(2 hrs.). Sketch phasor diagrams for a synchronous generator.(2 hrs.). Equations for power and torque in a synchronous generator.(2 hrs.). Derive the characteristics of a synchronous machine from measurements (OCC and SCC) .(2 hrs.). Conditions required to parallel two or more synchronous generators.(2 hrs.).

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

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	AC Machines Fundamentals Introduction, emf equation, mmf of three phase AC winding, production of rotating magnetic field.
Week 2	Polyphone Induction Motor Introduction. Construction, cage and wound rotors, principal
Week 3	Torque-slip characteristics, losses and efficiency,
Week 4	Problem-Solving Exercises
Week 5	Three phase induction motor starting
Week 6	Speed control of three phase induction motors
Week 7	Mid-term Exam
Week 8	Measure induction motor circuit model parameters

Week 9	Principle of starting single-phase induction motors.
Week 10	Characteristics of the different single-phase induction motor classes: split-phase, capacitor-type, and shaded pole.
Week 11	The equivalent circuit of a synchronous generator
Week 12	Sketch phasor diagrams for a synchronous generator.
Week 13	Equations for power and torque in a synchronous generator.
Week 14	Derive the characteristics of a synchronous machine from measurements (OCC and SCC).
Week 15	Conditions required to parallel two or more synchronous generators
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Simulation of three phase induction motor
Week 2	Lab 2: Torque –speed characteristics for three phase induction motor
Week 3	Lab 3: Speed control three phase induction motor by Supply frequency
Week 4	Lab 4: Efficiency-slip curve of three phase induction motor
Week 5	Lab 5: Speed control three phase induction motor by Supply Voltage
Week 6	Lab 6: Single phase induction motor performance characteristics
Week 7	Lab 7: Torque speed characteristics for capacitor start SPIM

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Microprocessors</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">c</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC320</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>3</td><td colspan="2">Semester of Delivery</td><td colspan="2">6</td></tr>
<tr><td>Administering Department</td><td></td><td>College</td><td colspan="3"></td></tr>
<tr><td>Module Leader</td><td></td><td>e-mail</td><td colspan="3"></td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td></td><td>Version Number</td><td colspan="3">1.0</td></tr>
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<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>Microprocessors</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Objectives
أهداف المادة الدراسية</td><td>1. To introduce the microprocessor interfacing and buffering system.
2. To understand the relation between microprocessor software program and its hardware interfacing.
3. To understand interrupts and directives.
4. This is the basic subject for microprocessor peripherals.
5. To perform various tasks using INT 21h.
6. To study 8086 microprocessor pin diagram in details.
7. To understand buffering system.
8. To understand how memories are designed and interfaced to microprocessors.
9. To design various types of applications by studying how 8086 microprocessors is interfaced to different input/output devices.
10. To study various types of microprocessor peripherals such as PPI, 8253 PIT, keyboard and display interfacing, interrupt controller and others.</td></tr>
<tr><td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td><td>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.
1. Explain what microprocessor is from hardware point of view.
2. Summarize what is meant by a buffering system.
3. Discuss the relation between software and hardware design.
4. Describe interrupts and directives.
5. Design different type of memories.
6. Design control circuits that use 8086 microprocessor connected to various types of input/output devices.
7. Discuss what is meant by microprocessor peripherals.</td></tr>
<tr><td>Indicative Contents</td><td>Indicative content includes the following.</td></tr>
</table>

المحتويات الإرشادية	<u>Part A – Interfacing:</u> Interrupts –directives - pin diagram – buffering system. [15 hrs] Input/Output device interfacing and examples. [15 hrs] <u>Part B – Peripherals:</u> Peripherals interfacing to microprocessor. [30 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		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**	2hr	10% (10)	7	All
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	8086 Microprocessor Pin-Out Diagram
Week 2	Multiplexing and Buffering in 8086 Microprocessor
Week 3	Memory Devices (part 1)
Week 4	Memory Devices (part 2)
Week 5	I/O Device Interfacing (part 1)
Week 6	I/O Device Interfacing (part 2)
Week 7	Mid-term Exam + Parallel Port Interfacing

Week 8	Serial Port Interfacing
Week 9	8253 PIT
Week 10	Keyboard and Display Interfacing
Week 11	A/D and D/A Converters
Week 12	Interrupt Controller
Week 13	8255 PPI
Week 14	8259 Interrupt Controller
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Interrupt 21h – part 1
Week 2	Lab 2: Interrupt 21h – part 2
Week 3	Lab 3: Interrupt 21h – part 3
Week 4	Lab 4: Applications on Interrupt 21h – part 1
Week 5	Lab 5: Applications on Interrupt 21h – part 2
Week 6	Lab 6: Applications on Interrupt 21h – part 3
Week 7	Lab 7: Applications on Interrupt 21h – part 4

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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MODULE DESCRIPTION FORM

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☐ Lecture
☒Lab
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<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="3">EE</td></tr>
<tr><td>Module Leader</td><td>Yazen Hudhaifa Shakir</td><td>e-mail</td><td colspan="3">yazen.shakir@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Mohanad Nihad N.</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>
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العلاقة مع المواد الدراسية الأخرى</th></tr>
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<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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<tr><td>Module Aims
أهداف المادة الدراسية</td><td>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.</td></tr>
<tr><td>Module Learning Outcomes

مخرجات التعلم للمادة الدراسية</td><td>1. Represent the position and orientation of objects in space
2. Determine the kinematic model of a robot arm based on its links and points of articulation.
3. 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).

4- 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.

5. 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.</td></tr>
</table>

	6. Implement robotic motion trajectories using different control techniques, including joint vs. task space and position vs. velocity control. 7. Understand the principles of dynamic modelling and force / torque control (this may not be implemented on the physical robot due to hardware limitations). 8. 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. 9. 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. 10. 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. 11. Singularity Analysis: The Jacobian matrix helps in analyzing and identifying singularities in robotic manipulators. Singularity refers to configurations where the manipulator loses certain degrees of freedom or experiences challenges in achieving desired motions. Understanding the Jacobian allows you to detect and avoid singular configurations or plan alternative paths when necessary.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	
	Poster presentation	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
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<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒Theory
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☒Lab
☒ Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">NVEESC322</td></tr>
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<tr><td>Administering Department</td><td>SCE</td><td>College</td><td colspan="3">EE</td></tr>
<tr><td>Module Leader</td><td>Name: Ibrahim Khalaf Mohammed</td><td>e-mail</td><td colspan="3">ibrahim.mohammed@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Assistance Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Ibrahim Khalaf Mohammed</td><td>e-mail</td><td colspan="3">ibrahim.mohammed@uoninevah.edu.iq</td></tr>
<tr><td>Peer Reviewer Name</td><td>Abdulla I. Abdulla</td><td>e-mail</td><td colspan="3">Abdulla.abdulla@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>
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<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC319</td><td>Semester</td><td>2</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To provide a knowledge and clear idea about differences between the control systems strategies. 2. This course should provide basic understanding, and learn motivation and applications of optimal control systems. 3. This course provides a clear idea about theoretical foundations of optimal control system. 4. The student should have a clear idea about optimal control techniques and their functions. 5. The student should be able to posses detailed knowledge about development of optimal control systems. 6. This course provides the student a clear knowledge about the differences between the ideal and realised systems. 7. Provide the student information about systems noise types. 8. To provide a clear knowledge about the full and partial-order state estimation techniques. 9. To provide an information about noise rejection of realise systems and develop their stability. 10. To provide details about state estimator design methods. 11. The student should be able to design, analysis and implement LQG controller systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Recognize the difference between the ideal and realised systems. 2. Describe the terminologies, basic concepts and fundamentals of optimal control systems. 3. Apply fundamental knowledge and principles of optimal control systems. 4. Recongize the role of Kalman filter in noise rejection and state estimation of practical systems. 5. Design and implementation of LQR controller. 6. Design approaches of state observer system. 7. Evaluate the response of optimal control systems using performance parameters. 8. Analysis and discuss the performance of LQG control systems using Matlab software accesseries.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Optimal Systems Theory</u> 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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	88	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.6

Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	8% (10)	5, 13	LO #3, 4, 5, 12 and 13
	Assignments	2	5% (10)	2, 12	LO # 6 and 14
	Lab.	1	15% (15)	Continuous	
	Report	1	2% (2)	13	LO # 6 and 7
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-9
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 2^{nd} order system in continous time
Week 4	Lab 4: LQR design and implementation of 3^{nd} 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 2^{nd} order system in continous time
Week 9	Lab 9: LQG design and implementation of 3^{nd} order system in continous time

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded

(0 – 49)	**F –** Fail	راسب	(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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Soft Computing**			**Module Delivery**	
Module Type	**Core**			☒Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐Practical ☐Seminar	
Module Code	**NVEESC323**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	4		**Semester of Delivery**	1	
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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة	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.

الدراسية	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. 5. 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 المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	58	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	67	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	

Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Process Control</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">NVEESC324</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>
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<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">Omar Yaseen Ismael</td><td>e-mail</td><td colspan="2">omar.ismael@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>Yazen Hudhaifa Sh.</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>
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<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC315</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	1- Explain the fundamental concepts and principles of process control. 2- Apply mathematical modeling techniques to represent and analyze dynamic systems in process control. 3- Identify and describe the roles and functions of sensors, transducers, actuators, and control valves in control systems. 4- Design and tune controllers, including proportional, integral, and derivative controllers, using various tuning methods. 5- Analyze the stability of control systems and apply stability criteria to determine system stability. 6- Evaluate the performance of control systems in terms of transient response, steady-state error, and frequency response. 7- Design and implement feedback control systems, understanding the advantages of closed-loop control. 8- Apply advanced control techniques such as feedforward control, cascade control, ratio control, and adaptive control in appropriate scenarios. 9- Analyze and manage interactions and coupling effects in multivariable control systems. 10- Consider design considerations and criteria for control system design, including stability, response time, and optimization. 11- Apply control system optimization techniques to improve control system performance. 12- Apply process control principles to real-world applications in various industries. 13- Utilize simulation software and control system design tools for analysis and design purposes. 14- Demonstrate critical thinking, problem-solving skills, and effective communication in the field of process control.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	88	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.6

Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
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<tr><td>Module Code</td><td colspan="3">NVEESC325</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>4</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>Abdurahman Basil AYOUB</td><td>e-mail</td><td colspan="3">abdulrahman.ayoub@uoninevah.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Asst. 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 Hudhaifa Shakir</td><td>e-mail</td><td colspan="3">yazen.shakir@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>
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العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC311</td><td>Semester</td><td>2</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims
أهداف المادة الدراسية</td><td>1. provide students with a solid understanding of the fundamental concepts and principles of industrial automation, emphasizing the integration of system dynamics and control theory.
2. teach students various control system design methodologies and techniques applicable to industrial automation.
3. provide an understanding of the interaction between industrial automation systems and robotics. Students learn about robot control, coordination of robotic systems with other automation components, and the integration of robots into industrial processes.
4. engage students in hands-on projects related to industrial automation. Students apply their knowledge to design, implement, and optimize control systems for real-world industrial processes, emphasizing system dynamics and control theory.
5. teach students about various control systems used in industrial automation, such as PLC (Programmable Logic Controllers).
6. familiarize students with different types of sensors and actuators used in industrial automation.</td></tr>
<tr><td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td><td>1. Demonstrate an understanding of the fundamental concepts and principles of industrial automation.
2. Apply control system design methodologies and techniques to design and analyze industrial automation systems.
3. Apply optimization techniques to industrial automation systems for process optimization, performance improvement, and energy efficiency.
4. Integrate various components of an industrial automation system, including sensors, actuators, controllers, and communication networks, considering system dynamics and control requirements.
5. Apply system and control principles in practical applications.
6. Analyze case studies and industry examples to understand the challenges and best practices in industrial automation.</td></tr>
<tr><td>Indicative Contents
المحتويات الإرشادية</td><td>Here is a classification of indicative contents for an Industrial Automation course for a System and Control Department, organized by the estimated hours of study for each topic (100 hours):

1. Introduction to Industrial Automation (10 hours)
o Definition and importance of industrial automation
o Evolution of industrial automation systems
o Role of system dynamics and control theory in industrial automation
2. Control Systems and Components (15 hours)</td></tr>
</table>

	○ Overview of control systems used in industrial automation (PLC, DCS, SCADA) ○ Sensors and actuators in industrial automation ○ Feedback control concepts and principles 3. Modeling and Simulation in Industrial Automation **(15 hours)** ○ Mathematical modeling of industrial processes ○ Simulation techniques for industrial automation systems ○ Validation and verification of simulation models 4. Control System Design **(15 hours)** ○ Control system design methodologies ○ PID control and tuning methods ○ Stability analysis and stability criteria **5.** Robotics in Industrial Automation **(15 hours)** ○ Control and coordination of robotic systems ○ End-effector selection and integration 6. Optimization in Industrial Automation **(15 hours)** ○ Optimization techniques for process optimization ○ Multi-objective optimization in industrial automation ○ Real-time optimization and model-based control **7.** Case Studies and Practical Applications **(15 hours)** ○ Analysis of real-world industrial automation systems ○ Design and optimization of control systems for specific applications ○ Industrial visits or projects to gain hands-on experience

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Traditional lectures can be used to deliver theoretical concepts and foundational knowledge of industrial automation. 2. Hands-on laboratory sessions provide practical experience in working with industrial automation systems, control components, and software tools. Students can engage in activities such as programming PLCs, configuring control systems, and troubleshooting. 3. Analyzing real-world case studies related to industrial automation helps students apply their knowledge and critical thinking skills to solve practical problems. These case studies can cover various industries and showcase the challenges and solutions in implementing automation systems. 4. Employing a variety of assessment methods, including exams, quizzes, laboratory reports, project presentations, and reflective essays, ensures comprehensive evaluation of students' knowledge, skills, and understanding of industrial automation concepts.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	44	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Industrial Automation
Week 2	Evolution of Industrial Automation Systems
Week 3	Role of System Dynamics and Control Theory in Industrial Automation
Week 4	Control Systems and Components
Week 5	Control Systems and Components
Week 6	Sensors and Actuators in Industrial Automation

Week 7	Sensors and Actuators in Industrial Automation
Week 8	Simulation Techniques for Industrial Automation Systems
Week 9	Control System Design Methodologies
Week 10	Control System Design Methodologies
Week 11	Robotics in Industrial Automation
Week 12	Case Studies and Practical Applications
Week 13	Case Studies and Practical Applications
Week 14	Analysis of Real-World Industrial Automation Systems
Week 15	Analysis of Real-World Industrial Automation Systems
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Industrial Automated Systems Instrumentation and Motion Control by Terry L.M. Bartelt, 2011 Delmar, Cengage Learning	No
Recommended Texts	Programmable Logic Controllers An Emphasis on Design and Application by Kelvin T. Erickson, Dogwood Valley Press.	No
Websites	https://www.classcentral.com/course/swayam-automation-in-manufacturing-19800	

Grading Scheme

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

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Advanced Control Systems</td><td colspan="2">Module Delivery</td></tr>
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☐Practical
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<tr><td>Module Code</td><td colspan="3">NVEESC308</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>4</td><td colspan="2">Semester of Delivery</td><td colspan="2">7</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>Abdullah Ibrahim Abdullah</td><td>e-mail</td><td colspan="3">Abdullah.abdullah@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">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>/</td><td>e-mail</td><td colspan="3">/</td></tr>
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<table>
<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESE313</td><td>Semester</td><td>5</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	➢ 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 مخرجات التعلم للمادة الدراسية	**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. 7. Apply knowledge of control theory for practical implementations in engineering and network analysis.
Indicative Contents المحتويات الإرشادية	**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 استراتيجيات التعلم و التعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.64
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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MODULE DESCRIPTION FORM

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<tr><td>SWL (hr/sem)</td><td colspan="2">150</td></tr>
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<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">Mohanad Nihad Noaman</td><td>e-mail</td><td colspan="2">mohanad.noaman@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">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>
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<tr><th colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC321</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Enable students to develop capabilities and skills for problem-solving and critical thinking in mobile robot design. 2. To provide an understanding of the fundamental principles of mobile robotics and related concepts. 3. To have knowledge about the different types of locomotion. 4. To understand the kinematics of different mobile robots. 5. To understand common sensors used in mobile robotics. 6. To understand basic control strategies for mobile robots. 7. 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 مخرجات التعلم للمادة الدراسية	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. 4. Drive kinematic models for several kinds of mobile robot. 5. Exploring a broad wide of sensors in many mobile robot applications. 6. Knowledge of how to choose a proper sensor for a certain task. 7. An ability to formulate and apply a control technique on mobile robot motion. 8. Practicing all aforementioned knowledge by delivering assignments.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	76	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="3">Adaptive Control</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">NVEESC327</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><td colspan="2">Module Level</td><td>4</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">Ibrahim Khalaf Mohammed</td><td>e-mail</td><td colspan="2">ibrahim.mohammed@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Assistance Professor</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Ibrahim Khalaf Mohammed</td><td>e-mail</td><td colspan="2">ibrahim.mohammed@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Abdulla I. Abdulla</td><td>e-mail</td><td colspan="2">Abdulla.abdulla@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>
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العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>NVEESC313</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To provide a basic understanding, and learn motivation and classification of adaptive control. 2. This course should enable the student to possess detailed knowledge of adaptive and learning control systems and their development. 3. This course provides a clear idea about theoretical foundations of the field of adaptive control. 4. To provide detailed knowledge about the stability of adaptive control systems. 5. To provide an idea about direct and indirect adaptive control systems. 6. To provide detailed knowledge about the standard and modeled input signals of systems. 7. To learn the student all about design process of Model Reference Adaptive Control (MRAC) using MIT Rule and implement it. 8. Design the MRAC system using Lyapunov method and implement it. 9. To learn basic ideas about gain scheduling regulator. 10. This course should enable the student to design and analysis a gain scheduling regulator for linearized actuators. 11. Design and analysis of adaptive control systems based on pole placement self tuner. 12. To design a pole placement adaptive control systems. 13. To connect between classic and adaptive control techniques. 14. To design an adaptive PID controller system.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Recognize the difference between the adaptive and non-adaptive control systems. 2. Describe the terminologies, basic concepts and fundamentals of adaptive control systems. 3. Apply fundamental knowledge and principles of adaptive control systems. 4. Design and development of adaptive control systems. 5. Evaluate adaptive control systems using several controlling adaptation techniques. 6. Analysis and discuss the performance of adaptive control systems using Matlab software environment.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Adaptive Systems Theory Definitions, Concepts, Fundementals, Dynamic properties of adaptive systems, Motivation and applications of adaptive control, Plants types. **[10 hrs]**

	Part B – Adaptive Control Systems Classifications and Strategies of adaptive control systems, Identifier-based adaptive control, Non-identifier adaptive control, Direct daptive control, Indirect adaptive control. **[14 hrs]** Part C – Adaptive Control Techniques -Response Model transfer function, Model reference Adaptive Control fundementals and design, MIT Rule, Lyapunvo method, Performance analysis **[10 hrs]** - Gain schedualing regulator, Identify and obtain auxiliary variables. **[10 hrs]** -Self tuning regulator, Adaptive pole placement adaptive control **[16 hrs]** - Fundementals and principles of adaptive PID controller, adaptive PID controller design and response analysis. **[14 hrs]**

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	Fast class assignment, activation the interaction between lecturer and students in the class, 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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	88	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.43
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	8% (10)	5, 10	LO #3, 4, 5 and 6
	Assignments	2	5% (10)	2, 12	LO # 3, 4, 14 and 15
	Lab.	1	15% (10)	Continuous	
	Report	1	2% (10)	13	LO # 8, 9, 10 and 11
Summative assessment	**Midterm Exam**	2 hr	20% (10)	7	LO # 1-10
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to adaptive control (definition, concepts, principles, comparision between adaptive and non-adaptive control, types of plants.
Week 2	Classification and strategies of adaptive control (Basic idea, principles)
Week 3	MRAC technique (Basics and theory), Reference model design and analysis
Week 4	MRAC design using MIT rule (scalar gain)
Week 5	Practical aspects and implementation
Week 6	MRAC design using MIT rule (vector gain I)
Week 7	MRAC design using MIT rule (vector gain II)
Week 8	MRAC design using Lyapunov method
Week 9	Gain-Schedualing Regulator Technique (Introduction, definition, principle and theory)
Week 10	Gain-Schedualing regulator design and practical aspects and implementation
Week 11	Self tuning regulator technique (Basic, principles, theory and analysis)
Week 12	Self tuning regulator using pole placement approach
Week 13	Pole placement self tuner design and practical aspects and implementation
Week 14	Adaptive PID controller technique
Week 15	Adaptive PID controller design and practical aspects and implementation
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Review to state space systems representation and implementation
Week 2	Lab 2: Standard and special signal inputs generation and implementation for state space systems.
Week 3	Lab 3: Design and Implementation of model reference blocks
Week 4	Lab 4: MIT based MRAC system implementation (scalar gain)
Week 5	Lab 5: MIT based MRAC system implementation (vector gain I)
Week 6	Lab 6: MIT based MRAC system implementation (vector gain II)
Week 7	Lab 7: Gain schedualing system design and implementation
Week 8	Lab 8: Adaptive PID controller system design and implementation I
Week 9	Lab 9: Adaptive PID controller system design and implementation II

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1.P. A. Ioannou and B. Fidan, Adaptive Control Tutorial, SIAM, 2006.	Yes
Recommended Texts	"Adaptive Control" By: K. J. ÅstrÖm and B. Wittenmark, Addison-Wesley; Subsequent edition (January 1, 1994)	No
Websites	https://muwo1.unibo.it/sidra2018deiuniboit/wp-content/uploads/sites/14/2018/07/Lecture-Notes-Adaptive-Control-Bertinoro-2018.pdf	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
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MODULE DESCRIPTION FORM

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<tr><th colspan="6">Module Information
معلومات المادة الدراسية</th></tr>
<tr><td>Module Title</td><td colspan="2">Computer Control Systems</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">NVEESC328</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>4</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">Omar Yaseen Ismael</td><td>e-mail</td><td colspan="2">omar.ismael@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Professor</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</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 Hudhaifa Sh.</td><td>e-mail</td><td colspan="2">yazen.shakir@uoninevah.edu.iq</td></tr>
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<tr><td>Prerequisite module</td><td>NVEESC324</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
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<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims
أهداف المادة الدراسية</td><td>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.</td></tr>
<tr><td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td><td>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:</td></tr>
</table>

	• 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 المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	58	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.571
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Computer Control Systems • Definition and significance of computer control systems • Comparison of computer control 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) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	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 مخطط الدرجات

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

Note: 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

نموذج وصف المادة الدراسية

<table>
<tr><td colspan="6">Module Information
معلومات المادة الدراسية</td></tr>
<tr><td>Module Title</td><td colspan="2">Embedded Systems</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">NVEESC329</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>4</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">Ahmed M.Basheer</td><td>e-mail</td><td colspan="2">ahmed.basheer@uoninevah.edu.iq</td></tr>
<tr><td colspan="2">Module Leader's Acad. Title</td><td>Professor</td><td colspan="2">Module Leader's Qualification</td><td>Ph.D.</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>Mohammad A.Thanoon</td><td>e-mail</td><td colspan="2">mohammed.alsayed@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><td colspan="4">Relation with other Modules
العلاقة مع المواد الدراسية الأخرى</td></tr>
<tr><td>Prerequisite module</td><td>NVEESC320</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 أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	1. Understand the fundamental concepts and principles of embedded systems, including hardware and software integration, real-time operation, resource constraints, and system-level design. 2. Demonstrate proficiency in programming languages commonly used in embedded systems development, such as C or C++, and understand their role in developing embedded software. 3. Acquire knowledge of microcontrollers or microprocessors commonly used in embedded systems and understand their architecture, features, and programming interfaces. 4. Develop skills in designing and implementing embedded software for specific applications, considering factors such as real-time requirements, power efficiency, and resource constraints. 5. Gain hands-on experience in working with development tools, software development kits (SDKs), integrated development environments (IDEs), and debugging techniques specific to embedded systems. 6. 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). 7. Understand the concepts of system-level integration, including sensor interfacing, actuator control, and data acquisition in embedded systems. 8. Explore techniques for testing, debugging, and troubleshooting embedded systems, including simulation, emulation, and hardware debugging tools. 9. Gain an understanding of the challenges and considerations related to power management, energy optimization, and battery life in embedded systems. 10. Develop an awareness of safety, security, and reliability issues in embedded systems and learn strategies for mitigating risks and ensuring system dependability. 11. Apply problem-solving and critical-thinking skills to analyze and solve real-world problems in embedded systems design and implementation. 12. Work effectively as part of a team to develop embedded system projects,

	demonstrating effective communication, collaboration, and project management skills.
Indicative Contents المحتويات الإرشادية	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 استراتيجيات التعلم والتعليم	
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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	74	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	76	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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 مصادر التعلم والتدريس		
	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 مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: 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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية		
Module Title	**Project**	**Module Delivery**
Module Type	**Core**	☒Theory ☐ Lecture ☒ Lab and Meetings ☐ Tutorial ☐Practical ☒ Seminar
Module Code	**NVEESC330**	
ECTS Credits	**6**	
SWL (hr/sem)	**150**	

Module Level	4	**Semester of Delivery**	1
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 العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	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 مخرجات التعلم للمادة الدراسية	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 المحتويات الإرشادية	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	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) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	72	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	78	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.571
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		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)

المنهاج الاسبوعي النظري	
	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) المنهاج الاسبوعي للمختبر	
	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

مصادر التعلم والتدريس

	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 مخطط الدرجات				
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