MODULE DESCRIPTION FORM

2025-2024

Module Information					
Module Title	English Language			**Module Delivery**	
Module Type	Support			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 101				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level	UGI		**Semester of Delivery**	One	
Administering Department	MTE		**College**	COE	
Module Leader	Raghad Raied Mahmood		**e-mail**	raghad.mahmood@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant lecturer		**Module Leader's Qualification**	MSc	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Foster the development of problem-solving skills, with a particular emphasis on speaking, reading, writing, and listening, while also gaining a comprehensive understanding of the English language as a foreign language through the utilization of various techniques. 2. Comprehend the fundamental principles of the English language. 3. Explore the foundational concepts essential for learning the key principles of English grammar and expanding English vocabulary. 4. Establish a solid foundation for proficient English writing and speaking.

	5. Gain a comprehensive understanding of constructing grammatically accurate English sentences.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon completing the course, students will be able to: 1. Demonstrate proficiency in utilizing main and auxiliary verbs, as well as possessive pronouns. 2. Compile a comprehensive list of words associated with questions and various subject pronouns. 3. Engage in conversations concerning social expressions and personal information, particularly regarding jobs, using affirmative, negative, and interrogative sentences. 4. Discuss the usage of adjectives and their placement within sentences. 5. Construct simple present sentences using "I," "we," "you," and "they," and accurately define the usage of articles. 6. Describe the present simple tense utilizing "he" and "she," and explore adverbs of frequency. 7. Identify basic question words and demonstrative pronouns, and effectively apply them in different contexts. 8. Examine the usage of "there is/are" and various prepositions. 9. Analyze the structure of simple past sentences and irregular verbs. 10. Explain the negative and interrogative structures of simple past tense sentences, along with adverbs associated with the past tense. 11. Recognize the usage of multiple adverbs and the use of "can/can't" in sentences, while explaining requests and offers. 12. Elaborate on the usage of "like" and "would you like," as well as the application of "some" and "any" in various expressions. 13. Discuss the application of the present continuous tense and distinguish it from the present simple tense. 14. Explain the structures employed to refer to future plans.
Indicative Contents المحتويات الإرشادية	The indicative content of the course comprises the following: 1. Introduction to the significance of English language acquisition and its role in social communication. 2. Application and practice of various tenses, such as present and past tenses. 3. Comprehensive exploration of key concepts, including offers, requests, future, personal expressions, and different tenses. 4. Utilization of a range of skills to facilitate English language learning, including listening, reading, writing, and speaking. Additionally, providing diverse examples to enhance understanding of concepts and structures.

Learning and Teaching Strategies	
Strategies	The main strategies adopted in delivering this module include:

	• Encouraging active participation and fostering critical thinking skills through engaging students in discussions. • Applying the communicative approach to enhance students' English language learning skills and enable effective communication. • Incorporating authentic materials in the classroom to create a realistic and immersive learning experience. • Emphasizing student motivation and promoting their engagement in the learning process. • Enhancing interaction and communication skills to achieve greater success in English language proficiency.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Unit one: Hello Am/are/is. My/your

	This is with practice in work
Week 2	Unit two: Your world He/she/they, his/her Questions
Week 3	Unit three: All about you Personal information/ social expressions
Week 4	Unit four: Family and friends Possessive adjectives/ possessive 's Have/has, adjective + noun
Week 5	Unit five: The way I live Present simple l/we/you/they An/a , adjective + noun
Week 6	Unit six: Every day Present simple he/she Negatives and questions, adverbs of frequency
Week 7	**Midterm Exam**
Week 8	Unit seven: My favorites Question words, pronouns, this/that Unit eight: Where l live There is/ are, prepositions
Week 9	Unit nine: Times past Was/ were born, past simple and irregular verbs
Week 10	Unit ten: We had a great time. Past simple, regular, and irregular Questions, negatives, ago
Week 11	Unit eleven: l can do that! Can/can't, adverbs, requests
Week 12	Unit twelve: Please and thank you. I'd like, some and any. Like and would like
Week 13	Unit thirteen: Here and now Present continuous Present simple and present continuous
Week 14	Unit fourteen: It's time to go! Future, writing email and information letter
Week 15	**Revision**

Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	John and liz Soar. (New Headway Beginner) 4th edition. Oxford: Oxford University Press.	Yes
Recommended Texts		No
Websites		

Grading Scheme				
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

Module Information					
Module Title	Mathematics I			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 102				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UGI		**Semester of Delivery**	One	
Administering Department	MTE		**College**	COE	
Module Leader	Laith Mohammed Jasim		**e-mail**	Jasiml68@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Rashad Adhed Kamal		**e-mail**	rashad.alsaigh@uomosul.edu.iq	
Peer Reviewer Name	Dr. Loay Younes Aldabbagh		**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to: 1. review and enhance aspects of pre-university mathematics in order to foster genuine confidence and fluency with the material. 2. present a wide range of mathematics ideas in preparation for more demanding material later. 3. introduce crucial basic concepts and important mathematical techniques.

	4. Develop problem-solving skills, especially in formulating verbal descriptions as mathematical problems and in constructing long, multi-step solutions. 5. Know basic differentiation formulas and rules and compute derivatives of elementary functions symbolically. And learn the tools of calculus to solve applied problems. 6. ensure competence in a wide range of essential concepts, techniques, and applications of differential and systems of linear algebraic equations.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1. Evaluate the behaviors and graphs of a wide variety of functions within a certain domain, including piecewise, polynomial, rational, algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic. 2. Give an intuitive explanation of the process of taking a limit, determine the existence of, compute the basic limits of functions, and identify and analyze the limits of a function. 3. Explain the notion of continuity as related to functions and relate it to the mathematical definition of continuity, determine continuity at a point or on intervals, and distinguish between the types of discontinuities at a point, compare the ideas of continuity and differentiability. 4. Define the basic concepts and principles of differential calculus, explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point, and then find the derivatives of various function types. 5. Understand the information that the first and higher derivatives of a function give you about that function, and determine derivatives implicitly. Determine the rate of change of a dependent variable with respect to an independent variable and linear approximations to implicit functions. 6. Determine absolute extrema, critical points, and inflection points of functions, and determine the concavity of curves for a continuous function on a closed interval. Use these and other appropriate techniques to solve optimization problems. 7. Understand the concept of a matrix, and matrix multiplication and addition rules. And determine the transpose, determinant, and Inverse of a matrix. 8. Using Cramer's, Inverse, and Gauss elimination methods to solve the system of linear algebraic equations.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Unit – I: Functions - concept of a function and its types, domain and range, coordinates and graphs in the Plane, directions and quadrants, distance between points, graphs of functions, representing a function numerically, intercepts, slope and equations for lines, slope of lines, vertical line test, piecewise functions, even and odd functions, greatest and least integer functions, function of power, polynomials, rational, algebraic, exponential, and logarithmic, equations for circles, parabolas and ellipses, combining and composite functions, shifting, scaling and reflecting a graph of a function, a review of trigonometric functions, radian measure, the six basic trigonometric functions and their graphs, law of cosines, inverse functions and their graph, logarithm. [10 hrs] UNIT- II: Part A; Limits- definition of limit, rates of change and tangents to curves, secant lines, limit of a function and its laws and theorems, the functions that haven't limits, eliminating common factors from zero denominators, The functions that haven't limits, sandwich theorem, approaching a limit from one side, sin (theta) theta theorem, limits Involving Infinity, horizontal, oblique and vertical asymptote. [10 hrs]

	Part B; Continuity- continuity definition, continuity at a point, continuity test, continuous functions and their properties and theorems, inverse functions and continuity; composites of continuous functions, limits of continuous functions. [10 hrs] UNIT- III: Derivatives- mathematical definition of the derivative, tangents and the derivative at a point, defining slopes and tangent lines, calculating derivatives from the definition, derivative of a function, graphing the derivative, differentiation rules, integer powers, multiples, sums, and differences, second and higher-order derivatives, velocity, speed, and other rate of change such as acceleration and jerk, derivatives of trigonometric functions such as sine, cosine and other basic functions, chain and outside-inside rule, integer powers of differentiable functions, implicit differentiation for find first and higher-order derivatives, lenses, tangents, and normal lines, derivatives of the inverse trigonometric functions, related rates, linearization and differentials. [15 hrs] UNIT – IV: Applications of Derivatives- related rates of change, maxima, minima, and the mean value theorem, first derivative test, increasing functions and decreasing functions, local extrema, second derivative test, concavity and curve sketching, points of inflection, second derivative test for local extrema, graphical behavior of functions from derivatives, graphing rational functions, asymptotes, hopital's rule, Optimization, applied examples from mathematics, applied examples from industry. [13 hrs] UNIT – V: Part A; Matrices- general concepts and notations of matrices, square and rectangular matrices, vectors, rules of addition and scalar multiplication of matrices and vectors, equality of matrices, matrix multiplication and their rules, transposition of matrices and their rules, special types of square matrices, determinant of matrix, evaluation of determinants by reduction to triangular form, Adjugate and cofactor of matrix, inverse of a matrix by determinants, Inverse of a matrix by Gauss-Jordan method. [10 hrs] Part B; System of Linear Algebraic Equation- general form, the matrix of equations, direct methods for solving systems of equations, Gramer's rule, matrix inverse, gauss elimination, Gauss-Jordan methods. [7 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver concepts and fundamental knowledge in relation to calculus and the application of their methods to purely mathematical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of calculus to different practical engineering problems. 3- Assignments - are arranged to provide the opportunity for students to search for information and analyze problems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Functions - concept of a function and its types, domain and range, coordinates and graphs in the Plane, directions and quadrants, distance between points, graphs of functions, representing a function numerically, intercepts, slope and equations for lines, slope of lines, vertical line test.
Week 2	Piecewise functions, even and odd functions, greatest and least integer functions, function of power, polynomials, rational, algebraic, exponential, and logarithmic, equations for circles, parabolas and ellipses, combining and composite functions, shifting, scaling and reflecting a graph of a function.
Week 3	Review of trigonometric functions, radian measure, the six basic trigonometric functions and their graphs, law of cosines, inverse functions and their graph, logarithm. Limits- definition of limit, rates of change and tangents to curves, secant lines, limit of a function and its laws and theorems, the functions that haven't limits, eliminating common factors from zero denominators.
Week 4	The functions that haven't limits, sandwich theorem, approaching a limit from one side, sin (theta) theta theorem, limits Involving Infinity, horizontal, oblique and vertical asymptote. Continuity- continuity definition, continuity at a point, continuity test.
Week 5	Continuous functions and their properties and theorems, inverse functions and continuity, composites of continuous functions, limits of continuous functions. Derivatives- mathematical definition of the derivative, tangents and the derivative at a point.
Week 6	Defining slopes and tangent lines, calculating derivatives from the definition, derivative of a function, graphing the derivative, differentiation rules, integer powers, multiples, sums, and differences, second and higher-order derivatives.

Week 7	**Mid-term Exam** + velocity, speed, and other rate of change such as acceleration and jerk, derivatives of trigonometric functions such as sine, cosine and other basic functions.
Week 8	Chain and outside-inside rule, integer powers of differentiable functions, implicit differentiation for find first and higher-order derivatives, lenses, tangents, and normal lines, derivatives of the inverse trigonometric functions, related rates, linearization and differentials.
Week 9	Applications of Derivatives- related rates of change, maxima, minima, and the mean value theorem, first derivative test, increasing functions and decreasing functions, local extrema.
Week 10	Second derivative test, concavity and curve sketching, points of inflection, second derivative test for local extrema, graphical behavior of functions from derivatives, graphing rational functions, asymptotes.
Week 11	Hopital's rule, Optimization, applied examples from mathematics, applied examples from industry.
Week 12	Matrices- general concepts and notations of matrices, square and rectangular matrices, vectors, rules of addition and scalar multiplication of matrices and vectors, equality of matrices, matrix multiplication and their rules, transposition of matrices and their rules, special types of square matrices.
Week 13	Determinant of matrix, evaluation of determinants by reduction to triangular form, adjugate and cofactor of matrix, inverse of a matrix by determinants, Inverse of a matrix by Gauss-Jordan method.
Week 14	System of Linear Algebraic Equation- general form, the matrix of equations, direct methods for solving systems of equations, Gramer's rule, matrix inverse.
Week 15	Gauss elimination, Gauss-Jordan methods.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

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

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	George Thomas Jr., Maurice Weir, Joel Hass, Thomas' Calculus: Early Transcendentals, Pearson, 13th Edition, October 8, 2013.	Yes
Recommended Texts	Richard Courant and Fritz John, Introduction to Calculus and Analysis, Vol. 1, Springer; 1999th edition, December 3, 1998.	No

Websites	https://www.coursera.org/learn/differentiation-calculus

Grading Scheme				
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

Module Information					
Module Title	Material Science			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 103				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UGI		**Semester of Delivery**	One	
Administering Department	MTE		**College**	COE	
Module Leader	Ahmad Wadollah Saleh Al-Sabawi		**e-mail**	ahmadalsabawi@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	MSc	
Module Tutor	Shahad Waleed Ahmed		**e-mail**	shahad.ahmed@uomosul.edu.iq	
Peer Reviewer Name	Loay B. Y.		**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	Upon successful completion of the course, students should be able to: 1. Model basic and complex parts and components. 2. Describe the fundamental components and limitations of a modern computer numerical control (CNC) machine tool. 3. Select suitable cutting tools and process parameters for a given milling or turning operation. 4. Write, read and troubleshoot NC programs written in standard G-code format. 5. Formulate free-form curves and surfaces mathematically using a parametric expression.

	6. Describe the basic principles of Hermite curve, Bezier curve, B-spline curve and NURBS curve representations 7. Use computer-aided manufacturing (CAM) software to generate both roughing and finishing operations. 8. Describe the relative advantages and disadvantages between two and half axis, three-axis and five axis machining. 9. Work and operate typical CNC machines.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the completion of course, the student will be able to 1. Apply/develop solutions or to do research in the areas of computer aided manufacturing. 2. Deal with simple or complex part geometries. 3. Write gcode for relatively simple shapes and parts. 4. Edit and develop gcode texts that is generated by CAM software and do in – site modification on a text file format. 5. Exposed to the available basic CNC machines. 6. Choose the suitable strategy for machining, either manual or programmed. 7. Design and manufacture CNC machines from scratch. 8. Get a fundamental knowledge of the software used for CNC simulation and gcode exporting tools.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Section 1 introduction to CAM and NC programming</u> Classification of CAM systems, NC programming, gcode, rapid movement command, G0, feedrate movement command, G1, circular interpolation commands, clockwise command G2, counter clockwise command, G3, pause command, dwell command, G4, XY plane designation, G17, YZ plane designation, G18, ZX plane designation, G19, English units of inputs, G20, metric units of inputs, G21, machine zero return positon check, G27, machine zero return – primary reference point, G28, skip function, G31, threading function, G33, exact stop, G61, Absolute input of motion values, G90, incremental input of motion values, G91, feedrate per minute in/min or mm/min, G94, feedrate per revolution – in/rev or mm/rev, G95, retract motion to the initial level in a fixed cycle, G98, retract motion to the initial level in a fixed cycle, G99 [25 hrs] <u>Section 2 Canned Cycles</u> High speed deep hole drilling cycle, G73, left hand tapping cycle, G74, precision boring cycle, G76, fixed cycle cancel, G80, plain drilling cycle, G81, spot drilling cycle, G82, deep hole drilling cycle (peck drilling), G83, right hand tapping cycle, G84, boring cycle, G85. [15 hrs] <u>Section 3 CNC Milling Operations and Computer Aided Design</u> 2.5 milling, facing, slotting, gear machining, 2d pocket machining, profile machining, boring, drilling, 2d contour, 2d adaptive clearing. [25]

Learning and Teaching Strategies	
Strategies	

	Tools and strategies, in addition to the student – teacher interaction in – and – off class, used to deliver the course to the students are basically divided upon the following: 1. Lectures 2. Lab works. 3. Assignments. 4. Mini projects

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to CAM
Week 2	Fundamental principles of NC programming
Week 3	Positional data

Week 4	Cutting commands I
Week 5	Cutting commands II
Week 6	Canned Cycles, part I
Week 7	Midterm Exam + Canned Cycles, part II
Week 8	Milling cycles, Part I
Week 9	Cutting conditions
Week 10	Tool offsets
Week 11	Milling cycles Part II
Week 12	Basic turning cycles, part I
Week 13	Basic turning cycles, part II
Week 14	Computer aided design, a model drawing section
Week 15	Computer aided design, a model machining section using CAM software
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Part or component modeling, section I
Week 2	Part or component modeling, section 2
Week 3	Part or component modeling, section 3
Week 4	Part or component modeling, section 4
Week 5	Part or component modeling, section 5
Week 6	Part machining, milling operation, section 1
Week 7	Part machining, milling operation, section 2
Week 8	Part machining, milling operation, section 3
Week 9	Part machining, milling operation, section 4
Week 10	Part machining, milling operation, section 5
Week 11	Part machining, turning operation, section 1
Week 12	Part machining, turning operation, section 2
Week 13	Part machining, laser cutting, section 1
Week 14	Part machining, laser cutting, section 2
Week 15	Part making, 3-d printing

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	P. Radhakrishanan, and others, CAD/CAM/CIM, 3rd Ed., New Age International Publishers, 2008	No
Recommended Texts	Peter Smid, CNC Programming Handbook, 3rd Ed., Industrial Press, Inc., 2007	No
Websites	https://ocw.mit.edu/courses/res-2-005-girls-who-build-make-your-own-wearables-workshop-spring-2015/pages/manufacturing-mechanical-design/	

Grading Scheme				
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

Module Information					
Module Title	Engineering Drawing & AutoCAD			**Module Delivery**	
Module Type	Basic			☐ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 104				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGI	**Semester of Delivery**		One
Administering Department		MTE	**College**		COE
Module Leader	Zahraa Reyad Mahmood		**e-mail**		zahraa.reyad@uomosul.edu.iq
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		Msc.
Module Tutor	Noor Jamal Younis		**e-mail**		Noor.jamal@uomosul.edu.iq
Peer Reviewer Name		Dr. Hassan Mudhafar Saeed	**e-mail**		saeed81@uomosul.edu.iq
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	Students will be able to:

	1. Drawing engineering shapes manually and clearly, including the effective use of the computer-aided drawing program (AutoCAD). 2. Develop a solid understanding of the basic principles of engineering drawing, Included: a. Solid conceptual understanding of the central principles of engineering drawing, b. The ability to work with concepts, analytically, and visualize them c. A functional understanding of how these ideas will manifest in the real world. 3. Use the graphic results of a specific design and convert them into engineering drawings. 4.Determine the strategies to be used and the assumptions to be made. 5.Use both manual and computer approaches in drawing figures. 6. Develop the ability to use engineering tools flexibly and creatively. 7. Develop an integrated understanding of the AutoCAD module. 8. Developing their ability to communicate scientific ideas. 9.Identify what they do not understand, and ask specific questions to gain understanding. 10. Develop expertise in experimental methodologies.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Understand and apply the basics of drawing types of lines. 2. Define, explain and apply engineering drawing operations. 3. Understand and apply the basic idea of central projection theory. 4. Saving time, effort and fatigue for designers compared to traditional methods of drawing diagrams. 5. Proficiency in AutoCAD: Gain a comprehensive understanding of AutoCAD software, its basic commands, and tools necessary for professional 2D drawing, design, and drafting. 6. Application of Drawing Commands: Acquire the ability to utilize various drawing commands in AutoCAD, including lines, circles, arcs, ellipses, polygons, and other geometric shapes, to create accurate and precise 2D drawings. 7. Modification and Editing Techniques: Develop skills in modifying and editing drawings by employing commands such as erase, trim, extend, mirror, lengthen, offset, chamfer, fillet, and other relevant tools to refine and adjust the design as required. 8. Dimensioning and Annotation: Understand the principles of dimensioning and annotation in engineering drawings. Learn to apply dimensioning commands, create

	text, use different font types, and utilize dimension styles to accurately convey measurements and annotations. 9. By the end of the course, students will have developed the necessary skills and knowledge to effectively use AutoCAD for 2D drawing and design tasks, enabling them to create professional engineering drawings in a computer-aided environment.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: - Introduction and introducing students to the subject of engineering drawing, which includes the following: --Identification of engineering tools and how to use them. - Types of pens used in drawing geometric shapes. - Billboard layout and address field numbers. - How to deal with the engineering board and the engineering Painting. The types of line and its properties, Line : Engineering shapes and the arcs , lamina. , Dimensions: - Various engineering operations: - - Introducing the drawing scale and its types: civil, mechanical, zoom-in, and zoom-out scale. - Teach students how to apply and draw the following engineering operations: - Drawing a straight line parallel to a known straight line - The division of the rectum into two halves - Angle division is known. - Draw an arc tangent to two straight lines - Draw an arc tangent to another arc and a straight line - Draw an arc that touches two other arcs (the inner parenthesis, the outer parenthesis, and the common parenthesis). AutoCAD (first introduction lecture). - Exploring AutoCAD user interface (title bar, menu bar, standard toolbar, drawing area, command window, status bar) and characteristics and benefits of each components to build a drawing in AutoCAD. - Using the keyboard and mouse in AutoCAD. - Use of absolute coordinates (linear and polar) strategy to specify points on workspace. - Use of relative coordinates (linear and polar) strategy to specify points on workspace. - Learning some draw and modify commands (action, access, options).

Learning and Teaching Strategies

Strategies	The primary strategy for delivering this module will be to encourage students to participate in the exercises while refining and expanding their critical thinking skills. This will be accomplished through classes, interactive tutorials, and the consideration of simple experiments involving sampling activities that students find interesting.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Basic concepts of engineering drawing Types of lines used in engineering drawing Drawing board dimensions, drawing paper layout, and title writing Units used in engineering drawing How to find out the scale of the drawing How to enlarge a scale

Week 2	Engineering Operations | straight line bisection | Bisecting the angle | Draw a straight line parallel to another line
Week 3	Draw an arc tangent to two straight lines Draw an arc tangent to another arc and a straight line Draw an arc that touches two other arcs (the inner parenthesis, the outer parenthesis, and the common parenthesis).
Week 4	Solve examples
Week 5	Teaching the basics of Autocad Basic settings, change the color, show the command bar, the command line, and convert the line to a center line or a hiden line
Week 6	**This lecture contains line and polyline drawing commands:** **The circle of the circle is the arc of the arc and the drawing of the tangent, the inner arc and the outer arc**
Week 7	**Mid-Term Exam I**
Week 8	This lecture contains drawing commands Polygonal Ellipse Rectangle (Pentagonal & Hexagonal & etc....)
Week 9	This lecture includes Modify in modification commands
Week 10	Solving engineering operations in AutoCAD
Week 11	This lecture includes the object of snap
Week 12	This lecture includes Drawing projections in AutoCAD
Week 13	
Week 14	Solve examples
Week 15	Solve examples
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1 - 15	The application of each part of the covered drawing subject theoretically and according to the weekly sequence of the curriculum in the AutoCAD laboratory **Note: By three hours a week**

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

Required Texts	**Engineering Drawing and Graphic Technology, By, French & Vierk, Thirteen edition**	Yes
Recommended Texts		
Websites	https://help.autodesk.com/view/ACD/2022/ENU/	

Grading Scheme				
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

Module Information					
Module Title	Computer			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 105				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	UG I		**Semester of Delivery**	One	
Administering Department	MTE		**College**	COE	
Module Leader	Mohammed Falah Mohammed		**e-mail**	mohammed.falah_kanna@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Raghad Raied Mahmood		**e-mail**	raghad.mahmood@uomosul.edu.iq	
Peer Reviewer Name	Sayf A. Majeed		**e-mail**	sayf@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are: 1. To familiarize students with computer software and hardware components 2. To develop proficiency in using Microsoft Office Word for a report and document preparation 3. To enhance students' ability to design professional presentations and lecture slides using Microsoft Office PowerPoint 4. To equip students with the skills to analyze data, create charts and graphs, and utilize different functions in Microsoft Office Excel

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	With the successful completion of this Module, students will be able to: 1. Demonstrate a sound understanding of computer software and hardware components. 2. Effectively use Microsoft Office Word to prepare reports and documents. 3. Design professional presentations and lecture slides using Microsoft Office PowerPoint. 4. Analyze data and create visualizations using Microsoft Office Excel charts, graphs, and functions. 5. Apply advanced features and techniques in Microsoft Office applications for enhanced productivity. 6. Demonstrate effective time management skills while working on computer-based tasks.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Introduction to Computer Software and Hardware: [10 hrs] • Overview of computer components and their functions • Introduction to Number System • Data and Information • Networking • Understanding operating systems and software applications Microsoft Office Word: [8 hrs] • Formatting and layout techniques for professional reports and documents • Working with headers, footers, and page numbering • Incorporating tables, images, and hyperlinks in documents • Advanced document formatting, such as styles, templates, and mail merge Microsoft Office PowerPoint: [4 hrs] • Design principles for creating visually appealing presentations • Creating effective slide layouts and transitions • Incorporating multimedia elements (images, audio, video) • Applying animations and interactive features in presentations Microsoft Office Excel: [10 hrs] • Data entry and basic functions (sum, average, count, etc.) • Creating and formatting charts and graphs for data visualization • Advanced data analysis using functions (IF, VLOOKUP, etc.) • Conditional formatting and data validation techniques Collaboration and sharing in Microsoft Office: [4 hrs] • Using collaboration features to work on documents simultaneously • Sharing and managing documents in a team environment • Version control and tracking changes in documents • Utilizing cloud storage platforms for document storage and sharing Productivity Tips and Tricks: [4 hrs]

	• Time-saving shortcuts and techniques for efficient document creation • Customizing toolbars and ribbons for a personalized workflow • Automating repetitive tasks using macros and templates • Utilizing add-ins and extensions to enhance productivity Practical Application Exercises: [6 hrs] • Hands-on projects and assignments to reinforce learned skills • Real-world scenarios for report creation, presentation design, and data analysis • Critical thinking exercises to apply computer skills in various contexts • Troubleshooting common issues and errors in software applications

Learning and Teaching Strategies	
Strategies	The learning and teaching strategies for the Computer Skills module include a combination of lectures, hands-on labs, group projects, case studies, online resources, and assessments. Here is a summary of the strategies: 1. Lectures: Instructors will deliver lectures to introduce theoretical concepts and provide an overview of computer software, hardware, and applications. Visual aids and interactive discussions will enhance understanding. 2. Hands-on Labs: Students will participate in lab sessions to gain practical experience with software applications. Instructors will guide them through exercises and projects, providing individualized assistance and feedback. 3. Group Projects and Assignments: Collaborative projects and assignments will foster teamwork and problem-solving skills. Students will work together to create documents, presentations, and data analysis projects. 4. Case Studies and Real-world Scenarios: Students will analyze and solve problems based on real-world scenarios, applying computer skills to practical situations. Instructors will provide examples from various academic and professional disciplines. 5. Assessments and Feedback: Formative and summative assessments, including quizzes, projects, presentations, and examinations, will evaluate students' progress. Constructive feedback will be provided to enhance their skills.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.8
Total SWL (h/sem)	75		

الحمل الدراسي الكلي للطالب خلال الفصل	

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to Computer Hardware
Week 2	Introduction to Computer Software (operating systems and software applications)
Week 3	Introduction to Data, Information, and Networking
Week 4	Getting Started with Microsoft Office Word: Document Formatting and Layout. Creating and Formatting Reports in Microsoft Office Word
Week 5	Advanced Document Formatting Techniques in Microsoft Office Word
Week 6	Introduction to Microsoft Office PowerPoint: Slide Design and Layout. Creating Engaging Presentations in Microsoft Office PowerPoint
Week 7	Mid-term Exam + Adding Multimedia and Interactivity to PowerPoint Presentations
Week 8	Introduction to Microsoft Office Excel: Data Entry and Basic Functions
Week 9	Analyzing Data with Charts and Graphs in Microsoft Office Excel
Week 10	Advanced-Data Analysis and Functions in Microsoft Office Excel
Week 11	Enhancing Excel Worksheets: Conditional Formatting and Data Validation
Week 12	Collaboration and sharing in Microsoft Office Applications
Week 13	Tips and Tricks for Productivity in Microsoft Office Word
Week 14	Tips and Tricks for Productivity in Microsoft Office PowerPoint

Week 15	Tips and Tricks for Productivity in Microsoft Office Excel
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Hands-on Practice with Microsoft Office Word: Formatting and Document Creation
Week 2	Report and Document Preparation in Microsoft Office Word
Week 3	Advanced Document Formatting Techniques in Microsoft Office Word
Week 4	Designing Professional Presentations in Microsoft Office PowerPoint
Week 5	Enhancing Slide Design and Layout in Microsoft Office PowerPoint
Week 6	Adding Multimedia and Interactivity to PowerPoint Presentations
Week 7	Data Entry and Basic Functions in Microsoft Office Excel
Week 8	Mid-term Exam
Week 9	Creating Charts and Graphs in Microsoft Office Excel
Week 10	Advanced Data Analysis and Functions in Microsoft Office Excel
Week 11	Conditional Formatting and Data Validation in Microsoft Office Excel
Week 12	Collaborative Work and Sharing in Microsoft Office Applications
Week 13	Increasing Productivity in Microsoft Office Word
Week 14	Increasing Productivity in Microsoft Office Excel
Week 15	Time Management Techniques for Computer-Based Tasks

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Microsoft Office Word 2019 Step by Step" by Joan Lambert	No
Recommended Texts	"COMPUTER HARDWARE: Installation, Interfacing, Troubleshooting, and Maintenance Kindle Edition," by K. L. James, Kindle Edition, 2013.	No
Websites	1. https://support.microsoft.com/en-us/training 2. https://www.tutorialspoint.com/computer_concepts/computer_concepts_hardware_software_concept.htm	

Grading Scheme

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

Module Information					
Module Title	Electrical Circuits Analysis I			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 106				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UG I		**Semester of Delivery**	One	
Administering Department	MTE		**College**	COE	
Module Leader	Sayf A. Majeed		**e-mail**	sayf@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Shahad Waleed Ahmed		**e-mail**	shahad.ahmed@uomosul.edu.iq	
Peer Reviewer Name	Sa'ad Ahmed Salih		**e-mail**	kazzazs60@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	None	**Semester**	None
Co-requisites module	MTE 113 - Electrical Circuits Analysis II	**Semester**	Two

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to: 1. **Understanding Fundamental Concepts**: The course aims to provide students with a solid understanding of fundamental concepts in electrical circuit analysis. This includes voltage, current, resistance, power, etc. 2. **Analysis Methodologies:** Students will learn a variety of analysis methods to solve DC circuits, including Kirchhoff's laws and series and parallel circuit analysis. They will gain proficiency in nodal and mesh analysis methods, enabling them to analyze complex circuits systematically.

	3. **Circuit Simplification:** This course aims to provide students with the skills necessary to use methods like Thevenin's and Norton's theorems to simplify complicated DC circuits and find the equivalent circuits. 4. **Problem Solving Skills:** The course aims to develop problem-solving skills through hands-on activities and problem-solving exercises. 5. **Laboratory Experience**: The course aims to provide hands-on laboratory experiences where students can apply theoretical knowledge to practical scenarios. 6. **Preparation for Advanced Courses:** Prepare students for more advanced courses. A solid understanding of this course is essential in electronics, signal processing, control systems, and other specialized areas. Overall, the Electrical Circuits Analysis I course aims to provide Mechatronics Engineering students with a solid foundation in DC circuit analysis, enabling them to understand, analyze, and design electrical circuits relevant to their field of study.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	With the successful completion of this Module, students will be able to: 1. Understand the fundamental concepts and principles of electric circuits, including circuit elements, systems of units, and voltage-current relations. 2. Demonstrate knowledge of Ohm's Law and its application in analyzing direct current (DC) networks. 3. Apply Kirchhoff's Laws to analyze and solve DC circuits using nodal and mesh analysis methods. 4. Analyze series and parallel resistor combinations and calculate voltage and current division in these configurations. 5. Perform Star (Wye)-Delta transformations to simplify complex resistor networks. 6. Apply source transformations to simplify circuit analysis and calculations. 7. Understand and apply the linearity and superposition theorems in DC circuit analysis. 8. Apply Thévenin's and Norton's theorems to simplify complex circuits into equivalent circuits. 9. Understand and apply the maximum power transfer theorem to optimize power transfer in DC circuits. 10. Analyze the behavior of capacitors and inductors in DC circuits, including their combinations in series and parallel.

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A - Introduction to DC Circuit Concepts Systems of Units, Current and voltage definitions, Passive sign convention and circuit elements, Combining resistive elements in series and parallel. Circuit Diagrams, Nodes, Branches, Loops, and Ohm's Law in the Direct Current (DC) Network. Kirchhoff's laws, Independent and Dependent sources [25 hrs] Revision problem Classes [6 hrs] Part B - Introduction to Methods of Analysis. Introduction to DC circuit analysis, Fundamentals Resistive networks, voltage and current sources, Voltage and Current Division, Nodal Analysis, and Super node, Mesh Analysis, and Super mesh. [20 hrs] Part C - Introduction to Circuit Theorems. Linearity Property, Superposition, Source Transformations, Thevenin and Norton equivalent circuits, and maximum power transfer, [18 hrs] Part D - Introduction to Capacitors and Inductors. Introduction to Capacitors in Parallel and Series; Capacitor Current and Voltage, Inductors in Parallel and Series; Inductors Current and Voltage [6 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussion, while at the same time refining and expanding their critical thinking skills. This will be achieved through: 1. Active Learning: Encourages students to participate in the learning process through discussions, group projects, practical experiments, and problem-solving exercises. 2. Interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students. 3. Gamification: in order to increase motivation and engagement in the learning process, game elements will be incorporated, such as competition, rewards, and challenges.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Review the Course MTE 106, Discuss the Syllabus, Introduction to Systems of Units
Week 2	Circuit Concepts - Passive and Active Elements, Voltage-Current Relations, and Circuit Diagrams
Week 3	Nodes, Branches, Loops, and Ohm's Law in the Direct Current (DC) Network.
Week 4	Kirchhoff's Laws: KVL and KCL
Week 5	Series and Parallel Resistors with Voltage and Current Division
Week 6	Nodal Analysis, and Super node
Week 7	Mesh Analysis, and Super mesh
Week 8	Mid-term Exam + Source Transformations + Independent and Dependent sources
Week 9	Star (Wye)-Delta Transformations
Week 10	Linearity and Superposition Theorems

Week 11	Thévenin's and Norton Theorems
Week 12	Maximum Power Transfer Theorem
Week 13	Capacitors: Capacitors in Parallel and Series; Capacitor Current and Voltage
Week 14	Inductors: Inductors in Parallel and Series; Inductors Current and Voltage
Week 15	Review, Practice
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to Lab instruments, Reports, Safety, and Rules
Week 2	Lab 2: Electrical Measurements, and use of Breadboards
Week 3	Lab 3: introduction to MultiSim simulation software
Week 4	Lab 4: Ohm's law (Hardware)
Week 5	Lab 5: Ohm's law (Simulation)
Week 6	Lab 6: Kirchhoff's Laws (Simulation)
Week 7	Lab 7: Kirchhoff's Laws (Hardware)
Week 8	Mid-term Exam
Week 9	Lab 9: Simple DC Circuits: A Series Circuits
Week 10	Lab 10: Simple DC Circuits: A Parallel Circuits
Week 11	Lab 11: Superposition Theorem
Week 12	Lab 12: Thevenin's Theorem (Simulation)
Week 13	Lab 13: Thevenin's Theorem (Hardware)
Week 14	Lab 14: Maximum Power Transfer (Simulation)
Week 15	Lab 15: Maximum Power Transfer (Hardware)

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

Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering

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

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

MODULE DESCRIPTION FORM

Module Information					
Module Title	Democracy and Human Rights			**Module Delivery**	
Module Type	Support			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 107				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level		UGII	**Semester of Delivery**		three
Administering Department		MTE	**College**	COE	
Module Leader	Rashad Adhed Alsaigh		**e-mail**	rashad.alsaigh@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant lecturer	**Module Leader's Qualification**		MSc
Module Tutor			**e-mail**		
Peer Reviewer Name		Zainab abd alellah abd alkareem	**e-mail**	lawyerzainabaa@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aim of studying the democracy and human rights topics is to: 1. **Understand** the concept of human rights and explore their sources, including international, regional, national, and religious sources. 2. **Define** administrative corruption, explore its types, and understand its detrimental effects on society. Study methods to combat administrative corruption and promote transparency, accountability, and good governance.

	3. **Trace** the historical development and evolution of human rights, examining key milestones and movements that have shaped the modern understanding of human rights. 4. **Differentiate** between different categories of human rights, including civil and political rights, economic and social rights, and environmental, cultural, and developmental rights. 5. **Explore** legal, institutional, and societal guarantees to prevent human rights violations, including guarantees of human rights in Islam, national-level protections, and international safeguards. 6. **Comprehend** the concept of democracy, including its principles, values, and various forms of democratic governance such as direct, semi-direct, indirect, and digital democracy. Overall, studying these topics aims to develop a comprehensive understanding of human rights, democracy, and combating corruption, empowering individuals to actively promote and protect human rights and democratic values in society.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After these module aims, students should be able to: 1. Demonstrate a comprehensive understanding of the concept of human rights and their sources, including international, regional, national, and religious sources. 2. Identify and explain the fundamental characteristics of human rights, such as universality, indivisibility, interdependence, and inalienability. 3. Analyze the historical emergence and evolution of human rights, including key milestones and movements that have shaped their development. 4. Differentiate between different categories of human rights, including civil and political rights, economic and social rights, and environmental, cultural, and developmental rights. 5. Evaluate and apply legal, institutional, and societal guarantees to prevent human rights violations, considering guarantees in Islam, at the national level, and within the international framework. 6. Understand and discuss the concept of democracy, including its principles, values, and different forms of democratic governance. 7. Evaluate the Islamic stance on democracy and engage in critical analysis of the strengths and weaknesses of the democratic system. 8. Recognize and assess the impact of administrative corruption on society and propose methods to combat and prevent corruption in administrative systems. 9. Demonstrate critical thinking skills by analyzing and evaluating different perspectives on human rights, democracy, and corruption. 10. Apply acquired knowledge and skills to promote and protect human rights, democracy, and good governance in personal, professional, and civic contexts. Overall, students should have a solid understanding of democracy and human rights, democracy, and corruption issues, and be able to apply this knowledge to contribute to the advancement of human rights and democratic values in society.
Indicative Contents المحتويات الإرشادية	The indicative content includes: 1. Definition and sources of democracy and human rights (international, regional, national, religious). [3h]

	2. Characteristics of democracy and human rights: universality, indivisibility, interdependence, inalienability. [3h] 3. Emergence and evolution of human rights: historical development, key milestones, influential movements. [3h] 4. Types of human rights: civil and political, economic and social, environmental, cultural, and developmental. [3h] 5. Guarantees to prevent human rights violations: legal, institutional, societal safeguards, Islamic guarantees, national and international levels. [3h] 6. Concept of democracy: principles, values, forms of governance (direct, semi-direct, indirect). [3h] 7. Islamic stance on democracy: compatibility, strengths, weaknesses. [3h] 8. Critique of the democratic system: analysis of strengths and weaknesses. [3h] 9. Administrative corruption: definition, types, societal impact. [3h] 10. Methods to combat administrative corruption. [3h]

Learning and Teaching Strategies	
Strategies	When it comes to learning and teaching strategies for a human rights module, there are several approaches can be taken to enhance understanding and engagement. Here are some effective strategies: 1. Interactive Discussions: Encourage students to actively participate in discussions, debates, and group activities. This promotes critical thinking, allows for different perspectives to be shared, and fosters a deeper understanding of human rights issues. 2. Case Studies: Present real-life case studies that highlight human rights violations or achievements. Analyzing these cases helps students apply theoretical concepts to practical situations and develops their problem-solving skills. 3. Research Projects: Assign research projects on specific human rights topics or issues. This encourages independent learning, critical analysis, and the development of research skills. 4. Collaborative Learning: Foster collaboration among students through group projects or assignments. This encourages teamwork, peer learning, and the exchange of diverse perspectives. 5. Assessment Variety: Use a variety of assessment methods, including essays, presentations, debates, and quizzes, to assess students' understanding of human rights concepts and their ability to apply them to real-world situations.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Definition of human rights and sources of rights (international sources / regional sources / national sources / religious sources).
Week 2	Characteristics of human rights.
Week 3	The emergence and evolution of human rights.
Week 4	Types of human rights / civil and political rights. Economic and social rights. Environmental, cultural, and developmental rights.
Week 5	Guarantees to prevent human rights violations / guarantees of human rights in Islam.
Week 6	Guarantees for the protection of human rights at the national level.
Week 7	Guarantees of human rights at the international level.
Week 8	The concept of democracy.
Week 9	Characteristics of a democratic system.
Week 10	Forms of democratic governance (direct democracy / semi-direct democracy / indirect democracy).
Week 11	Digital democracy / definition and advantages and disadvantages of digital democracy / manifestations of digital democracy.

Week 12	The Islamic stance on democracy.
Week 13	Critique of the democratic system.
Week 14	Administrative corruption / definition and types.
Week 15	Methods to combat administrative corruption.
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	ضمانات حقوق الانسان وحمايتها وفقا للقانون الدولي والتشريع الوطني / نبيل عبد الرحمن ناصر الدين	No
Recommended Texts	الديمقراطية وحقوق الانسان / د. امير عبد العزيز	No
Websites		

Grading Scheme				
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

Module Information					
Module Title	Arabic Language			**Module Delivery**	
Module Type	support			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 108				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level	UGI		**Semester of Delivery**	Two	
Administering Department	MTE		**College**	COE	
Module Leader			**e-mail**		
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

MODULE DESCRIPTION FORM

Module Information					
Module Title	Mathematics II			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 108				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGI	**Semester of Delivery**		two
Administering Department		MTE	**College**		COE
Module Leader	Dr. Abbas ANWER		**e-mail**		abbas.oghor@uomosul.edu.iq
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Dr. Abbas Anwer		**e-mail**		abbas.oghor@uomosul.edu.iq
Peer Reviewer Name		Dr. Loay Aldabbagh	**e-mail**		loayaldabbagh@uomosul.edu.iq
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	None
Co-requisites module	MTE 203 - Applied Mathematics I	**Semester**	Three

Module Aims, Learning Outcomes and Indicative Contents

Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Evaluate the definite integral by using the Fundamental Theorem of Calculus. 2. Recognize the integration by parts and substitution rule. 3. Evaluate the indefinite integrals. 4. Recognize the methods of numerical integration and define the hyperbolic and inverse hyperbolic functions. 5. Provide the evaluation of integrals by using integral techniques. 6. Work with transcendental functions and evaluate integrals using techniques of integration. 7. Apply integration to compute areas, arclength, volumes of a solid of revolution, moments and centers of mass, areas of surfaces of revolution, evaluate the areas and lengths in polar coordinates. 8. Recognize the convergences of sequence, series and power series.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. provide an accessible review of the advanced calculus from the text book to long after the class and to provide the concepts integration and the applications of integration. 2. It presents a source for undergraduate students at their first year. 3. Calculus is taught in a traditional lecture format or in laboratories with individual and group learning focusing on numerical and graphical experimentations. 4. Give an ability to apply knowledge of mathematics on engineering problems. Provide the evaluation of integrals by using integral techniques. 5. Give the basic concepts of analytic geometry. 6. Give a broad knowledge and basic understanding of sequences and series. 7. Provide the limit, continuity and integral of vector-valued functions in application.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: 1. Concept of area, estimating with finite sums, sigma notation and limits of finite sums definite integral, The Fundamental Theorems of Calculus and Integral [8 hrs]. 2. integration by parts, substitution rule, indefinite integrals, numerical integration [8 hrs]. 3. hyperbolic and inverse hyperbolic functions [8 hrs]. 4. techniques of integration, area, lengths of plane curves, volumes of a solid of revolution, areas of surfaces of revolution, moments and centers of mass, moments of inertia, Pappus theorems, areas and lengths in polar coordinates. [8 hrs] 5. improper integrals, sequences, infinite series, tests of convergence for arithmetic, geometric, harmonic, alternating series. [8 hrs] 6. absolutely convergent, conditionally convergent, derivation and internal of power series, convergence of power series. [8 hrs] 7. Taylor and Maclaurin Series, Fourier Series, vectors, dot Product, cross product [8 hrs]

	8. lines and planes in space, cylinders and quadric surfaces, vector-valued functions, limits and continuity and integrals of vector-valued functions. 9. [4 hrs]

Learning and Teaching Strategies	
Strategies	1- Lectures - aim to deliver fundamental knowledge in relation to calculus and theories to practical examples. 2- Assignments – is arranged to provide the opportunity for students to search for information, analyze economic theories with knowledge obtained, and present the completed tasks. 3- Quizzes - is arranged to provide to test the students level on the materials that studied.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Concept of area, estimating with finite sums, sigma notation and limits of finite sums, definite integral, the fundamental theorems of calculus
Week 2	Evaluation of Limit using the definite integral, indefinite integral and its properties
Week 3	Integration by parts, substitution rule, integral formulas
Week 4	Numerical integration metods, hyperbolic and inverse hyperbolic functions)
Week 5	Techniques of integration
Week 6	Techniques of integration
Week 7	Area, lengths of plane curves, volumes of a solid of revolution, areas of surfaces of revolution
Week 8	Moments and centers of mass, moments of inertia, Pappus theorems
Week 9	Midterm exam
Week 10	Sequences, infinite series, tests of convergence for arithmetic, geometric, harmonic, alternating series
Week 11	Absolute convergent, conditional convergent, convergence of power series
Week 12	Absolute convergent, conditional convergent, convergence of power series
Week 13	Derivation and integral of power series, Taylor and Maclaurin Series, Fourier Series
Week 14	Root locus Technique -2
Week 15	Vectors, dot product, cross product, lines and planes in space, cylinders and quadric surfaces
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Thomas' Calculus 14th Edition by Thomas' Calculus 14th Edition (Author),	Yes
Recommended Texts	Thomas' Calculus 14th Edition by Thomas' Calculus 14th Edition (Author),	Yes
Websites	https://drive.google.com/drive/u/2/folders/15AlyAcd4bVUUICaKFnM-qifdAedeJJUD	

Grading Scheme				
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

Module Information					
Module Title	Engineering Mechanics-Static I			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 110				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGI	**Semester of Delivery**		two
Administering Department		MTE	**College**		COE
Module Leader	Islam Abdullah Aziz		**e-mail**		islamabd@uomosul.edu.iq
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		Msc.
Module Tutor	Noor Jamal		**e-mail**		noor.jamal@uomosul.edu.iq
Peer Reviewer Name		Dr. Loay Younes Aldabbagh	**e-mail**		loayaldabbagh@uomosul.edu.iq
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Recognize various types of Forces, their components, and the function of each component. 2. Identify the types of moments and the methods used to calculate them. 3. Distinguish between different types of frictional forces. 4. Familiarity with the position of equilibrium and the equations used in

	the subject. 5. Identify the methods used to find the center of geometric shapes.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1. an ability to identify, evaluate and solve engineering problems utilizing the acquired principal knowledge of engineering, science, and mathematics. 2. an ability to design an integrated system and its various components and processes to produce solutions that fulfill the need of society. 3. an ability to communicate effectively using oral, written, and graphic forms with different levels of audiences. solve systems 4. an ability to acquire new engineering knowledge and skills in the mechatronics engineering fields. 5. an ability to function on multi-disciplinary teams to analyze, solve problems, and deadline commits.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Unit – I: Introduction - Basic concepts of force calculations, component analysis, and resultant calculation for the main and inclined axes [15 hrs] UNIT- II: Applications of moments in engineering works and methods of solving problems subject to moments of forces [15 hrs] UNIT- III: An introduction to couple moment and its practical uses and methods of solving problems related to couple moments [15 hrs] UNIT – IV: An introduction to the balance of forces and its engineering applications and the method of using equilibrium equations to solve problems related to the topic. [15 hrs] UNIT – V: Surface friction and methods of finding the internal forces of friction for flat and inclined surfaces [15 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aims to introduce the basic concepts and knowledge regarding forces analysis and the application of its methods to purely mathematical examples. 2- Tutorials - These are posted to illustrate the application of basic knowledge of equilibrium theory used to solve various practical engineering problems. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze problems and discrete data, model their equations, with knowledge obtained, and present the completed tasks.

	4-Computer courses - to develop actual computer codes to solve real problems, therefore the use of computer programs for force analysis and component calculation is an important part of the subject.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction - Concepts for the Analysis method in engineering mechanic
Week 2	Forces system
Week 3	Resultant for forces
Week 4	Introduction for moment
Week 5	Moment of forces
Week 6	Couple moment
Week 7	**Mid-term Exam**

Week 8	Interpolation - Equilibrum of forces
Week 9	Equilibrum of forces
Week 10	Interpolation -Friction
Week 11	Friction of forces
Week 12	Friction of forces
Week 13	Interpolation – of centroid
Week 14	Centroid of area
Week 15	Centroid of area
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	Engineering Mechanics, STATICS, Bedford A. and Fowler W., PEARSON, Prentice Hall, 5th Edition, 2008. 3. Vector Mechanics for Engineers, STATICS, Beer F. P. , Johnston E. R., Mazurek D. F.,	Yes
Recommended Texts	Vector Mechanics for Engineers, STATICS, Beer F. P. , Johnston E. R., Mazurek D. F., Cornwell P. J. and Eisenberg E. R., McGraw-Hill, 9th Edition, 2010.	Yes
Websites	https://www.coursera.org/learn/ engineering mechanic	

Grading Scheme

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

Module Information					
Module Title	Computer Programming			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 105				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		UGI	**Semester of Delivery**		Two
Administering Department		MTE	**College**	COE	
Module Leader	Raghad Raied Mahmood		**e-mail**	raghad.mahmood@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant lecturer	**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name		Mohammed Falah	**e-mail**	mohammed.falah_kanna@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Understanding algorithms & flowcharts: Introduce students to the concept of algorithms and how to represent them using flowcharts. They should be able to design and analyze algorithms for problem-solving. 2. Familiarizing with basic data types in C++: Teach students the fundamental data types in C++ such as integers, floating-point numbers, characters, and booleans. They should understand how to declare variables of these types and perform basic operations on them.

	3. Exploring the numbering system: Provide students with an understanding of different numbering systems, including binary, octal, and hexadecimal. They should be able to convert numbers between different bases and work with them in C++. 4. Implementing if-else statements: Teach students how to use if-else statements for making decisions in their programs. They should be able to write conditional statements based on specific conditions. 5. Utilizing for loops for repetition: Introduce the concept of for loops for executing a block of code repeatedly. Students should learn how to use for loops effectively for iteration and repetition tasks. 6. Understanding control structures: Explore additional control structures in C++ such as switch-case statements and nested if-else constructs. Students should understand how to control the flow of program execution based on various conditions. 7. Implementing functions: Teach students how to define and use functions in C++. They should learn how to write modular code by encapsulating reusable blocks of code into functions. 8. Exploring recursive functions: Introduce the concept of recursion, where a function calls itself. Students should understand how to design and implement recursive functions to solve problems that can be solved recursively. 9. Working with two- and multidimensional arrays: Teach students how to declare, initialize, and manipulate two- and multidimensional arrays in C++. They should understand how to access array elements and perform operations on them. 10. Passing arrays as parameters to functions: Introduce the concept of passing arrays as parameters to functions. Students should learn how to write functions that accept arrays as arguments and modify them within the function. 11. Understanding records (structs): Introduce the concept of structures or records in C++. Students should understand how to define and work with user-defined types that contain multiple variables of different data types.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1. Understand and apply algorithms and flowcharts to solve problems in C++ programming. 2. Demonstrate proficiency in using basic data types in C++, including integers, floating-point numbers, characters, and booleans. 3. Work with different numbering systems, such as binary, octal, and hexadecimal, and perform conversions between them.

	4. Implement if-else statements effectively to make decisions based on specific conditions in their programs. 5. Utilize for loops for efficient iteration and repetition of code blocks. 6. Demonstrate mastery over control structures in C++, including switch-case statements and nested if-else constructs. 7. Design and implement functions to write modular and reusable code in C++ programs. 8. Apply recursive functions to solve problems that can be addressed using recursive approaches. 9. Manipulate and work with two- and multidimensional arrays in C++, including accessing elements and performing operations on them. 10. Pass arrays as parameters to functions, allowing for more flexible and efficient code organization and manipulation. 11. Understand and work with records (structs) in C++, defining user-defined types that can contain multiple variables of different data types.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Algorithms & Flowcharts: Introducing the concept of algorithms and how to represent them using flowcharts. Students learn how to design step-by-step instructions to solve problems. [4 hrs.] 2. BASIC DATA TYPES IN C++: Covering the fundamental data types in C++, such as integers, floating-point numbers, characters, and booleans. Students learn how to declare and use variables of these data types. [4 hrs.] 3. Numbering System: Explaining different numbering systems like binary, octal, and hexadecimal, and their conversion to and from decimal. Students understand how to work with numbers in different bases. [4 hrs.] 4. if-else statements: Introducing conditional statements in C++ using if-else constructs. Students learn how to make decisions based on certain conditions. [6 hrs.] 5. for Looping (Repetition) Structure: Teaching the concept of loops in C++, specifically the for loop. Students learn how to execute a block of code repeatedly based on a given condition. [6 hrs.] 6. CONTROL STRUCTURES: Exploring additional control structures like switch-case statements and nested if-else constructs. Students understand how to control the flow of execution based on various conditions. [6 hrs.] 7. Functions: Introducing functions as reusable blocks of code that perform specific tasks. Students learn how to declare and define functions, pass arguments, and return values. [6 hrs.]

	8. Recursive Functions: Exploring the concept of recursion, where a function calls itself. Students learn how to design and implement recursive functions to solve specific problems. [6 hrs.] 9. Two- and Multidimensional Arrays: Introducing arrays as data structures to store multiple values. Students learn about one-dimensional arrays as well as two-dimensional arrays for representing matrices or grids. [6 hrs.] 10. Arrays as Parameters to Functions: Teaching how to pass arrays as parameters to functions. Students understand how to manipulate arrays within functions and return modified arrays. [6 hrs.] 11. Records (structs): Introducing the concept of structures or records in C++. Students learn how to define and work with user-defined types that contain multiple variables of different data types. [6 hrs.]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' active participation in discussions and promote the development of their critical thinking skills. This will be achieved through various approaches, including: 1. Interactive lectures: Engaging students through interactive lectures that involve discussions, demonstrations, and real-life examples related to the topics covered in the course. 2. Hands-on programming exercises: Providing students with practical programming exercises to apply their knowledge and reinforce their understanding of the concepts. These exercises can involve implementing algorithms, working with different data types, and solving problems using control structures and functions. 3. Group discussions and problem-solving activities: Encouraging students to collaborate in groups to discuss programming challenges, analyze algorithms, and find solutions. This promotes teamwork, communication, and critical thinking skills. 4. Code review and feedback: Providing constructive feedback on students' code to enhance their coding practices and improve their understanding of programming concepts. This feedback can be provided during individual or group code review sessions. 5. Case studies and real-world examples: Integrating case studies and real-world examples relevant to Mechatronic Engineering to demonstrate the practical application of programming concepts. This helps students connect theory with real-world scenarios and motivates their learning. 6. Assignments and projects: Assigning programming assignments and projects that require students to apply their knowledge and skills to solve specific

	problems related to Mechatronic Engineering. This allows students to practice and demonstrate their understanding of the covered topics. 7. Assessment and evaluation: Conducting regular assessments, such as quizzes and tests, to gauge students' understanding of the material. The assessments can include both theoretical questions and programming tasks to evaluate their knowledge and problem-solving abilities.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Algorithms & Flowcharts: Understanding the concept of algorithms and how to represent them using flowcharts to solve problems step by step.
Week 2	Basic Data Types in C++: Familiarizing with fundamental data types in C++ such as integers, floating-point numbers, characters, and booleans. Learning how to declare and use variables of these data types.

Week 3	Numbering System: Exploring different numbering systems like binary, octal, and hexadecimal, and their conversions to and from decimal. Applying the knowledge of numbering systems in C++ programming.
Week 4	if-else Statements: Implementing conditional statements using if-else constructs to make decisions based on specific conditions.
Week 5	Control Structures: Extending the knowledge of control structures beyond if-else statements.
Week 6	Control Structures: Extending the knowledge of control structures using switch-case.
Week 7	**Mid-term Exam**
Week 8	For Looping (Repetition) Structure: Understanding the for-loop structure to execute a block of code repeatedly for a specified number of iterations.
Week 9	While/ do while Looping (Repetition) Structure: Understanding the while and do while loop structure to execute a block of code repeatedly for a specified number of iterations.
Week 10	Functions: Learning how to define and use functions in C++ to organize and reuse code.
Week 11	Functions: Understanding function declaration, definition, parameter passing, and return values.
Week 12	One dimensional Array: Working with arrays in C++, including one-dimensional arrays Learning how to declare, initialize, access, and manipulate array elements.
Week 13	Multidimensional arrays: Working with arrays in C++, two- and multidimensional arrays. Learning how to declare, initialize, access, and manipulate array elements.
Week 14	Arrays as Parameters to Functions: Passing arrays as arguments to functions, allowing for efficient manipulation and processing of array data within functions.
Week 15	Records (Structs): Introducing structures or records in C++, defining user-defined types that can hold multiple variables of different data types.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1 - Algorithms & Flowcharts: Understanding the concept of algorithms and how to represent them using flowcharts to solve problems step by step.
Week 2	Lab 2 - Basic Data Types in C++: Familiarizing with fundamental data types in C++ such as integers, floating-point numbers, characters, and booleans. Learning how to declare and use variables of these data types.
Week 3	Lab 3 - Numbering System: Exploring different numbering systems like binary, octal, and hexadecimal, and their conversions to and from decimal. Applying the knowledge of numbering systems in C++ programming.
Week 4	Lab 4 - if-else Statements: Implementing conditional statements using if-else constructs to make decisions based on specific conditions.
Week 5	Lab 5 - Control Structures: Extending the knowledge of control structures beyond if-else statements.

Week 6	Lab 6 - Control Structures: Extending the knowledge of control structures using switch-case.
Week 7	**Mid-term Exam**
Week 8	Lab 8 - For Looping (Repetition) Structure: Understanding the for loop structure to execute a block of code repeatedly for a specified number of iterations.
Week 9	Lab 9 - While/ do while Looping (Repetition) Structure: Understanding the while and do while loop structure to execute a block of code repeatedly for a specified number of iterations.
Week 10	Lab 10 - Functions: Learning how to define and use functions in C++ to organize and reuse code.
Week 11	Lab 11 - Functions: Understanding function declaration, definition, parameter passing, and return values.
Week 12	Lab 12 - One dimensional Array: Working with arrays in C++, including one-dimensional arrays Learning how to declare, initialize, access, and manipulate array elements.
Week 13	Lab 13 - Multidimensional arrays: Working with arrays in C++, two- and multidimensional arrays. Learning how to declare, initialize, access, and manipulate array elements.
Week 14	Lab 14 - Arrays as Parameters to Functions: Passing arrays as arguments to functions, allowing for efficient manipulation and processing of array data within functions.
Week 15	Lab 15 - Records (Structs): Introducing structures or records in C++, defining user-defined types that can hold multiple variables of different data types.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	C++ Programming from Problem Analysis to Program Design [5th Edition] book	Yes
Recommended Texts		No
Websites		

Grading Scheme

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

Module Information					
Module Title	Engineering Materials and Manufacturing Processes			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 111				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGI	**Semester of Delivery**		Two
Administering Department		MTE	**College**	COE	
Module Leader	Ahmad Wadollah Saleh Al-Sabawi		**e-mail**	ahmadalsabawi@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		MSc
Module Tutor			**e-mail**		
Peer Reviewer Name		Dr. Loay Younes Aldabbagh	**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	This module aims to enable the students to: 1. Know the available engineering materials and their most important properties those are related to manufacturing subject. 2. Have a basic knowledge about the economy of manufacturing processes such the cycle time, batch time, …etc.

	3. Understand the basic testing methods those used to identify the material under test such tensile test, hardness test, …etc. 4. Have a general information about all of the manufacturing processes used in industry such as casting, forging, …etc. 5. Deal with traditional workshop items and the safety issues. 6. Have a fundamental knowledge about the measurements and measuring tools such as rulers, Verniers, … etc. 7. Be subjected to the comparison tools and equipment such gauge blocks and dial gauge indicator. 8. Understand the basics of the turning machines and its fundamental operations such as longitudinal turning, facing, tapering ,…etc. 9. Understand the basics of milling machines and milling operations such slab milling, slotting, straddle milling, gear machining, …etc. 10. Understand the basics of drilling and drill bits. 11. Know the general features of CNC machining and its industrial gcode language.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of the course students should be able to: 1. Be familiar with the terminology associated with engineering materials and manufacturing processes and economy of the subject. 2. Know basic mechanical properties of the materials such as yield stress, ultimate stress, ductility, hardness…etc. 3. Deal with measuring devices, such as verniers, micrometers, … etc. And gauge blocks and their applications. 4. Basically, deal with machining operations and its related calculations such as the spindle speed, feed rate, machining time, material removal rate, …etc. 5. Deal with milling machines, both vertical and horizontal. 6. Work fairly on the index head, one of the important parts of the milling machines, and its related operations such as simple indexing, differential indexing, helical gear milling, … etc. 7. Interact the society of manufacturing, in general.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part 1 Engineering Materials</u> Metals, ceramics, polymers, composites, ferrous metals, non – ferrous metals, tensile test, compression test, shear test, hardness test, impact test [10 hrs]. <u>Part 2 Manufacturing Processes</u> Processing operations, solidification processing, particulate processing, deformation processing, hot forging, cold forging, rolling, heat treatment, coating and dispositioning, assembly operations, welding, brazing and soldering, adhesive bonding, threaded fasteners [10 hrs] <u>Part 3 Dimensions, Measurements and Tolerances</u> Dimensions, tolerances representation, geometric attributes, angularity, circularity, concentricity, cylindricity, flatness, parallelism, alignment and misalignment, linear misalignment, angular misalignment, measuring instruments and gages, accuracy, precision, gauging, precision gages blocks, dial Indicators, applications of the dial indicator, straightness, flatness, parallelism, roundness, run – out, depth of cut, comparative tools, surface Plate, graduated measuring devices, vernier, micrometer, sine bar. [20 hrs]

	Part 4 Traditional Machining Material removal processes, machining, roughing and finishing, machining operations, turning, facing, tapering, longitudinal machining, thread machining, machining time, material removal rate, boring, drilling, milling, index head, differential indexing, helical milling, shaping and planning, broaching, engraving, laser cutting, grinding, sanding and polishing, cnc machining, 2.5 axis milling, gcode. [20 hrs] Part 5 Non – Traditional Machining Chemical machining, electrical discharge machining (edm), water jet and abrasive water jet machining, 3d printing. [5 hrs]

Learning and Teaching Strategies	
Strategies	In addition to the following strategies, students are encouraged to share and interact on and off – class in order to enhance their knowledge and skill. However, those strategies are: 1- Lectures: the main teaching technique that include the subjects and its related elements such applications, problems and example. 2- Assignments: is directly given after each subject and received through class or online afterward. 3- Lab work: some of the given topics are also covered experimentally through the mechanical workshop and the material testing lab.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	4, 11	LO #2, 4, and 6
	Assignments	4	10% (10)	3, 6, 8, 13	LO # 3, 5, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	

	Report	1	10% (10)	Continuous	LO # 1, 6 and 7
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-5
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Basic concepts and definitions
Week 2	Mechanical properties of materials: Fundamental tests I (Tensile Test)
Week 3	Fundamental tests II (Compression Test and Impact Test)
Week 4	Fundamental tests III (Hardness Test)
Week 5	Dimensions, measurements and measuring devices and Tolerances
Week 6	Engineering materials Part I
Week 7	Engineering materials Part II
Week 8	Cutting theory
Week 9	Mid-Term Examination
Week 10	Material removal processes (Lathe and its related operations)
Week 11	Material removal processes (Boring and drilling)
Week 12	Material removal processes (Milling) 1
Week 13	Material removal processes (Milling) 2
Week 14	Introduction to non – traditional machining
Week 15	CNC machining and gcode programming, an introduction.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Tensile test
Week 2	Compression test
Week 3	Hardness test
Week 4	Impact test
Week 5	Workshop technology (lathe machine) I

Week 6	Workshop technology (lathe machine) II
Week 7	Workshop technology (milling machine) I
Week 8	Workshop technology (milling machine) II
Week 9	Workshop technology (drilling machine) I
Week 10	Workshop technology (drilling machine) II
Week 11	Workshop technology (shaping machine)
Week 12	Workshop technology (casting)
Week 13	Workshop technology (welding)
Week 14	Workshop technology (grinding) I
Week 15	Workshop technology (grinding) II

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Mikell P. Groover, Fundamentals of Modern Manufacturing, seventh edition, John Wiley & Sons, Inc., 2020	No
Recommended Texts		No
Websites	https://www.classcentral.com/course/swayam-fluid-mechanics-and-its-applications-58461	

Grading Scheme				
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

Module Information					
Module Title	Electrical Circuits Analysis II			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 113				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UG I	**Semester of Delivery**		Two
Administering Department		MTE	**College**	COE	
Module Leader	Sayf A. Majeed		**e-mail**	sayf@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Shahad Waleed Ahmed		**e-mail**	shahad.ahmed@uomosul.edu.iq	
Peer Reviewer Name		Sa'ad Ahmed Salih	**e-mail**	kazzazs60@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	MTE 106 - Electrical Circuits Analysis I	**Semester**	One
Co-requisites module	MTE 204 - Electronic Principles and Devices MTE 205 - Electrical Machines	**Semester**	Three

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. **Understanding Fundamental Concepts**: This course aims to provide students with an understanding of the fundamental principles of AC circuits and their application in Mechatronics engineering.

	2. **Analysis Methodologies:** By learning numerous methods of analysis, students will have a comprehensive understanding of AC circuits. They will become proficient in using complex impedance, and phasor techniques to address complex AC circuit problems. 3. **Circuit Simplification:** Students will learn how to simplify complex AC circuits and determine their equivalent circuits using advanced analysis theorems, such as Thevenin's and Norton's theorems. 4. **Skills in Design and Problem Solving:** The course aims to develop design and problem-solving skills through hands-on activities and problem-solving exercises. 5. **Preparation for Advanced Courses:** Prepare students for more advanced courses. A solid understanding of this course is essential in electronics, Electrical Machines, and other specialized areas. 6. **Laboratory Experience**: The course aims to provide hands-on laboratory experiences where students can apply theoretical knowledge to practical scenarios. Overall, the Electrical Circuits Analysis II course aims to provide Mechatronics Engineering students with a solid foundation in AC circuit analysis, enabling them to understand, analyze, and design electrical circuits relevant to their field of study.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon completion of this course, the student will be able to: 1. Understand the main concept of the AC circuits. 2. Solve different types of AC circuits in the phasor domain. 3. Analyze series and parallel combinations of impedances and admittances in AC circuits. 4. Apply nodal and mesh analysis techniques to solve AC circuits. 5. Simplify and analyze complex AC circuits, use the superposition theorem, Thevenin's theorem, and Norton's theorem. 6. Apply the maximum power transfer theorem to determine the optimal load impedance for power transfer in AC circuits. 7. Understand and analyze the instantaneous, average, RMS, and apparent power, as well as power factor. 8. Understand and calculate complex power in AC circuits. 9. Analyze the frequency response of AC circuits. 10. Design and analyze passive filters in AC circuits 11. Understand the concept of resonance and calculate the quality factor in AC circuits. 12. Analyze and calculate resonance in series-parallel AC circuits, considering the impact of frequency and impedance values.
Indicative Contents	Indicative content includes the following.

المحتويات الإرشادية	Part A - Introduction to AC Circuit Concepts Introduction to complex numbers, complex arithmetic, and their representation in polar and rectangular forms. Understanding the relationship between complex numbers and AC circuit analysis. Waveforms and their properties: sinusoidal waveforms, peak value, peak-to-peak value, average value, root mean square (RMS) value. Introduction to phasor: Phasor diagrams, definition of complex impedance, Series and Parallel Combinations of Impedances and Admittances. [15 hrs] Revision problem classes. [7 hrs] Part B - Introduction to Methods of Analysis. Nodal and Mesh Analysis Techniques for AC Circuits: Application of nodal analysis and mesh analysis methods for solving AC circuits. Understanding the systematic approach to analyzing complex circuits using these techniques. Superposition Theorem: Introduction to the superposition theorem for AC circuits. Analysis and calculations using superposition to determine the response of circuits with multiple sources. Thevenin's and Norton's Theorems for AC Circuits: Understanding Thevenin's and Norton's theorems and their application in simplifying complex AC circuits. Calculation of equivalent circuits using these theorems. Maximum Power Transfer Theorem: Introduction to the maximum power transfer theorem and its application in AC circuits. Understanding the conditions for maximum power transfer and calculation of load impedance for maximum power transfer. [15 hrs] Part C - AC Power Analysis Introduction to power in AC circuits, Instantaneous, Average, RMS, and Apparent Power. Definition of power factor and Power Triangle in AC circuits, calculation methods for power factor in resistive, inductive, and capacitive loads. Complex Power: Introduction to complex power, calculation methods for complex power in AC circuits, understanding the relationship between real power, reactive power, and apparent power. [18 hrs] Part D - Frequency Response Introduction to transfer function, its significance in AC circuits, and representation in terms of complex numbers. The Decibel Scale and its application in measuring gains and losses in AC circuits. Bode Plots: the illustration of the frequency response of AC circuits in terms of magnitude and phase. Passive Filters: Analysis of passive filters, such as low-pass, high-pass, band-pass, and band-stop filters, their frequency response characteristics, and design considerations.

	RL, RC and RLC circuits - Frequency response of RLC circuits, simple filter and band-pass circuits, resonance and Q-factor. [20 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussion, while at the same time refining and expanding their critical thinking skills. This will be achieved through: 4. Active Learning: Encourages students to participate in the learning process through discussions, group projects, practical experiments, and problem-solving exercises. 5. Interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students. 6. Gamification: in order to increase motivation and engagement in the learning process, game elements will be incorporated, such as competition, rewards, and challenges.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Total assessment	100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Review the Course MTE 112, Discuss the Syllabus, Introduction to Alternating Current (AC) Circuits
Week 2	Review the Complex Number and Waveforms and A.C. Values
Week 3	Phasors, Phasor Diagrams, and Complex Impedance
Week 4	Impedance and Admittance, Series and parallel combinations of impedances and admittance
Week 5	Nodal and Mesh Analysis Techniques for AC Circuits
Week 6	Superposition Theorem, Thevenin's and Norton's Theorems for AC Circuits
Week 7	Maximum Power Transfer Theorem
Week 8	**Mid-term Exam**
Week 9	AC Power Analysis: Instantaneous, Average, RMS and Apparent Power and Power Factor
Week 10	AC Power Analysis: Complex Power
Week 11	Frequency Response: Transfer Function, The Decibel Scale and Bode Plots
Week 12	Frequency Response: Passive Filters I.
Week 13	Frequency Response: Passive Filters II.
Week 14	Resonance and Quality Factor
Week 15	Resonance in series-parallel circuits
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to Lab Instruments, Safety, and Equipment Familiarization
Week 2	Lab 2: Basic Measurements in AC Circuits: Basic RL and RC circuits
Week 3	Lab 3: Phasors and Phasor Diagrams: Measurement and Analysis of AC Phasors
Week 4	Lab 4: Total impedance, Current and voltage division
Week 5	Lab 5: Impedance and Admittance: Measurement of Impedance and Admittance
Week 6	Lab 6: Nodal and Mesh Analysis in AC Circuits
Week 7	Lab 7: Superposition Theorem in AC Circuits

Week 8	**Mid-term Exam**
Week 9	Lab 9: Thevenin's Theorem in AC Circuits
Week 10	Lab 10: Maximum Power Transfer in AC Circuits
Week 11	Lab 11: AC Power Analysis: Measurement of Instantaneous, Average, RMS, and Apparent Power.
Week 12	Lab 12: Frequency Response: Passive Filters.
Week 13	Lab 13: Series RLC Circuits: Resonance
Week 14	Lab 14: Parallel RLC Circuits: Resonance
Week 15	Lab 15: AC Circuit Simulation and Troubleshooting
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education	Yes
Recommended Texts	Introductory circuit analysis / Robert L. Boylestad, 11th ed.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

Grading Scheme

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

Module Information					
Module Title	Physics			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 114				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		UGI	**Semester of Delivery**		one
Administering Department		MTE	**College**	COE	
Module Leader	Myasar Salim Younus		**e-mail**	myasaralattar@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		PhD
Module Tutor	Teba Hani Fathi		**e-mail**	teba96mecha@gmail.com	
Peer Reviewer Name		Dr. Loay Younes Aldabbagh	**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

Relation with other Modules			
Prerequisite module		**Semester**	
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Understand the Fundamental of units and systems 2. Present the type of capacitors and capacitance and how their stored energy 3. Present the type of inductors and inductance and how their stored energy 4. Understand the magnetism and electromagnetic induction and its application 5. Understanding the lows deals with electromagnetic phenomena

	6. Knowing the resonance phenomena 7. Introduce the smart materials 8. Illustrate the semiconductors device and their characteristics 9. Presenting the photonic phenomena and its application
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Has the ability to recognize the different types materials 2. Use his knowledge to understand the phenomena of storing energy ,resonance ,and photonic 3. Has the ability to analyze the characteristic of materials 4. be able to select the type of material in selected circuit and application
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – introduction Units and systems CAPACITANCE, types of capacitors, construction of capacitor. [6 hrs] Capacitors connection (series, parallel, complex) , energy stored in capacitors, capacitors and dielectric Inductance types of Inductance , construction of Inductance. Inductance connection (series, parallel, complex) , energy stored in Inductance, solenoid [6 hrs] Faraday law , lenz law, motional emf ,induced electric field ,eddy current Resonance in an electric Circuit , example and application [7 hrs] Part B – nano and smart materials **Nanomaterials:** Introduction – Synthesis of Nano materials – Top down and Bottom-up approach- Ball milling- PVD method- Applications **Smart materials:** Shape memory alloys-Biomaterials (properties and applications) [8hrs] Part C – semiconductor device SEMICONDUCTOR DEVICES Introduction to P-N junction Diode and V-I characteristics, Zener diode and its characteristics, Introduction to BJT, its input-output and transfer characteristics SCR characteristics, FET, MOSFET and CMOS characteristics. [8 hrs] Part D – photonics PHOTONICS: Einstein's theory of matter radiation interaction and A and B coefficients; Properties of laser spontaneous and stimulated emissiongas lasers (CO2), applications –IR Thermography. Optical fibre- principle [TIR]-types-material, mode, refractive index-Fibre loss-Expression for acceptance angle and numerical aperture. Application-Communication amplification of light by population inversion, different types of lasers: solid-state laser (Neodymium) [10 hrs]

Learning and Teaching Strategies

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to engineering physics science and the application of the theories to practical examples. 2- Assignments - are arranged to provide the opportunity for students to search for information, analyze fluid systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.46
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Units and systems
Week 2	CAPACITANCE, types of capacitors, construction of capacitor,
Week 3	Capacitors connection (series, parallel, complex), energy stored in capacitors, capacitors and dielectric

Week 4	Inductance types of Inductances, construction of Inductance
Week 5	Inductance connection (series, parallel, complex) , energy stored in Inductance, solenoid
Week 6	Magnetism and electromagnetic induction, application
Week 7	Faraday law, lenz law, motional emf, induced electric field, eddy current
Week 8	**Resonance in an electric Circuit**
Week 9	**Nanomaterials:** Introduction – Synthesis of nano materials – Top down and Bottom up approach- Ball milling- PVD method- Applications
Week 10	**Smart materials:** Shape memory alloys-Biomaterials (properties and applications)
Week 11	SEMICONDUCTOR DEVICES Introduction to P-N junction Diode and V-I characteristics, Zener diode and its characteristics, Introduction to BJT, its input-output and transfer characteristics
Week 12	SCR characteristics, FET, MOSFET and CMOS characteristics. Basic logic gates - NAND, NOR
Week 13	PHOTONICS: Einstein's theory of matter radiation interaction and A and B coefficients; Properties of laser spontaneous and stimulated emission
Week 14	amplification of light by population inversion, different types of lasers: solid-state laser(Neodymium)
Week 15	gas lasers (CO2), applications –IR Thermography. Optical fibre- principle [TIR]-types-material, mode, refractive index-Fibre loss-Expression for acceptance angle and numerical aperture. Application-Communication
Week 16	**Preparatory week before the final Exam**

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

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

Required Texts	**University Physics Volume 2.SAMUEL J. LING, JEFF SANNY, 2016**	no
Recommended Texts	**Concepts of Modern Physics by Arthur Beisser, McGraw Hill, 7th edition**	no
Websites	https://www.classcentral.com/report/physics-free-online-courses/	

Grading Scheme				
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

Module Information					
Module Title	**Baath regime crimes in Iraq**			**Module Delivery**	
Module Type	**Support**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MTE 201**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level		UG II	**Semester of Delivery**		Three
Administering Department		MTE	**College**	COE	
Module Leader			**e-mail**		
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

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

MODULE DESCRIPTION FORM

Module Information					
Module Title	Engineering Mechanics-Dynamics			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☐**Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 202				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGII	**Semester of Delivery**		Three
Administering Department		MTE	**College**	COE	
Module Leader	Saad Zaghlul Saeed		**e-mail**	saeeds70@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Ahmed Abdulkareem Muhammad		**e-mail**	Ahmedmechatronics93@gmail.com	
Peer Reviewer Name		Dr. Hassan M. Saeed	**e-mail**	saeedh81@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. learn fundamental concepts and principles of particle and rigid body motion kinematics 2. Resolve the motion of single particles in multiple coordinate systems. 3. Obtain an understanding of Newton's Laws of Motion.

	4. Apply analytical techniques to the solution of important engineering dynamics problems. 5. Apply the basic concepts of force, mass and acceleration; of work and energy; and of impulse and momentum for particles and rigid bodies. 6. Obtain an understanding of mass moment of inertia. 7. Obtain basic knowledge on mechanical vibration. 8. Obtain the equation of motion for single degree of freedom system. 9. Control unwanted vibration so that its adverse effects are kept within acceptable limits.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Understand the basic kinematics concepts: displacement, velocity, and acceleration (and their angular counterparts). 2. Define basic kinematic quantities of rectilinear and curvilinear motion of particle such as: position, displacement, velocity and acceleration. 3. Understand how objects move and interact with one another. 4. Understand and apply Newton's laws of motion. 5. Understand and be able to apply work and kinetic energy, gravitational and elastic potential energy. 6. Understand and be able to apply impulse and momentum. 7. Apply appropriate mathematical techniques to translational motion and rotational motion for rigid bodies. 8. Determines how much torque an object needs to reach a specific angular acceleration. 9. Understand mechanical vibration and be familiar with basic terminology associated with it. 10. Model and analyze one degree of freedom mass-spring-damper systems. 11. Apply the theory of classically damped vibrating systems to problems of one degree of freedom.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A - kinematics of particle</u> Introduction: definition, fundamental units, International System of Units, Newton's laws of motion and law of gravitation. Rectilinear motion and basic kinematic quantities: position, displacement, velocity and acceleration. Special cases of rectilinear motion of particle: motion with constant velocity and motion with constant acceleration. Dependent rectilinear motions. Curvilinear motion of particle: position vector, velocity and acceleration. Free flight of a projectile. Tangential and normal components of velocity and acceleration. Cylindrical (r-θ) coordinates components of velocity and acceleration. Relative motion. [25 hrs] <u>Part B - kinetics of particle</u> Force and acceleration. Newton's second law, Definition of work, kinetic energy and power. Work of a gravitational force. Work of a spring force. Principle of work and energy. Potential energy: gravitational and elastic. Principle of impulse and momentum. Angular impulse and angular momentum. [15 hrs]

	Part C - kinematics of Rigid body Plane kinematics of rigid bodies. Types of plane motion of rigid bodies: translation, rotation, general plane motion. Relative Velocity and acceleration. Mass moment of inertia. [15 hrs] Part D – Mechanical vibration Introduction to vibration: types, mass, spring, damper. Free un-damped vibration, vibration isolation. [10 hrs] Free damped vibration, Forced damped vibration. [10 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to dynamic analysis and the application to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of dynamic analysis to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze machines with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction: definition, fundamental units, international system of units. Rectilinear motion and basic kinematic quantities: position, displacement, velocity and acceleration.
Week 2	Kinematics: Curvilinear motion of particle: position vector, velocity and acceleration. Free flight of a projectile.
Week 3	Tangential and normal components of velocity and acceleration (n-t).
Week 4	Cylindrical (r-θ) coordinates components of velocity and acceleration.
Week 5	Relative motion
Week 6	Kinetics: direct application of Newton's second law (force, mass, acceleration)
Week 7	Work and Energy: Definition of work, kinetic energy and power. Work of a gravitational force. Work of a spring force. Principle of work and energy. Potential energy: gravitational and elastic.
Week 8	Impulse and momentum: Principle of impulse and momentum. Angular impulse and angular momentum.
Week 9	Rigid body motion: Plane kinematics of rigid bodies. Types of plane motion of rigid bodies: translation, rotation, general plane motion.
Week 10	Relative Velocity
Week 11	Relative acceleration. Mass moment of inertia.
Week 12	Introduction to vibration: types, mass, spring, damper.
Week 13	Free un-damped vibration, vibration isolation
Week 14	Free damped vibration
Week 15	Forced damped vibration

Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Engineering Mechanics: Dynamics 5th edition by Meriam, J. L., Kraige, L. G. (2003)	yes
Recommended Texts	Engineering Mechanics 'Dynamics" R. C. Hibbeler, 2016	yes
Websites	https://www.classcentral.com/classroom/youtube-engineering-mechanics-dynamics-54539	

Grading Scheme

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

Module Information					
Module Title	Applied Mathematics I			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 203				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UGII		**Semester of Delivery**	Three	
Administering Department	MTE		**College**	COE	
Module Leader	Hassan Mudhafar Saeed		**e-mail**	Saeedh81@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Ali Ayad Albabeli		**e-mail**	alibabily9000@gmail.com	
Peer Reviewer Name	Laith Mohammed Jasim		**e-mail**	Jasiml68@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	MTE108 – Mathematics II	**Semester**	Two
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1) Student will study multivariable functions and their partial derivative. 2) Student should understand the critical points of a multivariable function.

	3) Student will study complex number, variable, various functions. Student will study how to transform complex function representation from Cartesian form to polar or exponential form or vice versa. 4) Student should understand continuous and analytic and harmonic complex functions. 5) Student will study even, odd, and periodic functions. 6) Student will study representation of periodic functions using trigonometric and complex Fourier Series representation. 7) Student will study the Fourier Transforms of various engineering functions. 8) Student will study, vector quantities, their algebraic operations.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1) Student will be able to identify multivariable functions and find any partial derivative of such function. 2) Student can search and find multivariable functions critical points. 3) Student can recognize complex number, variable, and various functions. Student should understand the the transform of complex function representation from Cartesian to polar or exponential forms. 4) Student will be able to identify continuous and analytic functions, and test if they are harmonic. 5) Student will be able to identify even, odd, and periodic functions. 6) Student will be able to represent periodic functions using trigonometric and complex Fourier Series representation. Also, will be able to represents aperiodic functions using Half range Fourier Series representation. 7) Student will be able to use Fourier Transforms of various engineering functions. 8) Student can recognize, understand, and implement vector quantities and algebraic operations.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Multivariable functions</u> Multivariable functions, partial derivative, geometrical meaning of these derivatives, critical points (maxima, minima, and saddle points). [15 hrs.] <u>Part B – Complex Analysis</u> Definition of complex number/variable, complex plane, equality, negative of and conjugate complex numbers, variable, various functions, Cartesian form, polar form, exponential form, complex roots, power of a complex variable, continuous and analytic functions, harmonic functions. [15 hrs.] <u>Part C – Fourier Analysis</u>

	Even, odd, and periodic functions, trigonometric and complex Fourier Series representation, represents aperiodic functions using Half range Fourier Series, Fourier Transforms of various engineering functions. [15 hrs.] Part D – Introduction to Vector Scalar quantity vs vector quantity, vector notation, components of a vector, null vectors, free vector property, length of vector, parallel vectors, negative of a vector, equality, unit vector, algebraic operations on vector quantities, addition and subtraction, scalar, dot, and cross products with applications, projection of a vector, triple products. [15 hrs.]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; **1. Lectures**: aim to deliver fundamental mathematical knowledge in relation to engineering and real-life topics. **3. Assignments**: are arranged to provide the opportunity for students to search for methods of solving engineering related problems, implement the methods, and present the solutions. **4. Seminars:** devoted to introduce students to various mathematical terminologies in relation to covered topics under study. How these terminologies affect the solution methodology and physical system behavior. **5. Computer:** the student will be asked to use state of the art available mathematical software those support the topics covered in this course

Student Workload (SWL)			
Structured USWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SSWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	**Multivariable functions:** Limits and continuity , Partial derivatives (definitions, functions of more than two variables), second and higher order partial derivatives.
Week 2	**Multivariable functions:** Chain rule for functions of two or three variables , Maxima and minima and saddle points.
Week 3	**Multivariable functions:** review and special cases of partial derivatives.
Week 4	**Complex analysis:** Definitions and basic concepts, Cartesian form, polar form, exponential form, representations of a complex variable. Complex variables algebra, Roots of a complex number.
Week 5	**Complex analysis:** complex functions, limits, derivatives and continuity of complex functions. Analytic functions, Cauchy-Riemann equations, derivatives of analytic functions. Laplace equation, Harmonic and conjugate harmonic functions.
Week 6	**Complex analysis:** Rational functions, Logarithmic functions, Exponential functions.
Week 7	**Complex analysis:** Trigonometric and hyperbolic functions, General power of complex variables.
Week 8	**Fourier Series:** even and odd function , Half Wave Symmetry, periodic functions, definition of Fourier series (Trigonometric form)
Week 9	**Mid-term Exam + Report + Lab Exam**
Week 10	Fourier Series: Line Spectrum (harmonic) the Fourier Series, Half wave symmetry, sum and shift of functions, Complex Exponential form of the Fourier Series
Week 11	Fourier Transforms: Fourier Integrals and introduction to Fourier Transforms
Week 12	Fourier Transforms
Week 13	Introduction to Vector Analysis: definition, notation, properties, Vector algebra: addition, subtraction, multiplications

Week 14	Introduction to Vector Analysis: vector algebra (continue) with applications
Week 15	Introduction to Vector Analysis: practices
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. E. Kreyszig, et al, "Advanced Engineering Mathematics," 10th ed., McGraw Hill, 2011. 2. George B. Thomas, Jr., "Thomas' Calculus Early Transcendentals," 13th Ed, 2014.	Yes
Recommended Texts	D.G. Zill, "Advanced Engineering Mathematics," 6th Ed, 2018.	Yes
Websites	https://uomosul.edu.iq/engineering/%d9%85%d9%81%d8%b1%d8%af%d8%a7%d8%aa-%d8%a7%d9%84%d9%85%d9%88%d8%a7%d8%af-%d8%a7%d9%84%d8%af%d8%b1%d8%a7%d8%b3%d9%8a%d8%a9/ https://eqworld.ipmnet.ru/ https://math.libretexts.org/ https://www.youtube.com/c/3blue1brown/featured	

Grading Scheme				
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

Module Information					
Module Title	Electronic Principles and Devices			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 204				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		UGII	**Semester of Delivery**		Three
Administering Department		MTE	**College**	COE	
Module Leader	Omar Saadallah Hamid		**e-mail**	omar.abdulwahid@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
Peer Reviewer Name		Sa'ad Ahmed Salih	**e-mail**	Kazzazs60@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

Relation with other Modules			
Prerequisite module	MTE 113- Electrical Circuits Analysis II	**Semester**	Two
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Introduce the students to the history and development of electronic devices and circuits and their uses in real life applications 2. Understand the fundamental of two-terminal semiconductor devices such as P-N junction and Zener diode and their applications in electronic circuits including rectifier, clamper, clipper, and voltage regulator.

	3. Introduce the students to the basic operation and configuration of Bipolar Junction Transistor (BJT). As well as introduce the DC analysis of BJT devices while helping the students to determine the DC load line, and be aware of the saturation and cut-off conditions of different configurations including fixed bias, emitter-bias, voltage divider, and collector feedback configurations. 4. Understand the AC analysis of BJT and learn how to extract the equivalent circuit model including re-model and how to find the most important ac parameters of amplifier. This is followed by designing multi-stage transistors ,cascade systems, and transistor as switch. 5. Introduce the operation and types of Field Effect Transistor (FET) and the structure of Metal Oxide Semiconductor Field Effect Transistor (MOSFET). Furthermore, to understand the operation and characteristics of the Depletion-type and Enhancement-type MOSFETs 6. Understand the biasing conditions of the FET configurations including fixed-bias, self-bias, voltage-divider, and common gate configurations. 7. Introduce the biasing of Depletion-type and Enhancement-type MOSFETs and the concept of combination circuits. 8. Introduce the Operational-Amplifier and its applications in various circuits such as Inverting Amplifier, Non-inverting Amplifier, Unity Follower, Integrator, Differentiator, Comparator, Voltage Subtraction, Voltage Summing, Multiple-Stage Gains, Constant-gain Multiplier)
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Know the types of semiconductor diodes and their uses in real life applications. As well as predict the output of clipper, clamper, and rectifier circuits. 2. Explain the basic operation of Bipolar Junction Transistor (BJT) devices, apply the DC biasing, draw the dc-load line of different configurations. 3. Design BJT amplifier and calculate the most important figure of merits including currents, voltages, current and voltage gains. 4. Design and derive the equations of multi stage transistors, and determine the difference between using BJT device as an amplifier and switch. 5. Discuss the operation of Field Effect Transistor (FET) and MOSFET devices 6. Determine and draw the output characteristics of Depletion-type and Enhancement-type MOSFET devices. 7. Use the MOSFET devices as an amplifier with applying the appropriate DC biasing, as well as derive the equation of combination circuits that contains two devices for high gain operation. 8. Explain the basics of Operational-Amplifier (Op-Amp), and derive the overall gain, and effectively determine the suitable Op-Amp depending on the desired application.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Semiconductor Diodes</u> This part deals with diodes and the electrical and physical characteristics of three important materials Si, Ge, and GaAs. More importantly, it illustrates the n-type and p-type materials used in the construction of P-N junctions. In addition, this part explain the biasing of such devices in three conditions: No-bias, forward bias, and reverse bias. It also contains the extraction of diode equivalent circuit under AC biasing. The special type of diode named (Zener diode) and the breakdown voltage is explained in this part. [8 hrs] <u>Diode Applications</u>

	This part explains the use of diodes in practical applications, as well as, the series and parallel connection of diodes. This part also contains the half-wave and full-wave rectifiers, clamper, clipper. More importantly, it explains the utilize of Zener diode as a voltage regulator. [10 hrs] Part B – DC of BJT transistor. This part delas with the following contents.: Introduction, Transistor construction, Transistor operation, common base configuration, common emitter configuration, common collector configuration, transistor development, operating point, load line analysis, fixed bias configuration, emitter bias configuration, voltage divider configuration, collector feedback configuration, emitter follower configuration, multiple BJT networks, transistor switching networks, and BJT stability. [20 hrs] Part C – AC analysis of BJT transistor This part delas with the following contents: BJT modelling, the re transistor model (common emitter configuration, common base configuration, common collector configuration), common emitter fixed bias configuration, voltage divider configuration, CE emitter bias configuration (unbypassed and bypassed connections), emitter follower configuration, phase relation, effect of output resistance, collector DC feedback configuration, effect of RL and RS, voltage and current gains of cascaded systems, RC coupled amplifier, and capcode connection. [20 hrs] Part D – Field Effect Transistor (FET) This part delas with the following contents: Introduction, construction and characteristics of JFET, effect of gate source voltage, derivation of JFET characteristics, JFET and BJT relationship, basic operation and characteristics of Depletion-type MOSFET and Enhancement-type MOSFET, p-channel Depletion-type MOSFET, p-channel Enhancement-type MOSFET, Fixed bias of FET, self-bias configuration, common gate configuration. [16 hrs] Part E – Operational Amplifier (Op-Amp) This part delas with the following contents: Introduction of Op-Amp, single ended input Op-Amp, double ended input Op-Amp, double ended output Op-Amp, practical Op-Amp circuits including inverting amplifier, non-inverting amplifier, unity follower, integrator, differentiator, Comparator, Voltage Subtraction, Voltage Summing, Multiple-Stage Gains, Constant-gain Multiplier. [16 hrs]

Learning and Teaching Strategies	
Strategies	The basic strategy that will be employed in providing this module is to increase student engagement in the discussions while also enhancing and expanding their critical thinking abilities. This will be achieved through;

	1- Class lectures - This strategy is to explain the fundamentals of semiconductor electronic devices, including diodes and transistors, as well as the key applications that rely on these devices. 2- Laboratory sessions - The main aims of the laboratory are to allow students gain practical experience, practice conducting and carrying out laboratory experiments, connect, study, and evaluate electrical and electronic circuits, as well as collect the data they need to write an experiment report. 3- Assignments and reports - are arranged to provide the opportunity for students to search for information, analyze electronic circuits, use of devices in various applications, perform modelling and simulation of electronic circuits.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	82	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered

Week 1	Introduction (Semiconductor Diodes, pn junction diode, Diode Applications, Rectifier circuits, clipper, clamper)
Week 2	Zener diode and its application (voltage regulator)
Week 3	Introduction to Bipolar junction transistors (BJT) and it is configurations
Week 4	DC analysis of BJT equivalent circuits(Introduction, operating point, Fixed-bias Configuration, Emitter-bias Configuration, Voltage-divider Bias Configuration, Collector Feedback Configuration, Emitter-follower Configuration (common collector).
Week 5	AC analysis of BJT equivalent circuits part 1, introduction, equivalent model, re-model Fixed bias configuration, re-model Voltage-divider bias configuration.
Week 6	AC analysis of BJT equivalent circuits part 2 (re-model CE Emitter-Bias configuration, 1) Un-bypassed situation. 2) bypassed configuration. re-model of Emitter-Follower Configuration, re model of common Base configuration , Re-model Collector Feedback C
Week 7	Effect of RL And RS, Design example of the C.E amplifier circuit
Week 8	Multi stages transistor , Cascaded Systems
Week 9	Transistor as switch
Week 10	**Mid-term exam+** Field-Effect Transistor FET (Introduction and types)
Week 11	Metal–Oxide–Semiconductor Field-Effect Transistor types of MOSFETs and Basic Construction and Basic Operation and Characteristics of:- 1. Depletion-type MOSFET (DMOSFET). 2. Enhancement-type MOSFET (EMOSFET).
Week 12	Field-Effect Transistor Biasing part 1 • Introduction. • Fixed-Bias Configuration. • Self-Bias Configuration. • Voltage-Divider Biasing. • Common-Gate Configuration.
Week 13	Field-Effect Transistor Biasing part 2 • Depletion-Type MOSFETs. • Enhancement-Type MOSFETs. • Combination Networks. • Design.
Week 14	Introduction to the operational amplifier, Practical OP-AMP Circuits, Applications of operational amplifier part1 (Inverting Amplifier, Non-inverting Amplifier, Unity Follower, Integrator, and differentiator
Week 15	Applications of operational amplifier part2 (Comparator, Voltage Subtraction, Voltage Summing, Multiple-Stage Gains, and constant-gain Multiplier)
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Diode Test and Characteristics

Week 2	Diode Application (1): Clipping circuits
Week 3	Diode Application (2): Clamper circuits
Week 4	Diode Application (3): Half-wave rectifier
Week 5	Diode Application (4): Full-wave rectifier
Week 6	Characteristics of Bipolar Junction Transistor (BJT)
Week 7	Transistor Amplifying Circuit (1) : fixed biasing , self-emitter biasing
Week 8	Transistor Amplifying Circuit (2) : voltage divider biasing
Week 9	Transistor Amplifying Circuit (3) : common base and common collector
Week 10	Transistor Amplifying Circuit (4) : Transistor As Switch and Multistage Transistor
Week 11	FET – Characteristics
Week 12	FET – amplifiers
Week 13	Op-Amp characteristics
Week 14	Op-Amp applications 1
Week 15	Op-Amp applications 2

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	R. L. Boylestad, Electronic Devices and Circuit Theory,10th Edition, Prentice Hall, 2009.	No
Recommended Texts	Thomas L. Floyd , Electronic Devices , 7th Addition, Pearson Prentice Hall, 2005	No
Websites	https://www.coursera.org/search?query=diode https://www.coursera.org/search?query=bjt%20transistor https://www.khanacademy.org/search?referer=%2Flogin&page_search_query=diode+and+transistor	

Grading Scheme				
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

Module Information					
Module Title	Electrical Machines			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 205				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	UGII		**Semester of Delivery**	Three	
Administering Department	MTE		**College**	COE	
Module Leader	Myasar Salim Younus		**e-mail**	myasaralattar@uomosul.edu.iq	
Module Leader's Acad. Title	lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Shahad Waleed Ahmed		**e-mail**	shahad.ahmed@uomosul.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	MTE 113 Electrical Circuits Analysis II	**Semester**	Two
Co-requisites module	None	**Semester**	None

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Understand the Fundamental of energy conversion (electrical to mechanical and vice versa) 2. Present the type of electrical machine ac , dc type .and special purpose type of machine 3. Understanding the operation principle of machine, voltage building, and torque generation. 4. Understand the equivalent circuit of electrical machine 5. Understanding the way used for starting electrical machine Introducing the way used for controlling the speed and direction of machine

	6. Knowing the losses generated in electrical machine and computing the efficiency. 7. Introduce the characteristics of electrical machine. 8. Introduced some types of special purpose machine.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Has the ability to recognize the types of different machines 2. Use his knowledge to choose a proper machine for the application 3. Has the ability to analyze the characteristic of machine 4. Understanding the principle of designing an electric system containing machine 5. Be able to understand an electrical drive system
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – energy conversion</u> Introduction to principle of energy conversion and electrical machine and. Types of electrical machine. [5 hrs] Construction of dc machine, principal operation of dc motor, torque equation, voltage equation and equivalent circuit. [8 hrs] <u>Part B – principle of operations and equations</u> General equation of dc motors (voltage and torque equation) , losses (cupper losses, hysteresis losses, iron losses) , efficiency, Characteristics of dc motors for shunt ,series and compound type (armature current-torque),(speed-torque)(armature current-speed) [16 hrs] <u>Part C – controlling of machine</u> Starting of motors Speed control of dc motors shunt type Speed control of dc motors series type (flux control method , armature control method, voltage variation method) [14 hrs] <u>Part D – permanent magnet motor</u> Dc permanent magnet motor, construction, principle of operation, speed (PWm method),(resistor method) control . [8 hrs] <u>Part E – stepper motor</u> Stepper motor, driving mode, Stepper motor, driving mode Stepper motor, construction, types, control circuit. [8 hrs] <u>Part F – single phase transformer</u> Single phase transformers, construction, types, principle of operation, Single phase transformers, equivalent circuit, losses and efficiency, test, connections [16]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to electrical machine and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of electrical machine to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze fluid systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to principle of energy conversion and electrical machine and. Types of electrical machine
Week 2	Construction of dc machine, principal operation of dc motor, torque equation, voltage equation and equivalent circuit
Week 3	General equation of dc motors, losses, efficiency
Week 4	Characteristics of dc motors for shunt, series and compound type
Week 5	Starting of motors
Week 6	Speed control of dc motors shunt type
Week 7	Speed control of dc motors series type
Week 8	Characteristics of dc motor shunt types
Week 9	Characteristics of dc motor series and compound types
Week 10	Dc permanent magnet motor, construction, principle of operation, speed control
Week 11	Stepper motor, construction, and types.
Week 12	Stepper motor, driving mode.
Week 13	Stepper motor, construction, types, and control circuit.
Week 14	Single phase transformers, construction, types, principle of operation
Week 15	Single phase transformers, equivalent circuit, losses and efficiency, test, connections
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to lab instrument and measurements
Week 2	Speed control of dc shunt motor , flux method
Week 3	Speed control of dc shunt motor , armature method
Week 4	Speed control of dc shunt motor , voltage variation method
Week 5	Dc shunt motor (speed – armature current)characteristic
Week 6	Dc shunt motor (speed – torque)characteristic
Week 7	Speed control of dc series motor (voltage variation)
Week 8	Speed control of dc series motor (resistance method)
Week 9	Dc series motor (speed – armature current)characteristic
Week 10	Dc series motor (speed – torque) characteristic

Week 11	Speed control of dc permanent magnet motor
Week 12	Stepper motor operation principle
Week 13	Single phase transformer no load test
Week 14	Single phase transformer load test (resistive load)
Week 15	Single phase transformer load test (inductive load)

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	PRINCIPLES OF ELECTRIC MACHINES AND POWER ELECTRONICS, THIRD EDITION DR. P. C. SEN, John 2014, John Wiley & Sons,	no
Recommended Texts	Electrical Machines S. K. Sahdev 2018	no
Websites	https://onlinecourses.nptel.ac.in/noc21_ee71/preview	

Grading Scheme				
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

Module Information					
Module Title	Thermodynamics			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 206				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	UGII		**Semester of Delivery**	Three	
Administering Department	MTE		**College**	COE	
Module Leader			**e-mail**		
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

MODULE DESCRIPTION FORM

Module Information					
Module Title	Experimental Methods for Engineers			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 207				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level		UGII	**Semester of Delivery**		Three
Administering Department		MTE	**College**		COE
Module Leader	Dr. Loay Younes Aldabbagh		**e-mail**	loayaldabbagh@uomosul.edu.iq	
Module Leader's Acad. Title			**Module Leader's Qualification**		Ph.D.
Module Tutor	Ahmed Abdulkareem Muhammad		**e-mail**	Ahmedmechatronics93@gmail.com	
Peer Reviewer Name		Laith Mohammed Jasim	**e-mail**	Jasiml68@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Moduile Aims	The aims of the module are to

أهداف المادة الدراسية	1. Understand the basic concepts (Definition of Terms, Calibration, Standards, Dimensions and Units, The Generalized Measurement System, Basic concepts in Dynamics Measurements. 2. To provide the student how to make analysis of the experimental data. 3. Understand the basic electrical measurements and sensing devices 4. Provide fundamental concepts and knowledge about displacement and area measurements. 5. Understand the concept of pressure measurements 6. Know about the flow measurements. 7. T understand the concept of the temperature measurements
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Be familiar with the methods associated with analyzing the experimental data and finding the best curve fits and the standard deviation of the data used. 2. To discuss the method s of calibration for any device before used. 3. To find the best measurements device used for any experiments (mechanical or electrical one). 4. Discuss the principles theories, concepts of the flow measurement device. 5. Understand and have ability to design any type of flow measurement. 6. Understand how to calibrate any measurement device before using it. 7. Deal with Displacement and Area Measurements. 8. To choose the best pressure device before taking the data. 9. Understand the principle of temperature measurement.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **<u>Part A - Introduction and Basic Concepts</u>** Definition of Terms, Calibration, Standards, Dimensions and Units, The Generalized Measurement System, Basic Concepts in Dynamic Measurements, System Response, Distortion, Impedance Matching, Fourier Analysis, Experiment Planning. [5 hrs] **Analysis of Experimental Data-** Causes and Types of Experimental Errors, Error, Analysis on a Commonsense Basis, Uncertainty Analysis and Propagation of Uncertainty, Evaluation of Uncertainties for Complicated Data Reduction, Statistical Analysis of Experimental Data, Probability Distributions, The Gaussian or Normal Error Distribution, Comparison of Data with Normal Distribution, The Chi-Square Test of Goodness of Fit, Method of Least Squares, The Correlation Coefficient, Multivariable Regression, Standard Deviation of the Mean, Student's *t*-Distribution, Graphical Analysis and Curve Fitting, Choice of Graph Formats, Causation, Correlations, and Curve-fits, General Considerations in Data Analysis. [6 hrs] **<u>Part B - Basic Electrical Measurements and Sensing Devices</u>** Forces of Electromagnetic Origin, Waveform Measures, Basic Analog Meters, Basic Digital Meters, Basic Input Circuit Amplifiers, Differential Amplifiers, Operational Amplifiers, Transformers, Power Supplies, Signal Conditioning, The Electronic Voltmeter, Digital Voltmeters, The Oscilloscope, Oscilloscope Selection, Output Recorders. [4 hrs]

	Displacement and Area Measurements-Dimensional Measurements, Gage Blocks, Optical Methods, Pneumatic Displacement Gage, Area Measurements, The Planimeter, a Device of Historical Interest, Graphical and Numerical Methods for Area Measurement. [4 hrs] **Part C - Pressure Measurement** Dynamic Response Considerations, Mechanical Pressure-Measurement Devices, Dead-Weight Tester, Bourdon-Tube Pressure Gage, Diaphragm and Bellows Gages, The Bridgman Gage, Low-Pressure Measurement, The McLeod Gage, Pirani Thermal-Conductivity Gage, The Knudsen Gage, The Ionization Gage, The Alphatron. [4 hrs] **Part D - Flow Measurement** Positive-Displacement Methods, Flow-Obstruction Methods, Practical Considerations for Obstruction Meters, The Sonic Nozzle, Flow Measurement by Drag Effects, Hot-Wire and Hot-Film Anemometers, Magnetic Flowmeters, Flow-Visualization Methods, The Shadowgraph, The Schlieren, The Interferometer, The Laser Doppler Anemometer (LDA), Smoke Methods, Pressure Probes. [4 hrs] **Part E - The Measurement of Temperature** Definition of Terms, Temperature Scales, The Ideal-Gas Thermometer, Temperature Measurement by Mechanical Effects, Temperature Measurement by Electrical Effects, Temperature Measurement by Radiation, Effect of Heat Transfer on Temperature Measurement, Transient Response of Thermal Systems Thermocouple Compensation, Temperature Measurements in High-Speed Flow). [3 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to experimental data and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of measurement device to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze and design the flow measurement with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.34
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Introduction and Basic Concepts** -Definition of Terms, Calibration, Standards, Dimensions and Units, The Generalized Measurement System, Basic Concepts in Dynamic Measurements, System Response, Distortion, Impedance Matching, Fourier Analysis, Experiment Planning
Week 2	**Introduction and Basic Concepts** -Definition of Terms, Calibration, Standards, Dimensions and Units, The Generalized Measurement System, Basic Concepts in Dynamic Measurements, System Response, Distortion, Impedance Matching, Fourier Analysis, Experiment Planning
Week 3	Analysis of Experimental Data
Week 4	Analysis of Experimental Data
Week 5	Analysis of Experimental Data
Week 6	Measurements and Sensing Devices
Week 7	Measurements and Sensing Devices
Week 8	**Mid-term Exam**
Week 9	Displacement and Area Measurements

Week 10	Displacement and Area Measurements
Week 11	Pressure Measurement
Week 12	Pressure Measurement
Week 13	Flow Measurement
Week 14	Flow Measurement
Week 15	The Measurement of Temperature
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	J. P. Holman, Experimental Methods for Engineers, 8th ed., The McGraw-Hill Companies, New York, © 2011.	Yes
Recommended Texts		
Websites		

Grading Scheme				
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
	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

Module Information					
Module Title	Applied Mathematics II			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 208				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGII	**Semester of Delivery**		Four
Administering Department		MTE	**College**	COE	
Module Leader	Hassan Mudhafar Saeed		**e-mail**	Saeedh81@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Ali Ayad Albabeli		**e-mail**	alibabily9000@gmail.com	
Peer Reviewer Name		Laith Mohammed Jasim	**e-mail**	Jasiml68@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. This course gives the students the ability to understand and classify DEs 2. Student will investigate solving the ordinary DEs using different methods, most types of ordinary DEs will be covered (1st order and second order , linear and non- linear). 3. Student will study the LT method to solve the ordinary DEs 4. Student will study the solution of system of linear equations including the eigenvalue-eigenvector problems. solution procedure and applications.

	5. Student will study the vectors and geometry, equation of line, plane, curve parameterization. 6. Student will study vector functions and vector field, derivative of vector function and it applications, space curve and its field, curvature, 7. Student will study the gradient of a vector, Laplacian, divergence, and curl
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Student is able to recognize the underling rule of DEs in real world problems, 2. Student is able to classify the DEs mathematically, and the types of physical problems (IVP, BVP). 3. Student is able to solve 1st order, homogeneous and non-homogeneous, linear and nonlinear, ordinary DEs, 4. Student is able to solve 2nd order, homogeneous and non-homogeneous, linear ordinary DEs, using Undetermined coefficients and variation of parameters methods. 5. Student is able to make LTs of various kinds of functions, 6. Student is able to use LTs to solve any order, homogeneous and non-homogeneous, linear ordinary DEs. 7. Student is able to understand and solve systems of linear equations with various conditions, recognize and analyze the eigenvalue problems and their underlying physics. 8. Student will be able to recognize and deal with the equation of line, plane, curve and parameterization. 9. Student will be able to recognize and deal with the Derivative of vector function and it applications, space curve and its field, Curvature, gradient of a vector, Laplacian, divergence, and curl.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Differential Equations</u> Types of problems involving DEs, notation of differentiation, mathematical calssification of DEs, Physical problems classifications (IVPs, BVPs), solution of 1^{st} order linear homogenuous and nonhomogenuous ODE using intigrating factor method, solution of specific forms of 1^{st} order nonlinear ODE using separation of variables, Exact, and substitution methods, Introduction to higher order DEs, exactness and uniqueness, BVPs, solution of homogenuous equations with constant coefficients, Solution of 2^{nd} order, Ordinary, Linear, Non-homogeneous DE using method of variation of parameters and undetermined coefficients, stability consideration of systems goverened by this type of Des, [15 hrs.] <u>Part B – Laplace Transforms</u> Fields of applications, definition of LT, Linearity of LT, inverse LT, partial fraction, long division, LT of derivatives, solving linear ODEs using LT, 1^{st} shifting theorem, derivatives of Transforms theorem, unit step function and its LT, 2^{nd} shifting theorem, LT of integrals theorem, LT of integrals of transforms theorem, convolution theorem, special cases of LT. [15 hrs.] <u>Part C – Linear Algebra</u> Quick review to matrices, eigenvalue and eigenvector. Solution procedure and applications, orthogonal and symmetric matrices, eigenvalue problem, nonhomogeneous problem. [15 hrs.] <u>Part D – Vector Analysis</u>

	Vectors and Geometry, equation of line, plane, curve parameterization with geometric applications, derivative of vector function and it applications, space curve and its field, curvature, gradient of a vector, Laplacian, divergence, and curl. [15 hrs.]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; **1. Lectures**: aim to deliver fundamental mathematical knowledge in relation to engineering and real-life topics. Power point presentations are used through data show. **3. Assignments**: are arranged to provide the opportunity for students to search for methods of solving engineering related problems, implement the methods, and present the solutions. **4. Seminars:** devoted to introduce students to various mathematical terminologies in relation to covered topics under study. How these terminologies affects the solution methodology and physical system behavior. **5. Computer:** the student will be asked to use state of the art available mathematical software those support the topics covered in this course

Student Workload (SWL)			
Structured USWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SSWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	10% (10)	5, 9, 13, 15	LO # 1, and 2
	Assignments	8	10% (10)	2 to 6, 9, 12, 15	LO # 1, and 2
	Projects / Lab.	1	10% (10)	1, 3, 4, 6, 9, 11 to 14	LO # 1, 2, and 6

	Report	1	10% (10)	10	LO # 1, 2 and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	10	LO # 1, 2 and 6
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	• **DE:** Definition and Classification of DE (ordinary and partial, order, degree, Linear and non-linear, homogeneous and non-homogeneous). • Solutions of 1st order linear ordinary DEs, homogeneous and non-homogeneous. General and particular solutions.
Week 2	**DE:** Solutions of 1st order nonlinear ordinary DEs, homogeneous and non-homogeneous, using the method of Separation of Variables and and Exact and modified exact equations method.
Week 3	• **DE:** Solution of 2nd order, homogeneous, linear ordinary DEs with constant coefficients. • Possible solutions of boundary value problems. also, introduce the stability criteria of solution (its physical meaning in engineering systems). • The dependence of stability and system behavior on the characteristic roots.
Week 4	**DE:** Solution of 2^{nd} order, nonhomogeneous, linear ordinary DEs with constant coefficients by the methods of Undetermined coefficients and Variation of parameters.
Week 5	**Laplace Transform:** definition, versatility and application, Laplace Inverse Transform, using tables and partial fractions. Application of LT definition on various Geometric functions.
Week 6	**Laplace Transform:** LT of derivatives, solution of linear ordinary DEs using LTs, 1st-shifting theorem (Translation in S- domain), , LTs of derivatives.
Week 7	**Laplace Transform:** Unit step function and its LT. 2nd shifting theorem (Translation in t-domain), LT of impulse function, LT of periodic functions.
Week 8	**Laplace Transform:** LTs of integrals (t-function integral and S-function integral), Convolution Theorem.
Week 9	**Laplace Transform:** Practices of applying Laplace inverse transform on various special functions.
Week 10	**Mid-term Exam + Report + Lab Exam**
Week 11	**Linear Algebra (Eigen value problem):** Quick review to matrices, eigenvalue and eigenvector. Solution procedure and applications.
Week 12	**Linear Algebra (Eigen value problem):** Orthogonal and symmetric matrices, eigenvalue problem, nonhomogeneous problem.
Week 13	**Vector field:** Vectors and Geometry, equation of line, plane, curve parameterization with geometric applications.
Week 14	**Vector functions and vector field:** Derivative of vector function and it applications, space curve and its field, Curvature.
Week 15	**Vector Calculus:** Gradient of a vector, Laplacian, Divergence, and Curl.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	3. E. Kreyszig, et al, "Advanced Engineering Mathematics," 10th ed., McGraw Hill, 2011.	Yes
Recommended Texts	D.G. Zill, "Advanced Engineering Mathematics," 6th Ed, 2018.	No
Websites	https://uomosul.edu.iq/engineering/%d9%85%d9%81%d8%b1%d8%af%d8%a7%d8%aa-%d8%a7%d9%84%d9%85%d9%88%d8%a7%d8%af-%d8%a7%d9%84%d8%af%d8%b1%d8%a7%d8%b3%d9%8a%d8%a9/ **https://eqworld.ipmnet.ru/** **https://math.libretexts.org/** **https://www.youtube.com/c/3blue1brown/featured**	

Grading Scheme				
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

Module Information					
Module Title	Fluid Mechanics			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 209				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGII	**Semester of Delivery**		Four
Administering Department		MTE	**College**	COE	
Module Leader	Laith Mohammed Jasim		**e-mail**	Jasiml68@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Zahraa reyad Mahmood		**e-mail**	Zahraa.reyad@uomosul.edu.iq	
Peer Reviewer Name		Dr. Loay Younes Aldabbagh	**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 9. Understand the Fundamental fluid properties and their significance in Engineering and methods of fluid pressure measurement and calculation of forces on different surfaces. 10. Introduce the student to the terminology, principles, and methods used in engineering fluid mechanics. 11. Provide the student with the background necessary to understand static and dynamic fluid principles so that they are able to formulate and solve flow

	problems by applying knowledge of fluid mechanics and be given the tools to design fluid systems. 12. Understand the laws of conservation of mass, energy and momentum applied to fluid flow 13. Know about the working of different types of devices used for the measurement of fluid flow 14. provide fundamental concepts and knowledge of inviscid and viscous flows, low-Reynolds number and high-Reynolds number flows, incompressible and compressible flows, and their applications in mechanical engineering. 15. Apply the concepts of modeling and similitude to develop prediction equations. 16. Understand various characteristics of the flow in pipes and discuss the main properties of laminar and turbulent pipe flow and calculate losses in straight portions of pipes as well as those in various pipe system components. 17. Search for updated technology in fluid mechanics in completing assignments related to fluid systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 6. Be familiar with the terminology associated with fluid mechanics. 7. Use fluid properties correctly to solve problems. 8. Discuss the principal theories, concepts, and principles of fluid static and dynamics. 9. Explain the significance of pressure gradients and solve basic hydrostatics problems involving manometers and submerged surfaces. 10. Demonstrate knowledge of Ideal potential (inviscid and incompressible) fluid flow, Compressible fluid flow, Viscous fluid flow, and boundary layer. 11. Derive basic governing equations of fluid flow based on the conservation laws for mass, momentum and energy in fluid flow. 12. Explain the physical basis of Bernoulli's equation, and apply it to flow measurement. 13. Understand the principals of flow rates and velocity measurement. 14. Appreciate the importance of Dimensional Analysis techniques and dimensionless parameters in fluid mechanics; Reynolds number; Mach number. And how to apply the concepts of modeling and similitude to develop prediction equations. 15. discuss basic problems involving pressure losses through pipes and pipe bends and fittings. 16. Be able to determine pressure drops for pipe systems and choose appropriate pumps and turbines depending on the application.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A - Fluid Properties</u> Introduction - Fluid mechanics applications in science and mechatronics engineering, Matter, Solid and Fluid (liquid and Gas), Dimensions, Dimensional Homogeneity, and Units, Shear and normal stress, pressure, Definition of Fluid static and dynamic, Approaches to study fluid mechanics, Analytical method, Experiments, and Computation (Computation Fluid Dynamic, CFD), Definition of Hydrodynamics, Hydraulics, Gas dynamics and Aerodynamics. [5 hrs]

	Fluid Properties - Mass Density, Specific Volume, Specific Weight, Specific Gravity, Idea Gas Law, Dynamic and Kinematic Viscosity, shear stress and velocity gradient, Newtonian and Non-Newtonian Fluids; Compressibility, Process (Isothermal and Isentropic). [5 hrs] <u>Part B - Fluid Static (Hydrostatics)</u> Pressure definition - Pressure at a Point, Pressure Force on a Fluid Element, Equilibrium force of a Fluid Element, Body and Viscous force, Pressure variation in a Fluid at Rest for Incompressible and compressible Fluid, Standard Atmosphere, Variation of Temperature, Pressure and Density of air with the Elevation, Absolute Pressure, Gage Pressure and Vacuum Pressure. Pressure Measurements - Barometer (Mercury and Aneroid Barometer), Piezometer Tube, U-Tube Manometer, Differential U-tube manometer, Inclined-tube manometer, Bourdon gage, Pressure transducers. [10 hrs] Hydrostatic Force - Pressure distribution on flat surface, Hydrostatic Force on an Inclined Plane Surface of Arbitrary shape; resultant force and location of center of pressure, centroid and parallel axis theorem, Hydrostatic Force on Submerged Curve Surface. [10 hrs] <u>Part C - Fluid Dynamics</u> Physical Quantities of Flow and Classification of Fluid Flow - Velocity, Pressure, Density, Temperature and Acceleration, Lagrangian and Eulerian Systems, Control volume method. Uniform and Non-uniform Flow, Steady and Unsteady flow, one, two and three dimensional flows, Viscous and Inviscid Flow, Internal and External Flow, Laminar and Turbulent Flow, boundary layer, Compressible and Incompressible. [5 hrs] Elementary Equation of Motion - Differential and Control Volume Approach, Continuity Equation (Conservation of Mass) derivation, Volume and Mass Flow Rate, Momentum Flux, Applications on Conservation of Mass. Bernoulli Equation - limitations and the assumptions, Pressure head, Velocity head, Elevation head, Piezometric head, Total head, Hydraulic and Energy Grade lines. Application of the Bernoulli equation; Pitot Tube, Pitot-Static Tube (stagnation point), Free Jet; Flowrate Measurement. [10 hrs] linear momentum equation – Derivation, Application of the Linear Momentum Equation, Change in Flow Direction, Weight, Pressure, and Change in Speed. Pressure and Change in Flow Direction, Pressure, Change in Speed, and Friction, Weight, Pressure, Friction, and Nonuniform Velocity Profile; Thrust; Nonuniform Pressure, Moving Control Volume. Derivation of the Moment-of-Momentum Equation, Application, Torque and Power. [10 hrs] <u>Part D - Dimensional Analysis</u> Buckingham Pi Theorem - Determination of Pi Terms, Application, Dimensionless Groups in Fluid Mechanics, Dimensionless Correlation of Experimental Data. Modeling

	and Similitude - Theory of Models, Model Scales, Practical Aspects of Using Models, Typical Model Studies. [10 hrs] Part E - Viscous Flow in Pipe Characteristics of Pipe Flow - laminar and turbulent pipe flow, Energy Considerations, Dimensional Analysis of Pipe Flow, Major Losses, Moody chart, Comparison of Laminar or Turbulent, Minor Losses; loss coefficient of valve, entrance and exit, pipe components. Pipe flow topics - Single pipes, Pressure drop, Head loss, Flowrate, Determine diameter, Multiple Pipe System, Series and parallel pipe systems. [10 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to fluid mechanics and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of fluid mechanics to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze fluid systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction - Fluid mechanics applications, Matter, Solid and Fluid (liquid and Gas), Dimensions, Definition of Fluid static and dynamic.
Week 2	Fluid Properties, Idea Gas Law, shear stress, Newtonian and Non-Newtonian Fluids, Compressibility, Process.
Week 3	Fluid Static - Pressure at a Point, Pressure variation in a Fluid, Standard Atmosphere, Absolute and Gage Pressure.
Week 4	Pressure Measurements.
Week 5	Hydrostatic Force - Pressure distribution on Plane Surface of Arbitrary shape; center of pressure.
Week 6	Centroid and parallel axis theorem, Hydrostatic Force on Submerged Curve Surface.
Week 7	**Mid-term Exam** + Fluid Dynamics - Classification of Fluid Flow, Internal and External Flow, boundary layer.
Week 8	Elementary Equation of Motion - Conservation of Mass, Control volume method, Applications.
Week 9	Bernoulli Equation - limitations and the assumptions, Hydraulic and Energy Grade lines, Application.
Week 10	linear momentum equation – Derivation and Application, Moving Control Volume.
Week 11	Moment-of-Momentum Equation - Derivation and Application, Torque and Power.
Week 12	Dimensional Analysis - Buckingham Pi Theorem, Dimensionless Groups, Dimensionless Correlation of Experimental Data. Modeling and Similitude - Theory of Models, Model Scales.
Week 13	Practical Aspects of Using Models, Typical Model Studies. Viscous Flow in Pipe - laminar and turbulent pipe flow.
Week 14	Major Losses, Moody chart, Comparison of Laminar or Turbulent, Minor Losses, loss coefficients.
Week 15	Pipe flow topics - Single pipes, Multiple Pipe System, Series and parallel pipe systems.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	B.R. Munson, D.F. Young and T.H. Okiishi, Fundamentals of Fluid Mechanics, seventh edition, John Wiley & Sons, Inc., 2013	Yes

Recommended Texts	Frank M. White, Fluid Mechanics, seventh edition, McGraw-Hill, 2011	Yes
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

Grading Scheme				
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

Module Information					
Module Title	Mechanics of Materials			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 210				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGII	**Semester of Delivery**		Four
Administering Department		MTE	**College**	COE	
Module Leader	Islam Abdullah Aziz		**e-mail**	islamabd@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		MSc
Module Tutor	Amena Fawzy		**e-mail**	enaminafawzy@gmail.com	
Peer Reviewer Name		Dr. Omar Waleed Maaroof	**e-mail**	omarmaaroof@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	1. To give students the main tools for the mechanical properties of materials by finding the effect of internal loads on a member and analyzing related stresses and strains, to find the state of stresses. 2. To make students discover the types of stresses that happen in machines under different loads. 3. To provide students with a thorough and pure presentation of the philosophy and application of the fundamentals of mechanics of materials. 4. Provide analysis and design problems to engage students in thinking through real-life problems.

	5. To Provide students with the chance to develop their problem-solving skills.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The students who successfully fulfill the course requirements will: 1. Understand the basics of material properties 2. Be able to relate the effect of internal loads on a solid object to the strength of its material in real-life engineering applications. 3. Gain knowledge about the different types of stresses and deformations related to different types of loads. 4. Gain the ability to use the principles of this subject for the use of the formulas and rules of mechanical design cited in engineering codes. 5. Design a component to meet desired needs within realistic constraints of safety.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A - Introduction</u> A review of some of the important principles of statics and to show how they are used to determine the internal resultant loadings in a body. Cover topics such as Equilibrium of deformable body, support Reactions, and coplanar loadings. Introducing the different categories of stresses and the general state of stress.[3 hrs.] <u>Part B - Stress:</u> This part introduces normal stresses (tensile stress, compressive stress) the general state of stress, average normal stress in an axially loaded bar, maximum average normal stress, and normal force diagram. Followed by. Shear stress which includes: Average shear stress, shear stress equilibrium, maximum average shear stress, allowable stress, and design of simple connections. [3 hrs.] <u>Part C - Strain</u> Deformation- can be represented by the concept of normal and shear strain. In this subject, we will be able to define these quantities and show how they can be determined. The general state of strain is defined in this part. [3 hrs.] <u>Part D - Mechanical Properties of Materials</u> In this part, the stress-strain relationship depending on the experimental method will be presented. The behavior of some materials will be discussed on a stress-strain diagram such as Ductile materials, and brittle materials. Mechanical properties will be discussed as Hooke's law, the Modulus of resilience, the Modulus of toughness, Poisson's ratio, and Shear modulus of rigidity. Tests related to the mechanics of materials, tension and compression test, Failure of Creep, and Fatigue, will be discussed. [6 hrs.] <u>Part E – Deformation in materials</u> Axial load - Elastic deformation of an axially loaded member, Superposition, statically indeterminate axially loaded member, Thermal stress, stress concentrations, inelastic deformations, and residual stress will also be discussed. Torsion - torsional formula to relate the external torque to the shear stress distributed on the cross-section of a circular shaft or tube, angle of twist (how to determine the stress distribution within the member). The torsional deformation of a

	circular shaft, power transmission, and statically indeterminate torque-loaded members will be discussed. [12 hrs.] Part F – Bending on beams and shafts and Transverse shear Bending in shafts and beams will be studied. Shear and moment diagrams for beams and shafts due to bending will be presented. The Flexure Formula relates the stress distribution in a beam to the internal resultant bending moment acting on the beam's cross-section will be produced. The shear formula for transverse force [9 hrs.] Part G – Combined loads and the deflection of beams and shafts Combined especially in Thin-walled pressure vessels, and cylindrical/spherical vessels. Deflection in shafts and beams will be studied. [9 hrs.]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to the mechanics of materials and the application of the theories to practical examples used in engineering design. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of the mechanics of materials to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze problems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Principles of statics: External loads, support reactions, equations of equilibrium, internal resultant loadings
Week 2	Stress: Normal stress (tensile stress, compressive stress), shear stress, general state of stress, average normal stress in an axially loaded bar, average shear stress, allowable stress.
Week 3	Strain: Deformation, normal strain, shear strain, general state of strain.
Week 4	Mechanical properties of materials: The tension and compression test, Conventional stress-strain diagram, true stress-strain diagram.
Week 5	Mechanical properties of materials: ductile materials, brittle materials, Hooke's law, Poisson's ratio, Shear stress-strain diagram, shear modulus of rigidity.
Week 6	Axial load: Elastic deformation of an axially loaded member, superposition.
Week 7	**Mid-term Exam** Axial load: Statically indeterminate axially loaded member, Thermal stress.
Week 8	Torsion: Torsional deformation of a circular shaft, torsion formula, power transmission.
Week 9	Torsion: Angle of twist, statically indeterminate torque-loaded members.
Week 10	Bending: Shear and moment diagrams.
Week 11	Bending: The graphical method.
Week 12	Transverse shear: Shear formula for transverse force.
Week 13	Combined loads: Thin-walled pressure vessels, cylindrical vessels, combined loads.
Week 14	Deflection of beams and shafts: The elastic curve, slope and displacement by integration.
Week 15	Deflection of beams and shafts: The elastic curve, slope and displacement by integration.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Hibbeler, R. C. Mechanics of Materials, 8th Edition, Prentice Hall (2011).	Yes
Recommended Texts	Ferdinand P. Beer, E Russell Johnston Jr., John T. DeWolf; Mechanics of Materials, Fourth edition, Mc Graw Hill.	Yes
Websites	https://www.youtube.com/playlist?list=PLx2F3tH7KEgtcLB1_JxMk6ilwuJ8fxySI	

Grading Scheme				
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

Module Information					
Module Title	Digital Circuits Design			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 211				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	UGII		**Semester of Delivery**	Four	
Administering Department	MTE		**College**	COE	
Module Leader	Dr. Muhamad Azhar Abdilatef		**e-mail**	muhamad.azhar@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Rashad Adhed Kamal		**e-mail**	rashad.alsaigh@uomosul.edu.iq	
Peer Reviewer Name	Sa'ad Ahmed Salih		**e-mail**	kazzazs60@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	On completion of the course students should be able to: 1. Understand the need of Numerical Systems and their general types. 2. Understand the conversions methods tin Numerical systems. 3. Demonstrate gates' principles. 4. Understand the needs for Boolean algebraic. 5. Understanding the Karnaugh map. 6. Appreciate the needed method of Karnaugh map. 7. Designing circuits using Multiplexer, De-Multiplexers, Encoder and decoders. 8. Designing Adders Subtractors circuits.

	9. Understanding the principals of Latches and Flip- Flops circuits. 10. Understanding the principals of Counters.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Be familiar with Numerical Systems. 2. Use the conversions methods to convert Numbers from one system to another. 3. Understand the logic gates' working principles. 4. Demonstrate knowledge of minimizations (Boolean algebraic) 5. Study the method of Karnaugh map with their types and methods' steps. 6. Appreciate the needed method of Karnaugh map. 7. Understanding the principals of Multiplexers Usage and Design with their applications. 8. Understanding the principals of De-Multiplexers Usage and Design with their applications. 9. Understanding the principals of Encoder-decoder Usage and Design with their applications. 10. Understanding the principals of Adders inside their types, Usage and Design with their applications. 11. The principals of Latches and Flip- Flops Design with their applications. 12. The principals of Counters Design with their applications.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A Numerical Systems</u> [15 hrs] In the realm of digital logic, numerical systems play a fundamental role in representing and manipulating information. These systems provide a foundation for encoding data in various forms, enabling the construction of complex digital circuits and the execution of powerful computational operations. Understanding numerical systems is essential for anyone seeking to delve into the fascinating world of digital logic and engineering. In this introductory text, we will explore the key concepts and principles behind numerical systems. We will begin by examining the binary system, which serves as the foundation of all digital systems. From there, we will expand our understanding to other important numerical systems such as the decimal, octal, and hexadecimal systems. Along the way, we will uncover the interrelationships between these systems and discover their unique properties and advantages. <u>Part B - Logic gates [10 hrs]</u> Logic gates are the building blocks of digital circuits and are responsible for performing logical operations on one or more binary inputs to produce a binary output. There are several types of logic gates, each with its own equation and truth table. Let's explore the most common logic gates: AND Gate: The AND gate takes two or more input signals and produces a high output (1) only if all of its inputs are high (1). Otherwise, it produces a low output (0). Equation: Y = A * B (for a two-input AND gate)

	OR Gate: The OR gate takes two or more input signals and produces a high output (1) if any of its inputs are high (1). It produces a low output (0) only if all of its inputs are low (0). Equation: Y = A + B (for a two-input OR gate) NOT Gate (Inverter): The NOT gate, also known as an inverter, takes a single input signal and produces the complement of that input as the output. It negates the input value. Equation: Y = NOT A XOR Gate: The XOR gate (Exclusive OR gate) takes two input signals and produces a high output (1) if the number of high inputs is odd. It produces a low output (0) if the number of high inputs is even. Equation: Y = A XOR B (for a two-input XOR gate) These are just a few examples of common logic gates. Other types of gates include NAND (NOT AND), NOR (NOT OR), and XNOR (Exclusive NOR) gates, which combine multiple logic operations. Each gate has its own equation and truth table, defining its behavior and functionality within a digital circuit. It's important to note that in real-world implementations, logic gates are typically realized using electronic components such as transistors. These gates can be combined to create complex digital systems capable of performing a wide range of operations and computations. <u>Part C – Logic Circuits Minimization</u> [10 hrs] Logic circuit minimization, also known as logic optimization or Boolean function minimization, is the process of simplifying a given logical expression or circuit to achieve a more efficient and compact representation. The goal of minimization is to reduce the number of logic gates, inputs, and overall complexity of the circuit, leading to benefits such as improved performance, reduced power consumption, and easier circuit design. Logic circuit minimization involves two main techniques: algebraic manipulation and Karnaugh maps. Algebraic Manipulation: Algebraic manipulation involves applying Boolean algebra rules and theorems to simplify logical expressions. By using identities such as commutative, associative, and distributive laws, as well as De Morgan's theorem and other Boolean rules, the expression can be simplified. The aim is to reduce the number of terms, eliminate redundant or unnecessary gates, and optimize the overall structure of the circuit. For example, the expression A * (B + C) can be simplified using the distributive law to A * B + A * C. This simplification reduces the number of gates needed in the circuit. Karnaugh Maps: Karnaugh maps, also known as K-maps, provide a graphical method for minimizing logical expressions. They are helpful for simplifying expressions with multiple variables. A Karnaugh map is essentially a truth table representation of the logical function, organized in a grid-like structure. The map allows for visual identification of patterns and simplification opportunities. By grouping adjacent 1s or 0s in the Karnaugh map, logical expressions can be simplified using a technique called "sum-of-products" or "product-of-sums" form. The goal is to identify and eliminate

	redundant terms and find the simplest form of the expression. Minimizing logic circuits using Karnaugh maps can often result in a more compact and efficient circuit design compared to algebraic manipulation alone. The process of logic circuit minimization requires careful analysis, application of Boolean algebra rules, and consideration of optimization goals such as circuit speed, area utilization, or power consumption. It is a crucial step in digital circuit design, as it helps improve circuit performance and reduce complexity. By minimizing logic circuits, engineers can achieve circuits that are easier to understand, implement, and maintain. Additionally, optimized circuits often lead to better overall system performance, reduced costs, and improved reliability. <u>Part D – Multiplexer , De-Multiplexer, Decoder, Encoder</u> [10 hrs] Multiplexer, de-multiplexer, decoder, and encoder are essential components in digital systems. Let's explore each of them: Multiplexer (MUX): A multiplexer is a combinational logic circuit that selects one of many input signals and forwards it to a single output line based on a selection input. It is often referred to as a data selector. The number of input lines in a multiplexer is denoted as 2^n, where 'n' represents the number of selection inputs. The operation of a multiplexer can be described by the equation: Y = D0 * S' + D1 * S. In this equation, 'Y' represents the output, 'D0' and 'D1' represent the input signals, and 'S' represents the selection input. Multiplexers are commonly used in data routing, data transmission, and in designing memory units. They enable the selection of a specific input to be transmitted or stored based on the control signal. De-multiplexer (DEMUX): A de-multiplexer is the inverse of a multiplexer. It takes a single input and selects one of many output lines based on the selection input. A de-multiplexer is often referred to as a data distributor. The operation of a de-multiplexer can be described by the equation: Y0 = D * S' and Y1 = D * S. In this equation, 'Y0' and 'Y1' represent the output lines, 'D' represents the input signal, and 'S' represents the selection input. De-multiplexers are used for routing data from a single input line to multiple output lines based on the control signal. They are commonly used in applications such as memory address decoding and digital communication systems. Decoder: A decoder is a combinational logic circuit that converts an n-bit input code into a set of m outputs, where 2^n = m. It essentially decodes the input and activates a specific output line based on the input combination. Decoders are often used for tasks such as memory address decoding, data selection, and control signal generation. They are widely employed in digital systems, including microprocessors, programmable logic devices (PLDs), and memory units. Encoder: An encoder is the inverse of a decoder. It converts a set of m input lines into an n-bit output code, where m = 2^n. An encoder generates a binary code

corresponding to the active input line. Encoders are frequently used in applications such as data compression, error detection and correction, and multiplexing. They play a crucial role in digital communication systems, data acquisition, and various other areas of digital electronics. Both decoders and encoders are fundamental components in digital systems that enable efficient data representation and manipulation. These components (multiplexers, de-multiplexers, decoders, and encoders) are essential in digital circuit design, data processing, communication systems, and various other applications, enabling efficient and reliable information handling.

Part E – Adders Subtractors Logic Circuits [5 hrs]

In logic design, adders and subtractors are implemented using a combination of logic gates and flip-flops. Here's an overview of how adders and subtractors are designed in logic circuits:

Adders: Adders are used to perform binary addition of two or more binary numbers. The most commonly used adder is the ripple carry adder, which is built by cascading full adders. A full adder takes three input bits: A, B, and a carry-in (Cin), and produces two output bits: a sum (S) and a carry-out (Cout). The sum bit represents the addition of A, B, and Cin, while the carry-out bit represents the carry generated from the addition. To implement a ripple carry adder, connect the Cin of the first full adder to a logic low (0). For subsequent full adders, the Cin is connected to the Cout of the previous full adder. The output sum (S) bits of each full adder form the final sum bits, while the Cout of the last full adder represents the carry-out (Cout).

Subtractors: Subtractors are used to perform binary subtraction of two binary numbers. The most commonly used Subtractors is the ripple borrow Subtractors, which is built using full Subtractors. A full Subtractors takes three input bits: A, B, and a borrow-in (Bin), and produces two output bits: a difference (D) and a borrow-out (Bout). The difference bit represents the subtraction of B from A, taking into account the borrow-in, while the borrow-out bit represents the borrow generated from the subtraction.

To implement a ripple borrow Subtractors, connect the Bin of the first full Subtractor to a logic low (0). For subsequent full Subtractors, the Bin is connected to the Bout of the previous full subtractor. The output difference (D) bits of each full subtractor form the final difference bits, while the Bout of the last full subtractor represents the borrow-out (Bout). It's important to note that for subtraction, the binary representation of the subtrahend is typically inverted (using an inverter) and the borrow-in is set to 1. This is equivalent to performing addition using two's complement representation.

Part F – Latches, Flip-Flops and Counters [10 hrs]

	Latches, flip-flops, and counters are important components in digital systems for storing and manipulating binary information. Let's explore each of them: Latches: are sequential logic circuits that are capable of storing a single bit of information. They are level-sensitive and have two stable states: set (1) and reset (0). Latches are typically constructed using cross-coupled NAND or NOR gates. There are various types of latches, including SR latch (Set-Reset latch), D latch (Data latch), JK latch, and T latch. Latches are simple memory elements that can hold data as long as the enable signal is active. However, they are prone to timing issues and can exhibit race conditions. Flip-Flops: are edge-triggered sequential circuits that store one bit of binary data. They are more reliable and widely used than latches. Flip-flops have a clock input that controls the timing of storing and updating data. They can be implemented using various logic gates. The most common types of flip-flops are D flip-flop, JK flip-flop, T flip-flop, and SR flip-flop. Each type has its own characteristics and functionality. Flip-flops provide better timing control and are commonly used for building memory elements, registers, and sequential circuits. Counters: are sequential circuits that generate a sequence of binary numbers. They are widely used in digital systems for counting events, generating control signals, and implementing various functionalities. Counters can be synchronous or asynchronous. Synchronous counters are controlled by a common clock signal, and their outputs change simultaneously. Asynchronous counters, also known as ripple counters, have outputs that change sequentially based on the propagation of carry signals. Counters can be further categorized as binary counters, decade counters (which count up to 10), and modulus counters (which count up to a specific value). They can be implemented using flip-flops and additional logic gates. Counters play a crucial role in applications such as frequency division, timekeeping, digital clocks, timers, and sequential control systems. In digital systems, latches, flip-flops, and counters are essential for storing, manipulating, and generating binary information. They enable the implementation of memory elements, sequential circuits, and various functionalities required for digital computation and control.

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to Digital Logic and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of Digital Logic to different practical exercises.

	3- Assignments - are arranged to provide the opportunity for students to search for information, analyze Digital Logic and Numerical S systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.47
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction - Numerical System, Binary System, Octal System, Hexadecimal System.
Week 2	Numerical System Converting Methods, (Binary, Octal, Hexadecimal, Decimal), Mathematical Operations, Binary System Problems..
Week 3	Logic Gates, Gates with their symbols and truth tables, Logical Operations, Timing Diagram for logic gates, Logic gates as switches.

Week 4	Logic Circuit Design, Logic circuit designing steps, Implementation of Logic circuits using truth tables, Implementation of logic circuits using equations, Converting logic circuit to logic equations
Week 5	Boolean Algebra and Identities, Basic Identification of Boolean algebra, Duals of Expressions, Demorgan's Theories, Truth tables for Demorgan.
Week 6	Boolean Algebra and Identities, Algebraic Manipulation, Simplifying Functions, Fewer Gates, Duality Properties, Complement of Functions
Week 7	Mid-term Exam + Strategies of Minimizations, Terminology and Definitions, Guidelines of Simplifying Functions.
Week 8	K-Map Simplifying SOP Procedures, Three Variable K-Map, Four Variable K-Map, Five Variable K-Map, Karnaugh Map POS Minimization, Three Variable K-Map, Four Variable K-Map, Variable K-Map, Getting between SOP and POS, Don't Care Conditions.
Week 9	Multiplexer (Definitions, Constructions, 2-1-multiplexer, 4-1-multiplexer, 8-1-multiplexer, 16-1-multiplexer, 32-1-multiplexer, Realizing Logic Functions Efficiently, Larger Multiplexer, Cascading Multiplexer Circuits).
Week 10	De-Multiplexer (Definitions, Applications, 1-4-demultiplexer, 1-8-demultiplexer, 1-16-demultiplexer, Timing Diagram, 1-m-demultiplexer, De-multiplexer as Decoder, Characteristics table of De-multiplexer).
Week 11	Decoder (Characteristics of Decoder, Construction of Decoder, Types of Decoders, 2-4-decoder, 3-8-decoder, 4-16 –decoder, Applications of Decoder, Expansions of Decoder).
Week 12	Encoder(Definitions, Types, Applications, Code Convertor, Binary to Gray Code Convertor)
Week 13	Adders and Subtractors Circuits, Half Adder, Full Adder, Binary Adder, Binary Subtractor, Binary Adder Subtractor
Week 14	Sequential Logic Circuits, Latches and Some Definitions, Synchronous and Asynchronous Sequential Circuits, SR-Latches, SR-Latches as Memories, D-Latches
Week 15	Sequential Logic Circuits, JK-latches, T-Laches, Counters
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Discovering digital design kit
Week 2	Introduction to logic gates and truth tables
Week 3	Applying of Logic Algebraic equations
Week 4	Karnaugh Map
Week 5	Adders Circuits

Week 6	Mid Term Practical Exam
Week 7	Decoder Circuits
Week 8	Encoder Circuits
Week 9	Multiplexer Circuits
Week 10	De-multiplexer Circuits
Week 11	Latches and Flip-Flops
Week 12	Counters Circuits
Week 13	Registers Circuits
Week 14	Preparation for the Final Exam
Week 15	Final Practical Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Digital Logic and Computer Design by M Morris Mano	Yes
Recommended Texts	Digital Logic Design by Pu-Jen Cheng, Digital Logic Design by Nasser M. Sabah	Yes
Websites	Error! Hyperlink reference not valid.	

Grading Scheme				
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

Notes: 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. Attendance to lectures and submitting assignments is obligatory according to the Ministry of Higher Education and Scientific Research of Iraq legislations.

MODULE DESCRIPTION FORM

Module Information					
Module Title	Engineering Economics with Statistics			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 212				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	UGII		**Semester of Delivery**	Four	
Administering Department	MTE		**College**	COE	
Module Leader	Dr. Abbas Anwer		**e-mail**	abbas.oghor@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Noor Jamal		**e-mail**	noor.jamal@uomosul.edu.iq	
Peer Reviewer Name	Dr. Loay Aldabbagh		**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 18. Describe and determine the effect of financial analysis and its impact on budgeting of projects and their outcomes. 19. Identify the characteristics of various methods used for the generation of financial management decisions. 20. Develop and analyze information on investment planning and cost controls, and conduct cost/benefit analysis. 21. Quantify and include elements of uncertainty and risk into an economic analysis. 22. Introduce the student to collecting and presenting statistical data. 23. Classify and tabular the engineering information in a manner consistent with the data and the field of academic work.

	24. Conduct experiments, analyze and interpret data. 25. Identify and solve engineering problems. 26. Take the appropriate decision through scientific analysis of information.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 11. obtain the ability to use modern and classical engineering methodologies pertaining to cost analysis, break-even point calculation, engineering economic analysis, cost effectiveness analysis, sensitivity analysis, and financial planning. 12. attain the ability to conduct an analysis of different alternatives and make appropriate recommendations. 13. acquire the ability to work individually and on multi-disciplinary teams to identify, formulate and analyze financial problems. 14. engage in professional service such as participation in professional societies, and to always consider and support professional ethics 15. have a constant desire for professional development through life-long learning activities, self-confidence, creativity and leadership
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Introduction to Allocation of resources, types of economic resources, efficient use of resources, economic development, engineering economics [5 hrs] Depreciation, straight line method, interest, economic comparisons of alternatives. [5 hrs] Economic feasibility, simple rate of return, internal rate of return [5 hrs] The time value of money, the present value in fixed installments, the present value in variable installments, in the case of equal annual installments, criteria for measuring commercial profitability [10 hrs] Costs of production. Economic feasibility Sensitivity analysis. Break-even point [5 hrs] General introduction of Engineering Statistics. Why study statistics? Types of Statistics Data classification. Descriptive statistics. Central tendency measurement. Dispersion measures. Variance [10 hrs] Introduction to probability. Application of probability. Probability calculation steps, Probability Tree Diagram, Radar detection, Models based on conditional probability, independent events [10 hrs] Continuous Probability Distributions, Sampling distribution , Counting Principle, Permutation and combination [10 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through;

	1- Lectures - aim to deliver fundamental knowledge in relation to economic engineering and theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the fundamental knowledge of economic engineering. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze economic theories with knowledge obtained, and present the completed tasks.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction, Engineering Economics/Extinction
Week 2	Engineering Economics/Interest, Engineering Economics/Alternatives
Week 3	Engineering Economics/Alternatives

Week 4	Engineering Economics / Economic Feasibility,
Week 5	Engineering Economics / Time Value of Money
Week 6	Engineering economics / production costs
Week 7	Engineering economics / economic feasibility
Week 8	Engineering economics/sensitivity analysis
Week 9	Midterm exam/ Break-Even Point
Week 10	Engineering Economics / Break-Even Point
Week 11	General introduction of Engineering Statistics, Data Presentation: Tabular presentation /Creating Frequency Table. Graphical presentation (Histogram, Frequency Polygon).
Week 12	Measures of central tendency (Arithmetic mean, median and mode, the relation between the central tendency measures for unimodal distributions, Measurement of dispersion and variation, absolute dispersions
Week 13	**Probability:** Basic Concepts of Probability Theory, Rule of Probability Additional rule Two events, mutually and non-mutually events- Three events, mutually and non-mutually events
Week 14	Multiplication rule, Tow events, (independent and dependent events), The definition of conditional probability and their properties. Bayes' theorem, The definition and classification of random variable (Discrete and Continuous), type of discrete distribution
Week 15	Discrete probability distributions (Binomial and Poisson distribution), Continuous distribution, (normal distribution) Normal distribution.
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	Principles of Economics, Gregory Mankiw, Published by South Western, 2007. Introduction to Probability and Statistics for Engineers, Holický, Milan	Yes
Recommended Texts	Principles of Economics, Gregory Mankiw, Published by South Western, 2007. مدخل الى الاحصاء , د. خاشع الراوي	Yes
Websites	https://uomosul.edu.iq/engineering/%d9%85%d9%81%d8%b1%d8%af%d8%a7%d8%aa-%d8%a7%d9%84%d9%85%d9%88%d8%a7%d8%af-%d8%a7%d9%84%d8%af%d8%b1%d8%a7%d8%b3%d9%8a%d8%a9/	

Grading Scheme

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
	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

Module Information					
Module Title	Signals and Systems			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 213				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level		UGII	**Semester of Delivery**		Four
Administering Department		MTE	**College**		COE
Module Leader	Zahraa Tarik Mohammad		**e-mail**		zahraata.eng@uomosul.edu.iq
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Abdullah Murtadha Alfakhrey		**e-mail**		Alfakhry.abdullah@gmail.com
Peer Reviewer Name		Dr. Aws Hazim Anaz	**e-mail**		aws.anaz@uomosul.edu.iq
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of this course are: 1. Coverage of continuous and discrete-time signals and representations and methods that is necessary for the analysis of continuous and discrete-time signals. 2. To analyze and modify the properties of signals and systems in the time domain.

	3. To understand the relationships between signals and system types and to know time-domain representation and analysis concepts as they relate to difference equations, impulse response, convolution, etc. 4. To Apply the fundamental theories in continuous signal and convert it to discrete signal, then how to manipulate discrete signals. 5. To understand the behavior of signals in the time domain 6. Understand the characteristics of the LTI system. 7. Comprehend the effects of sampling on a continuous-time signal. 8. To understand the properties of the digital signal, sampling, and quantizing. 9. To obtain Mathematical and computational skills needed in application areas like communication, signal processing, and control. 10. Analyze and basic design signals and simple systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1. Understand and classify signals types, functions, operations, and applications 2. Study and classify systems types, operations, and application 3. Checking systems properties stability, time-variant, causality, linearity, and memory. 4. Represent both signals and systems in multiple forms. 5. Understand and analyze systems interconnection and block diagrams to be able to modify or build systems. 6. Apply sampling, and the Nyquist theorem and study their effects, display aliasing problem and solution. 7. Apply quantizing, coding and understand modern digital signal processing and its advantages, disadvantages, and application 8. Represent, classify, and manipulate discrete time signal types in terms of graphical, functional, tabular, and sequential (vector). 9. Understand and apply key operations: convolution, deconvolution, correlation, and modulation with their types and relation.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Introduction: Introduces the fundamental knowledge needed for the signals and systems and their application related to real-life requirements such as medical applications and with other engineering fields such as communication, image and video processing, and others. Report and project ideas clarifying and discussion. [6 hrs] Signals representation and properties: Recognize, sketch, and manipulate basic signals commonly used in engineering applications. Define, use, and cite signal types and some simple properties of these basic signals. Classify signals according to their types and a variety of criteria including energy, power, and duration. Use common signal transformation operations and draw them in block diagram form. Competently manipulate complex-valued signals. [12 hrs] Systems manipulation: Formulate the input-output description of continuous-time (CT) linear systems and discrete systems. Classify system types and display system representation methods. Define, state, and identify system properties of linearity, time (in)variance, causality, memory, and stability. Formulate and solve differential equations describing linear, time-invariant (LTI) systems, including their conditions and responses. Analyze and synthesize systems as a composite of sub-systems through series, parallel, and feedback combinations [9 hrs] Discrete-time signals and systems: Generation of DT signals and their representation, classification of Discrete-time signals, mathematical operations of discrete-time signals, and mathematical equations of the discrete-time system. Study the effect of sampling on signals. Applying the

	Nyquist theorem and its related states. Principle of CT signal Sampling, its objective and its implications, under and over sampling, ideal Sampling and quantization of signals Spectra of sampled signals, aliasing and its effects and solution, and the relation between continuous and discrete time. Quantization properties and implementation. Coding idea and representation. Introduction to digital signal processing with advantages and disadvantages supporting multiple fields application. [9 hrs] Convolution, correlation, and modulation: Perform convolution with analysis and deconvolution to reconstruct signals. Study and implement convolution and deconvolution multiple types or methods. Relation between Convolution and Correlation, Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions with applications. Describe the concept and techniques for performing signal modulation in communication systems. Analyze the performance of Amplitude Modulation (AM), Phase Modulation (PM), and Frequency Modulation (FM) systems, displaying other modulation types and methods of modulation. [9 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this course is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through: 1- Lectures - aim to deliver concepts and fundamental knowledge concerning signals and systems types and applications, and increase the ability of students to distinguish, identify, define, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics 2- Tutorial sessions - are deployed to practice and illustrate the representation of fundamental knowledge of signals and systems in the time domain and discrete and their methods in different practical engineering fields. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze problems and discrete data, model their equations, with knowledge obtained, and present the completed tasks. 4- Report - To give motivation to students and urge them to search for practical applications affecting life and to reveal the relationship between what has been studied with engineering reality and the needs and requirements of life. 5- Project- Helping students start their steps towards practical implementation and simulation of ideas and effective applications and their relationship to other engineering aspects such as communications, control, image and video processing, and others.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem)	27	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.8

الحمل الدراسي غير المنتظم للطالب خلال الفصل			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction, the basic definition of signals and their main types with examples (continuous and discrete-time signals)
Week 2	Introduction to systems and their types and application examples
Week 3	Classification of signals: (continuous-discrete), (analog-digital), (periodic – aperiodic), and (causal–noncausal)
Week 4	Classification of signals: (even – odd), (power – energy), (deterministic – random), and (finite - infinite length)
Week 5	Signal operation: shifting, scaling (time and value), inversion (time and value), and combined operation. Signal useful function: unit step (continuous and discrete), ramp, unit impulse (with properties), triangular and complex exponential (continuous and discrete)
Week 6	Signal expression and representation: graphical form, functional form, and equation form
Week 7	**Mid-term Exam** + Signals construction
Week 8	Sampling theorem: Nyquist low and aliasing problem with solution
Week 9	Introduction to Quantization and Coding
Week 10	Discrete-time signal representation types: graphical, functional, tabular, and sequential (vector), Elementary discrete time signal with classification and manipulation
Week 11	Description and classification of the system with interconnection & block representation)

Week 12	Introduction to the linear time-invariant system (LTIS) with conditions and System properties (linearity, time-invariant, causality, stability, and memory)
Week 13	Convolution operation and methods: graphical, table look-up, vector by a matrix, add overlap, and analytical method with image (matrix) convolution.
Week 14	Deconvolution method: iterative, polynomial, and graphical method, Correlation types and application: quantitative correlation, cross-correlation, and auto-correlation
Week 15	Modulation: reason, classification, and types (amplitude, frequency, phase, and spread spectrum), Modern digital signal processing advantages, disadvantages, and applications + Report and project discussion
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	"Fundamentals of signals and systems", Benoit Boulet, Charles River Media 2006	No
Recommended Texts	"Signal Processing First", James H., Ronald W., Mark A. Pearson Education, Inc, Pearson Prentice Hall 2003	Yes
Websites		

Grading Scheme

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

Module Information					
Module Title	Measurement and Instrumentation			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 301				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGIII	**Semester of Delivery**		Five
Administering Department		MTE	**College**	COE	
Module Leader	Saad Ahmed Saleh Al Kazzaz		**e-mail**	kazzazs60@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Teba Hani Fathi		**e-mail**	teba96mecha@gmail.com	
Peer Reviewer Name		Rafid Ahmed Khalil	**e-mail**	rafidahmedkhalil@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	**The aims of the module are to:** Learn how to work with different components of modern measurement systems and discuss the concepts instrumentations as parts of control system field. Design a practical project to build a measurement system.
Module Learning Outcomes	**On completion of the course, students should be able to:** 1. introduce the basic functional elements of measurement systems and the system of units

مخرجات التعلم للمادة الدراسية	2. understand the static and dynamic characteristics of the instrument and to obtain the errors in measurements. 3. understand the fundamentals of electrical and electronic instruments, learn how to calibrate and use different types of instruments. 4. make comparison between various measurement techniques 5. make analytical analysis of different parts of measurement systems 6. deal with various transducers, sensors and the data acquisition systems 7. design a full measurement system.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. UNIT – I: 1. Measurement system, Characteristics of instruments, 2. Methods of measurement, Errors in Measurement & Measurement standards, 3. Review of indicating and integrating instruments: Voltmeter, Ammeter, 4. Three phase Wattmeter, Multimeter and Energy meter. [15 hrs] UNIT- II: 1. Measurement of low, medium and high resistances, 2. insulation resistance measurement, 3. AC bridges for inductance and capacitance measurement. [15 hrs] UNIT- III 1. Current and Potential transformer, ratio and phase angle errors, 2. design considerations and testing. [20 hrs] UNIT – IV: 1. Electronic voltmeter, Multimeter, Wattmeter & energy meter, 2. Time, Frequency and phase angle measurements using CRO; 3. Spectrum & Wave analyzer. Digital counter, 4. frequency meter, voltmeter, multimeter and storage oscilloscope. [15 hrs] UNIT – V: 1. Transducers, classification & selection of transducers, strain gauges, 2. Thermistors, Thermocouples, LVDT, Inductive & capacitive transducers, 3. Piezoelectric and Hall-effect transducers, 4. Measurement of motion, force, pressure, 5. temperature, flow and liquid level, 6. basic concepts of smart sensors and application. 7. Data Acquisition Systems. [25 hrs]
Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures: aim to deliver concepts and fundamental knowledge in measurement techniques, instrumentation and their application in different systems. 2- Tutorial sessions: to give the student the skills to solve and discuss numerical problems related to the theory given in lectures.

	3- Laboratory: to perform practical implementation under guidance of lab instructor. The students perform the experiments in groups. 4- Assignments - are arranged to provide the opportunity for students to search for information, analyze problems, model their equations, with knowledge obtained, and present the completed tasks. 5- Projects: to give the student the opportunity to develop a simple individual measurement project.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction - Units and Dimensions, type of instruments
Week 2	Errors in measurement systems, Sources of measurement noise, Techniques for reducing measurement noise
Week 3	Electrical analogue and digital meters

Week 4	Dc & ac Bridge circuits analysis, effect of measuring instrument internal resistance on output errors
Week 5	Resistance, inductance and capacitance measurement
Week 6	Current measurement, frequency and phase measurement
Week 7	Mid-term Exam
Week 8	Sensors and Transducers, Sensor Categories, Position and displacement Transducer
Week 9	Strain gauges, Force Sensors. Torque sensors
Week 10	Rotational motion transducers, Rotational displacement and velocity, Absolute angular displacement and Velocity, Gyroscopes
Week 11	Capacitive, resistive and magnetic sensors, Hall effect sensor
Week 12	Piezoelectric transducers and Ultrasonic transducers as rangier
Week 13	Level measurement and Pressure measurement,
Week 14	Introduction to MEMS and Vibration sensors
Week 15	Basic concepts of smart sensors and application.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Make Introduction to the instruments available in the Lab and explain the working principles
Week 2	Experiment #1 Obtain practically the Errors in different measurements
Week 3	Experiment #2 Design and achieve DC & AC analogue meter
Week 4	Experiment #3 Measurement resistance and strain using Dc Bridge circuits and obtain the effect of measuring instrument internal resistance on the output reading.
Week 5	Experiment #4 Measurement of inductance and capacitance us AC bridge circuit.
Week 6	Experiment #5 Measurement of displacement using different ways
Week 7	Mid-term Exam
Week 8	Experiment #6 Introduction to Arduino microcontroller, how to connect sensors and how to develop the required software
Week 9	Experiment #7 Measurement of Force and Torque using different types of sensors.
Week 10	Experiment #8 Measurement of rotational velocity and displacement.

Week 11	Experiment #9 Measurement of displacement using proximity magnetic sensors and Hall effect sensor.
Week 12	Experiment #10 Measurement of temperature and humidity using different types of sensors.
Week 13	Experiment #11 Measurement range using ultrasonic transducers
Week 14	Experiment #12 Measurement of fluid level and flow rate
Week 15	Final Lab Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	"Measurement and Instrumentation Principles" Third edition, by Alan S. Morris Reference book:	Yes
Recommended Texts	1- "The Measurement Instrumentation and Sensors Hand Book" by John G. Webster 2- "Introduction to Instrumentation Measurement", Second Edition by Robert B. Northrop	No
Websites	https://www.coursera.org/learn/measuerment-Instrumentation	

Grading Scheme				
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

Module Information					
Module Title	Control Systems			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 302				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGIII	**Semester of Delivery**		Five
Administering Department		MTE	**College**	COE	
Module Leader	Firas Ahmed Majeed		**e-mail**	dr.firasaldurze@uomosul.edu.iq	
Module Leader's Acad. Title		Lecture	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
Peer Reviewer Name		Dr. Aws Hazim Saber Anaz	**e-mail**	aws.anaz@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Define and explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design.

	2. Interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules. 3. Compute stability of linear systems using the Routh array test and use this to generate control design constraints. 4. Use Evans root locus techniques in control design for real world systems. 5. Compute gain and phase margins from Bode diagrams . 6. Design Lead-Lag compensators based on frequency data for an open-loop linear system.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1. an ability to identify, evaluate and solve engineering problems utilizing the acquired principal knowledge of engineering, science, and mathematics. 2. an ability to design an integrated system and its various components and processes to produce solutions that fulfill the need of society. 3. an ability to communicate effectively using oral, written, and graphic forms with different levels of audiences. solve systems 4. an ability to acquire new engineering knowledge and skills in the mechatronics engineering fields. 5. an ability to function on multi-disciplinary teams to analyze, solve problems, and deadline commits.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Unit1 [20 hrs] Introduction to Control Systems: Open loop and Closed loop control systems, Mathematical modeling of physical systems, Derivation of transfer function, block diagram representation & signal flow graph, Reduction Technique, Mason's Gain Formula. Effect of feedback on control systems. Unit2 [25 hrs] Time Domain Analysis: Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants, Performance indices. Concept of Stability: Asymptotic stability and conditional stability, Routh – Hurwitz criterion, relative stability analysis, Root Locus plots and their applications. Unit3 [25 hrs] Frequency Domain Analysis: Correlation between time and frequency response, Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode Plots), gain and phase margins, Nyquist plots, relative stability criterion, constant. Unit4 [20 hrs]

	State Space Analysis: Definitions of state, state variables, state space, representation of systems. Controllers and Compensation Techniques: Response with P, PI and PID Controllers, Concept of compensation, Lag, Lead and Lag-Lead Compensation

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to control systems and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of control systems to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze control systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Summative assessment	**Final Exam**	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Control, Classification of Dynamic Systems.
Week 2	Closed Loop Control System with Feedback, Mathematical Preliminaries – Complex Variables, Laplace Transform.
Week 3	Standard Inputs, Free and Forced Response, Transfer Function, Poles and Zeros.
Week 4	Response to various Inputs, Effect of Poles, Notion of Bounded Input Bounded Output (BIBO) stability.
Week 5	Effect of Zeros, Closed Loop Transfer Function, Dynamic Performance Specification, First Order Systems.
Week 6	Second Order Systems, Unit Step Response of Underdamped Second Order Systems, Concepts of Rise Time, Peak Time, Maximum Peak Overshoot and Settling Time.
Week 7	**Mid-term Exam**
Week 8	Controllers – Proportional (P), Integral (I) and Derivative (D) Blocks, Examples of PID controller design.
Week 9	Routh's Stability Criterion, Use in Control Design, Incorporation of Performance Specifications in Controller Design.
Week 10	Analysis of Steady State Errors.
Week 11	Root Locus and its Application in Control Design.
Week 12	Frequency Response, Bode Plots.
Week 13	Nyquist Plots, Nyquist Stability Criterion.
Week 14	Relative Stability – Gain and Phase Margins.
Week 15	Control System Design via Frequency Response – Lead, Lag and Lag-Lead Compensation.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	MATLAB-The Language of Technical Computing
Week 2	Transfer Function and Converting Between System Representations

Week 3	Introduction to Matlab Simulink
Week 4	Time domain for second order system in Matlab
Week 5	DC Motor Position: Simulink Modeling
Week 6	Servo Motor: Simulink Modeling
Week 7	PID controller

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Benjamin C. Kuo, Automatic Control Systems, Prentice Hall	Yes
Recommended Texts	J. Nagrath& M. Gopal, Control System Engineering, New Age International	Yes
Websites	https://www.coursera.org/learn/ engineering	

Grading Scheme				
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

Module Information					
Module Title	Signal Processing			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 303				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		UGIII	**Semester of Delivery**		Five
Administering Department		MTE	**College**	COE	
Module Leader	Aws Anaz		**e-mail**	aws.anaz@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
Peer Reviewer Name		Dr. Rafid Ahmed	**e-mail**	rafidahmedkhalil@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 11. Understand the Fundamentals of signal processing and their significance in Engineering applications. 12. Introduce the student to the terminology, principles, and methods used in discrete-time signals 13. Teach student the design fundamental of DSP filters. 14. Provide the student with the background necessary to understand analytical tools to transform, analyze, and design digital signal processing systems 15. Know about the working of different types of devices used in DSP systems

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 6. Understand mathematical description and representation of continuous and discrete time signals and systems. 7. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system. 8. Understand and resolve the signals in frequency domain using Fourier transforms. 9. Analyze the discrete time signals and system using different transform domain techniques. 10. Design and implement LTI filters for filtering different real-world signals. 11. Develop different signal processing applications using DSP processor.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A</u> Introduction - Review of Linear Continuous-Time Signal Processing Fourier methods, Laplace transform, convolution, frequency/time domain processing. [4 hrs] Introduction to Real-Time Computation Data converters (A/D, D/A), machine architecture, Sampling theorem, aliasing, quantization, sampled data systems [4 hrs] <u>Part B</u> Discrete-Time Signal Processing The z transform, difference equations, relationship between F(z) and F*(jw), mappings between s-domain and z-domain, inverse z transform. Discrete–time stability. [12 hrs] Discrete Spectral Analysis The DFT and its relationship to the continuous FT, the FFT and implementations (decimation in time and frequency). Uses of the DFT: convolution — (overlap and add, select savings), correlation. [8 hrs] <u>Part C</u> Real-Time Simulation Methods Using Difference Equations Impulse-, step-, ramp-invariant simulations. Matched poles/zeros, bilinear transform methods. Error analysis. [12 hrs] <u>Part D</u> Filter Design — Continuous and Discrete Butterworth, elliptic, Chebyshev low-pass filters. Low-pass design methods based on continuous prototypes. Realizations. Conversion to high-pass, band-pass, band-stop filters. Discrete-time filters: IIR and FIR. Linear phase filters. Frequency sampling filters. [20 hrs]

Learning and Teaching Strategies

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to signal processing and the application of the theories to practical examples. 2- Project - is deployed to illustrate the application of fundamental knowledge of DSP to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze signal processing systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction - Review of Linear Continuous-Time Signal Processing

	Fourier methods, Laplace transform
Week 2	Review of Linear Continuous-Time Signal Processing Convolution, frequency/time domain processing
Week 3	Introduction to Real-Time Computation Data converters (A/D, D/A), machine architecture
Week 4	Sampling theorem, aliasing, quantization, sampled data systems
Week 5	Discrete-Time Signal Processing The z transform, difference equations, relationship between F(z) and F*(jw)
Week 6	Mappings between s-domain and z-domain, inverse z transform. Discrete–time stability.
Week 7	**Mid-term Exam** + Discrete Spectral Analysis: The DFT and its relationship to the continuous FT.
Week 8	the FFT and implementations (decimation in time and frequency). Uses of the DFT: convolution — (overlap and add, select savings), correlation
Week 9	Real-Time Simulation Methods Using Difference Equations: Impulse-, step-, ramp-invariant simulations.
Week 10	Matched poles/zeros, bilinear transform methods. Error analysis.
Week 11	Filter Design — Continuous and Discrete: Butterworth, elliptic, Chebyshev low-pass filters.
Week 12	Filter Design — Continuous and Discrete: Digital Low-pass design methods based on continuous prototypes.
Week 13	Filter Design — Continuous and Discrete: Digital Filter Realizations
Week 14	Filter Design — Continuous and Discrete: Conversion to high-pass, band-pass, band-stop filters.
Week 15	Filter Design — Continuous and Discrete: Discrete-time filters: IIR and FIR. Linear phase filters. Frequency sampling filters.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Proakis, John G., and Dmitris K. Manolakis. Digital Signal Processing. 4th ed. Upper Saddle River, NJ: Prentice Hall, 2006. ISBN: 9780131873742	No
Recommended Texts	Oppenheim, Alan V., Ronald W. Schafer, and John R. Buck. Discrete-Time Signal Processing. 2nd ed. Upper Saddle River, NJ: Prentice Hall, 1999. ISBN: 9780137549207.	No
Websites	https://classroom.google.com/c/NTgzNTA4NDgxODZa?cjc=mvrqnjt	

Grading Scheme				
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

Module Information					
Module Title	Microprocessor and Assembly Language			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 304				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UGIII	**Semester of Delivery**	Five		
Administering Department	MTE	**College**	COE		
Module Leader	Dr. Mohammed Yaseen	**e-mail**	mohammed.alnuaimi@uomosul.edu.iq		
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.		
Module Tutor	Abdullah Murtadah	**e-mail**	Alfakhry.abdullah@gmail.com		
Peer Reviewer Name	Dr. Rafid Ahmed	**e-mail**	rafidahmedkhalil@uomosul.edu.iq		
Scientific Committee Approval Date	2024-2025	**Version Number**	1.0		

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to: 1. **Develop Understanding:** To provide students with a comprehensive understanding of microprocessors, specifically the 8086/8088 microprocessors, and their microarchitectures. 2. **Learn Assembly Language:** To introduce students to the software model of 8086 microprocessors, focusing on the assembly language, its syntax, semantics, and the assembly process.

	3. **Understand Addressing Modes:** To equip students with knowledge of different addressing modes - Register, Immediate, and Memory addressing modes. 4. **Master Instructions:** To instruct students in various assembly language instructions, including data transfer, arithmetic, logic, and control instructions. 5. **Explore Advanced Concepts:** To familiarize students with advanced assembly language topics, including shift and rotate statements, formulation of assembly loops, and usage of subroutines and strings in assembly language. 6. **Promote Hands-On Experience:** To offer students practical experience in assembly language programming through lab sessions and a final project, reinforcing their theoretical knowledge with practical skills. 7. **Apply Learning:** To encourage students to apply their knowledge in assembly language to design and implement a microprocessor-based project, demonstrating their understanding and competency in the subject.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. **Understanding Microprocessors:** Students will be able to demonstrate a clear understanding of the principles of microprocessors, specifically the architecture and functionality of the 8086/8088 microprocessors. 2. **Mastering Assembly Language:** Students will be proficient in the assembly language related to the 8086 microprocessors, including its syntax, semantics, and the process of assembly. 3. **Applying Addressing Modes:** Students will be able to effectively apply different addressing modes - Register, Immediate, and Memory - in assembly language programming. 4. **Executing Instructions:** Students will understand and effectively use various assembly language instructions including data transfer, arithmetic, logic, and control instructions. 5. **Understanding Advanced Concepts:** Students will demonstrate competency in advanced assembly language topics, such as shift and rotate statements, the formulation of assembly loops, and the usage of subroutines and strings in assembly language. 6. **Practical Application:** Students will be able to design and implement a basic assembly language program using 8086 microprocessors, demonstrating their ability to apply their theoretical knowledge practically. 7. **Project Development:** By the end of the module, students will have developed, presented, and evaluated a project involving the 8086/8088 assembly language, reflecting their overall understanding and competency in the subject.
Indicative Contents المحتويات الإرشادية	1. **Microprocessors and Microcomputers:** Introduction to microprocessors and microcomputers, including the historical development, basic components, and operation of these systems. [10 hrs.]

	2. **System Numbers:** Review of binary, decimal, hexadecimal number systems and conversions, and arithmetic operations in these systems. [10 hrs.] 3. **Microarchitecture of 8086 Microprocessors:** In-depth exploration of the structure, functions, and operations of the 8086 microprocessor. [10 hrs.] 4. **Assembly Language Basics:** Introduction to the 8086 assembly language, including its syntax, semantics, and assembly process. [10 hrs.] 5. **Addressing Modes:** Discussion of Register, Immediate, and Memory addressing modes, their uses and applications in assembly programming. [10 hrs.] 6. **Assembly Language Instructions:** Detailed study of data transfer, arithmetic, logic, and control instructions in the 8086 assembly language. [10 hrs.] 7. **Advanced Assembly Topics:** Exploration of shift and rotate statements, formulation of assembly loops, usage of subroutines, and manipulation of strings in the 8086 assembly language. [10 hrs.] 8. **Practical Programming:** Hands-on practice in assembly language programming, with coding exercises and labs covering all the key areas of the course. [10 hrs.] 9. **Final Project:** Design and implementation of a project involving the 8088/8086 assembly language, demonstrating students' overall understanding and competency in the subject. [10 hrs.] Each of these indicative contents covers a specific aspect of the module and is directly aligned with the module's learning outcomes. They ensure that students gain a comprehensive understanding of microprocessors, especially the 8086, and assembly language, from basic concepts to advanced topics.

Learning and Teaching Strategies	
Strategies	1. **Lectures:** Traditional lectures will be the primary method for delivering course content. This approach allows for in-depth coverage of the theory behind microprocessors and assembly language. Multimedia presentations and real-world examples can be used to enhance understanding. 2. **Interactive Discussions:** Engage students in class discussions to clarify concepts and encourage critical thinking. This could be based on the lecture content, assigned readings, or problems from past exams. 3. **Practical Labs:** These provide hands-on experience in programming in assembly language, using the various addressing modes, instructions, and advanced assembly techniques. Labs are instrumental in bridging the gap between theoretical knowledge and practical implementation. 4. **Problem-solving Sessions:** Regular sessions can be organized where students solve problems or execute tasks related to microprocessors and assembly language. This aids in reinforcing classroom learning. 5. **Group Work:** Encourage students to work in small groups for certain lab tasks or problems. This promotes collaborative learning and prepares students for teamwork in professional environments.

	6. **Project-Based Learning:** The course includes a final project where students apply the knowledge and skills they've acquired throughout the course. This helps in developing a deeper understanding of the subject, as well as practical skills. 7. **Self-Learning:** Encourage students to use self-learning resources like online tutorials, programming exercises, and research articles. This fosters independent learning, a critical skill for lifelong learning. 8. **Feedback:** Provide regular feedback on students' lab work, problem-solving exercises, and the final project. This helps students understand their strengths and areas needing improvement. 9. **Office Hours:** Offer office hours for students to seek help with course content, labs, or the final project. This gives students an opportunity for personalized learning and assistance. These strategies cater to different learning styles and provide a comprehensive, inclusive, and engaging learning experience. They balance the need for theoretical knowledge with the importance of practical skills.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

		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)	2, 12	LO 5, and 6
	Projects / Lab.	1	15% (10)	Continuous	
	Report	1	5% (10)	13	LO #1, 2, and 7
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1, 2, 4, 5, 6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Introduction to microprocessors and microcomputers: History, evolution and an overview of system numbers.**
Week 2	**Detailed exploration of the 8086 microprocessors and their Microarchitectures.**
Week 3	**The 8086 microprocessors software model, and basic assembly language concepts.**
Week 4	**Register and Immediate addressing mode, including practical exercises.**
Week 5	**Memory addressing mode, complemented with coding exercises.**
Week 6	**Data transfer instructions, with hands-on coding sessions.**
Week 7	**Mid-term Exam + Assembly Arithmetic instructions and application in coding**
Week 8	**Assembly logic instructions**
Week 9	**Control instructions and their applications in coding.**
Week 10	**Shift and rotate statements and instructions**
Week 11	**Formulation and creation of assembly loops**
Week 12	**Introduction to subroutines and strings in 8088/8086 assembly language.**
Week 13	**Review and reinforcement of key concepts, doubt clearing, and feedback.**
Week 15	**Student Project Discussion**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus	
	Material Covered
Week 1	**Introduction - Setup of the assembly language development environment, familiarization with debugging and simulation tools.**
Week 2	**Addressing Modes - Perform operations using Register and Immediate addressing modes, and interpret the results.**
Week 3	**Memory Addressing Mode - Write a simple program to understand memory addressing mode and observe its functioning in real time.**
Week 4	**Data Transfer and Arithmetic Instructions - Implement basic programs for data transfer and to perform arithmetic operations.**
Week 5	**Control Instructions and Logic Instructions - Design basic programs implementing control and logic instructions.**

Week 6	**Shift and Rotate Instructions, and Assembly Loops - Use shift and rotate instructions in different scenarios and create assembly loops in a program.**
Week 7	**Subroutines and Strings - Write programs implementing subroutines and manipulating strings.**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Walter A. Triebel, Avtar Singh, "The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications", Fourth Edition, Pearson Education Ltd, 2014.	Yes
Recommended Texts	W. Triebel, A. Singh, "The 8088 and 8086 Microprocessors", Fourth Edition, Pearson Education Ltd, 2018.	Yes
Websites	https://www.udemy.com/course/microprocessor-and-assembly-language/	

Grading Scheme				
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

Module Information					
Module Title	Mechanical Engineering Laboratory			**Module Delivery**	
Module Type	Core			☐ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 305				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level		UGIII	**Semester of Delivery**		Five
Administering Department		MTE	**College**	COE	
Module Leader	Laith Mohammed Jasim		**e-mail**	Jasiml68@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Hassan Mudhafar Saeed Ahmad Wadollah Saleh Islam Abdullah Aziz Zahraa reyad Mahmood Abdullah Murtadha Alfakhrey Ahmed Abdulkareem Muhammad Amena Fawzy Teba Hani Fathi		**e-mail**	Saeedh81@uomosul.edu.iq ahmadalsabawi@uomosul.edu.iq islamabd@uomosul.edu.iq zahraa.reyad@uomosul.edu.iq Alfakhry.abdullah@gmail.com Ahmedmechatronics93@gmail.com enaminafawzy@gmail.com teba96mecha@gmail.com	
Peer Reviewer Name		Dr. Loay Younes Aldabbagh	**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. have students perform laboratory experiments in various areas of mechanical engineering to reinforce concepts presented in the Department's core courses. 2. expose students to experimental equipment, data collection, and reporting which would support the theoretical background obtained in these topics. 3. Identify measuring devices and study the mechanism of their work. 4. teamwork practice training.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1. apply general safety rules while carrying out experiments. 2. measure the coefficient of friction. 3. determine the behavior of materials when subjected to torsion and to obtain a Modulus of Rigidity. 4. investigate the relationship between a force and the extension of a spring and obtain a constant of a spring. 5. find experimentally the reactions at the supports of a simply supported beam and compare the results with analytical values. 6. determine the amount of energy absorbed by a material during fracture. 7. determine the constant of proportionality (the thermal conductivity k) for one-dimensional steady flow of heat. 8. demonstrate unsteady heat transfer to a lumped mass. 9. Determine the heat transfer coefficient for a flow around a cylinder under free and forced convection. 10. obtain the performance characteristics of a centrifugal pump. 11. validate Bernoulli's assumptions and theorem by experimentally proving that the sum of the terms in the Bernoulli equation along a streamline always remains a constant. 12. obtain the coefficient of discharge from experimental data by utilizing venturi meter and, also the relationship between Reynolds number and the coefficient of discharge. 13. estimate the head loss that occurs due to the flow of the fluid. 14. investigate the reaction forces produced by the change in momentum of a fluid flow when a jet of water strikes a flat plate or a curved surface.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A: Applied mechanics experiments- introduction to the laboratory, Friction on Inclined Plane, Reaction of Beams. [6 hrs] Part B: Materials experiments- Torsion of Bar, Hook's Law, Impact Test. [6 hrs] **Mid-term Exam.** [2 hrs] Part C: Heat transfer experiments- One Dimensional Heat Conduction, Transient Heat Transfer, Force Convection from a Cylinder in a Cross Flow. [6 hrs] Part D: Fluid mechanics experiments- Centrifugal Pump Performance, Verification of Bernoulli Equation, Venturi Meter Apparatus, Losses in Piping Systems, Impact of a Jet. [10 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver concepts and fundamental knowledge in relation to the subject of the experiment. 2- Conducting experiments- aims to teach students to make use of laboratory equipment to study mechanical phenomena and provide essential knowledge of basic laboratory measurement techniques and how to collect experimental results. 3- Report -Learn how to write technical reports in the form of engineering reports and executive summaries and analyze and interpret the data.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.133
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

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

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered

Week 1	An introduction to the laboratory and familiarization with public safety procedures.
Week 2	Experiment 1: Friction on Inclined Plane.
Week 3	Experiment 2: Torsion of Bar.
Week 4	Experiment 3: Hook's Law.
Week 5	Experiment 4: Reaction of Beams.
Week 6	Experiment 5: Impact Test.
Week 7	Experiment 6: One Dimensional Heat Conduction.
Week 8	**Mid-term Exam**
Week 9	Experiment 7: Transient Heat Transfer.
Week 10	Experiment 8: Force Convection from a Cylinder in a Cross Flow.
Week 11	Experiment 9: Centrifugal Pump Performance.
Week 12	Experiment 10: Verification of Bernoulli Equation.
Week 13	Experiment 11: Venturi Meter Apparatus.
Week 14	Experiment 12: Losses in Piping Systems.
Week 15	Experiment 13: Impact of a Jet.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	Technical Documents for Laboratory Equipment	Yes
Recommended Texts	J.P. Holman, Experimental Methods for Engineers, 8th Edition, McGraw-Hill, 2012.	No
Websites		

Grading Scheme

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

Module Information					
Module Title	Theory of Machines			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☐**Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 306				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UGIII		**Semester of Delivery**	Five	
Administering Department	MTE		**College**	COE	
Module Leader	Saad Zaghlul Saeed		**e-mail**	saeeds70@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Noor Jamal		**e-mail**	noor.jamal@uomosul.edu.iq	
Peer Reviewer Name	Dr. Hassan M. Saeed		**e-mail**	saeedh81@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	MTE 202 Engineering Mechanics-Dynamics	**Semester**	Three
Co-requisites module	None	**Semester**	None

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Understand the fundamentals of the theory of kinematics and dynamics of machines. 2. Understand techniques for studying motion of machines and their components. 3. Develop the ability to analyze and understand the dynamic (position, velocity, acceleration, force and torque) characteristics of mechanisms. 4. Develop the ability to systematically design and optimize mechanisms to perform a specified task. 5. Understand mechanisms for system control – Gyroscope. 6. Develop competency in understanding of theory of all types of gears.

	7. Understand the analysis of gear train. 8. Increase the ability of students to effectively present written, oral, and graphical solutions to design problems. 9. Increase the ability of students to work cooperatively on teams in the development of mechanism designs.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Be familiar with the terminology associated with theory of mechanics. 2. Determine the degrees-of-freedom (mobility) of a mechanism. 3. Identify the basic relations between distance, time, velocity, and acceleration. 4. Use graphical and analytic methods to study the motion of a planar mechanism. 5. Apply the fundamental principles of statics and dynamics to machinery. 6. Understand balancing of rotary and reciprocating masses. 7. Analyze dynamic force analysis of slider crank mechanism and design of flywheel. 8. Analyze the gyroscopic couple or effect for stabilization of aero plane and Four-wheeler vehicles. 9. Compute frictional losses, torque transmission of mechanical systems. 10. Understand fundamentals of gear theory which will be the prerequisite for gear design. 11. Analyze speed and torque in epi-cyclic gear trains which will be the prerequisite for gear box design. 12. Choose appropriate drive for given application.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A - mechanism kinematics</u> Introduction: definition, fundamental units, International System of Units, Types of Constrained Motions, Kinematic link / element, Kinematic Pair, Kinematic chain. Mechanisms: types, characteristics, and applications, kinematic analysis for different mechanisms. Velocity analysis: velocity of a point on a link by instantaneous centre method, number and types of instantaneous centers in a mechanism, method of locating instantaneous centers in a mechanism. Relative Velocity Method: velocity of a point on a link, velocities in a slider crank mechanism, rubbing velocity at a pin joint. [15 hrs] Acceleration analysis: acceleration diagram for a link, acceleration of a point on a link, acceleration in the slider crank mechanism, Coriolis Component of Acceleration. [15 hrs] <u>Part B - machine dynamics</u> Dynamic force analysis, Calculation of efficiency and power transmition. Balancing of rotating masses: Balancing of a single rotating mass by two masses rotating in different planes, balancing of several masses rotating in the same plane, balancing of several masses rotating in different planes. Balancing of reciprocating masses: Primary and secondary unbalanced forces of reciprocating masses, Partial balancing of unbalanced primary force in a reciprocating engine. [15 hrs] <u>Part C – Inertia forces</u> Turning Moment Diagram: Turning moment diagram for a multi-cylinder engine, Fluctuation of energy, Determination of maximum fluctuation of energy, Coefficient of fluctuation of energy and speed, Energy stored in a flywheel, Dimensions of the flywheel. Gyroscope: Precessional angular motion, Gyroscopic couple, Effect of

	gyroscopic couple on an airplane, Stability of a four-wheel drive moving in a curved path. [10 hrs] Part D – Friction Belts: Types of Flat Belt Drives, Velocity Ratio of belt drive, Length of an open belt Drive, power transmitted by a belt, Ratio of driving tensions for flat belt drive, centrifugal tension, maximum tension in the belt, initial tension in the belt. V-belt drive, ratio of driving tensions for V-belt. Clutches: flat collar bearing, single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutches. [12 hrs] Part E – Gear theory & Analysis Toothed Gearing: terms used in gears, low of gearing, velocity of sliding of teeth, length of arc of contact, interference in involute Gears, minimum number of teeth. Gear train: simple and compound gear trains, reverted gear train, Epicyclic gear train, compound Epicyclic gear train (Sun and Planet), torques in Epicyclic gear trains. [8 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to theory of machines and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of theory of machines to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze machines with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction: definition, fundamental units, International System of Units, kinematics and kinetics of motion.
Week 2	Mechanisms: types, characteristics, and applications, kinematic analysis for different mechanisms.
Week 3	**Velocity analysis**: velocity of a point on a link by instantaneous centre method, number and types of instantaneous centers in a mechanism, method of locating instantaneous centers in a mechanism. Relative Velocity Method: velocity of a point on a link, velocities in a slider crank mechanism, rubbing velocity at a pin joint.
Week 4	**Acceleration analysis**: acceleration diagram for a link, acceleration of a point on a link, acceleration in the slider crank mechanism
Week 5	Coriolis Component of Acceleration.
Week 6	**Dynamic force analysis:** Calculation of efficiency and power transmition.
Week 7	**Mid-term Exam** + **Balancing of Rotating Masses**: Balancing of a Single Rotating Mass By Two Masses Rotating in Different Planes, Balancing of Several Masses Rotating in the Same Plane, Balancing of Several Masses Rotating in Different Planes.
Week 8	**Balancing of Reciprocating Masses:** Primary and Secondary Unbalanced Forces of Reciprocating Masses, Partial Balancing of Unbalanced Primary Force in a Reciprocating Engine.
Week 9	**Turning Moment Diagram:** Turning Moment Diagram for a Multicylinder Engine, Fluctuation of Energy, Determination of Maximum Fluctuation of Energy, Coefficient of Fluctuation of Energy and speed, Energy Stored in a Flywheel, Dimensions of the Flywheel.
Week 10	**Gyroscope:** Precessional Angular Motion, Gyroscopic Couple, Effect of Gyroscopic Couple on an Airplane, Stability of a Four Wheel drive Moving in a Curved Path.
Week 11	**Belts:** Types of Flat Belt Drives, Velocity Ratio of belt drive, Length of an open belt Drive, power transmitted by a belt, Ratio of driving tensions for flat belt drive, centrifugal tension, maximum tension in the belt, initial tension in the belt.
Week 12	V-belt drive, ratio of driving tensions for V-belt

Week 13	**Clutches**: flat collar bearing, single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutches.
Week 14	**Toothed Gearing:** terms used in gears, low of gearing, velocity of sliding of teeth, length of arc of contact, interference in involute Gears, minimum number of teeth.
Week 15	**Gear train:** simple and compound gear trains, reverted gear train, Epicyclic gear train, compound Epicyclic gear train (Sun and Planet), torques in Epicyclic gear trains.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Theory of Machine. By: R.S. Khurmi and J. K. Gupta. 14th ed.; S. Chand & Co. Ltd., New Delhi, 2005.	NO
Recommended Texts	Design of Machinery: an introduction to synthesis and analysis of mechanisums and machines, R. L. Norton, McGraw-Hill, 2004	NO
Websites	https://drive.google.com/drive/folders/151XuIZZvf-l-Ur1XiOwFMS0KuxIYGvQh?usp=sharing https://www.classcentral.com/course/swayam-kinematics-of-mechanisms-and-machines-13022	

Grading Scheme

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

Module Information					
Module Title	Heat Transfer			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 307				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGII	**Semester of Delivery**		Six
Administering Department		MTE	**College**	COE	
Module Leader	Loay B. Younis Aldabbagh		**e-mail**	loayaldabbagh@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Zahraa Reyad Mahmood		**e-mail**	zahraa.reyad@uomosul.edu.iq	
Peer Reviewer Name		Laith Mohammed Jasim	**e-mail**	Jasiml68@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are 1. To study the Introduction and basic concepts, dimension and units, system and control volume, properties of system, states and equilibrium, process and cycle, temperature and the zero law of thermodynamics, pressure, and manometer, barometer. 2. To understand the Energy, and energy transfer and general energy analysis 3. To provide the student for the properties of pure substances, Energy analysis of closed systems, and Energy analysis of closed systems.

	4. Understanding the type of to heat transfer and its relationship to thermodynamics (first and second law of thermodynamics). 5. To introduce the Mass and energy analysis of control volumes 6. Study the second law of thermodynamics, heat engine, heat pump, and refrigerators system 7. To study and understand the one-dimensional, steady-state conduction with and without heat generation. 8. To study and understand the thermal resistance and extended surfaces and their design (Fins). 9. Provide the students with two-dimensional, steady-state conduction (Separation of variables, Shape factors, and Finite difference methods). 10. To introduce the heat transfer by convection (laminar and turbulent boundary layer equation, dimensionless parameters, Reynolds analogy). 11. To understand the subject of radiation, physics of thermal radiation, black body heat exchange. 12. To provide the students with heat exchange, Classification of heat exchangers in Mechatronics systems, Design of heat exchangers.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Will understand the basic concepts, dimension and units, system and control volume, properties of system. 2. Be familiar with properties of pure substance and close and open system. 3. They have deep understanding of first and second law of thermodynamic and its application in heat engine, heat pump, and refrigeration system. 4. Be familiar with the terminology associated with type of heat transfers and their applications. 5. Use the three types of heat transfer (conduction, convection and radiation correctly to solve problems. 6. The student can understand the physics and analyze and solve all type of one-dimensional, steady-state conduction with and without heat generation. 7. The student have familer with all type of fins and there appllication and they can analyze and desigen the extended surfaces. 8. To solve the two-dimensional, steady-state conduction by using the Separation of variables, Shape factors, and Finite difference methods. 9. Will understand the principle and the physics of the convection heat transfer and they can distinction between laminar and turbulent boundary layer equation. 10. Thy can use a prototype to solve any problem using the dimensionless parameters and Reynolds analogy. 11. They have a deep understand the subject of radiation, physics of thermal radiation, black body heat exchange. 12. The students learn the classification of heat exchangers in Mechatronics systems and how can use it for design of heat exchangers.
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following.** **<u>Part A</u>** Basic concepts and definitions of thermodynamics. Properties of pure substances. The first law of thermodynamics for the closed and open systems. The second law of thermodynamics. Entropy. Second-Law analysis of engineering systems. And Energy, and energy transfer and general energy analysis [6 hrs] **<u>Part B</u>**

	Properties of pure substances, pure substance, phases of a pure substance, phase-change processes of pure substances, property diagrams for phase-change processes, property tables, the ideal-gas equation of state, compressibility factor—a measure of deviation from ideal-gas behavior. [12 hrs] **Part C** energy analysis of closed systems, moving boundary work, energy balance for closed systems, specific heats, internal energy, enthalpy, and specific heats of ideal gases, internal energy, enthalpy, and specific heats of solids and liquids. [6 hrs] **part D** mass and energy analysis of control volumes, conservation of mass, flow work and the energy of a flowing fluid, energy analysis of steady-flow systems, some steady-flow engineering devices. [12 hrs] **part E** the second law of thermodynamics, introduction to the second law, thermal energy reservoirs, heat engines, refrigerators and heat pumps, reversible and irreversible processes, the carnot cycle, the carnot principles, the thermodynamic temperature scale, the carnot heat engine, the carnot refrigerator and heat pump. [6 hrs] **Part F** introduction to heat transfer, conduction, convection, radiation, the thermal resistance concept, relationship to thermodynamics, relationship to the second law of thermodynamics and the efficiency of heat engines, units and dimensions, introduction to conduction, the conduction rate equation, the thermal properties of matter, the heat diffusion equation, boundary and initial conditions [12 hrs] **Part G** one-dimensional, steady-state conduction, the plane wall, the composite wall, contact resistance, an alternative conduction analysis, conduction with thermal energy generation, heat transfer from extended surfaces, a general conduction analysis, fins with uniform and nonuniform cross-sectional area, fin performance. [12 hrs] **Part H** two-dimensional, steady-state conduction, alternative approaches, the method of separation of variables, the conduction shape factor and the dimensionless conduction heat rate, finite-difference equations, solving the finite-difference equations. [12 hrs] **Part I** introduction to convection, the convection local and average convection coefficients on boundary layers, compressible flow, boundary layer similarity: the normalized boundary layer equations. [12 hrs]
Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to heat transfer and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of heat transfer to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze the type of heat transfer, conduction, convection, and radiation, with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	108	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	42	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction and basic concepts, dimension and units, system and control volume, properties of system, states and equilibrium, process and cycle, temperature and the zero law of thermodynamics, pressure, and manometer, barometer.
Week 2	Energy, and energy transfer and general energy analysis
Week 3	Properties of pure substances
Week 4	Energy analysis of closed systems
Week 5	Mass and energy analysis of control volumes
Week 6	The second law of thermodynamics, heat engine, heat pump, and refrigerators system
Week 7	**Mid-term Exam**
Week 8	Introduction - Heat transfer by conduction, Heat transfer by convection (classified according to the nature of the flow), Heat transfer by radiation.
Week 9	The Thermal Resistance Concept, Relationship to Thermodynamics, Units and Dimensions, solving problem. And introduction to one dimensional heat Conduction, The Conduction Rate Equation.
Week 10	The Conduction Rate Equation, The Heat Diffusion Equation in caritasan , cylindrical and spherical coordinate. Boundary and Initial Conditions.
Week 11	One-Dimensional, Steady-State Conduction with out and with thermal Energy Generation, plane wall, Thermal Resistance, The Composite Wall, Contact Resistance, Porous Media, in *Radial,* Cylinder*, and spherical Systems*, *An Alternative Conduction Analysis*, Conduction.
Week 12	Heat Transfer from Extended Surfaces (A General Conduction Analysis, Fins of Uniform and nonuniform Cross-Sectional Area, Fin Performance.
Week 13	Two-Dimensional, Steady-State Conduction, Alternative Approaches, The Method of Separation of Variables.
Week 14	The Conduction Shape Factor and the Dimensionless Conduction Heat Rate, solving problem
Week 15	Finite-Difference Equations, The Energy Balance Method
Week 16	Introduction to Convection, The Convection Local and Average Convection Coefficients on Boundary Layers, Compressible Flow, Boundary Layer Similarity: The Normalized Boundary Layer Equations

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Thermodynamics: An Engineering Approach, 7th Edition, Yunus A. Cengel, Michael A. Boles McGraw-Hill, 2008. 2. *Property Tables Booklet*, by Y.A Çengel and M. A. Boles, 4th Edition, 2002	Yes

	1. *fundamental of Heat and Mass transfer, by Frank P. Incropera and David P. Dewitt, 7th Printed in the United States of America2011*	
Recommended Texts	In the library, there are many thermodynamics books that can be used as reference books.	
Websites	https://www.amazon.com/Thermodynamics-Engineering-published-Mcgraw-Hill-Education/dp/B00E28JL0Q https://www.amazon.com/Fundamentals-Heat-Transfer-Frank-Incropera/dp/0471457280	

Grading Scheme				
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

Module Information					
Module Title	Hydraulic & Pneumatic Systems			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 308				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGIV	**Semester of Delivery**		Six
Administering Department		MTE	**College**	COE	
Module Leader	Hassan Mudhafar Saeed		**e-mail**	Saeedh81@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Teba Hani Fathi		**e-mail**	teba96mecha@gmail.com	
Peer Reviewer Name		Laith Mohammed Jasim	**e-mail**	Jasiml68@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1) introduce students to the hydraulic and pneumatic systems; their principles of operation and applications of basic industrial processes. 2) The components in the power generation, control, and drive sections are discussed in various levels with more focus on the control section. 3) Component functions, construction, and usage. 4) The control section using fluid power, electric power, and PLC is used throughout the example circuits.

	5) During the progress in the course, with various industrial circuits are discussed, with focus on fluid pressure and flow rate to control the output work at the actuators. 6) The course ends with the types of actuators and their special uses and a how to calculate actuator efficiency.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1) Recognize various types of fluid power circuits, their components, and the function of each component. 2) Distinguish the preparation section components and the function of each component in a circuit. 3) Recognize various types of valves: directional, non-return, flow, pressure, and other combination control valves. Also identify the function of each of these valves in a circuit. 4) Select the proper actuator for a fluid power circuit including special duty actuators. 5) Recognize various basic industrial and workshop fluid power circuits, and their special duty. 6) Read and symbolize various fluid power circuit and their components.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Introduction to fluid power systems</u> Introduction to fluid power systems, hydraulic vs pneumatic, criteria of choosing working media, advantages and disadvantages, construction of electro-hydraulic/pneumatic systems, performance relations (pressure, flowrate, power, efficiency), Identification code of fluid power circuit components. <u>Part B – Power supply section</u> Working media power generation unit and components, Working media, power generation (pump, compressor), reservoirs, working media conditioning, symboles used in power generation section, Air service unit. <u>Part C - DCVs</u> DCV designation , classification, usage, selection, and performance. <u>Part D - Non-return Valves</u> definition, types, check valve, applications of check valve, pilot-check valve, logic valves, quick exhaust valve, shut-off valve. <u>Part D - FCVs</u> function and types, non-pressure compensated valves (throuttle, oriffice), meater-in, meter-out, bleed-off circuits, one-way FCV, mechanically adjustable one-way FCV, pressure compensated FCV, hydraulic Flow divider, time delay valves. <u>Part E - PCVs</u> functions and types, pressure switches, symboling of PCVs, pressure releif valve, safety valve, counter-balance PCV, Brake valve, sequence valve, piloted releif valve, pressure regulating valve (2-ways, 3-ways), pressure compensated vs non-pressure compensated valves. <u>Part F – PLC control</u> electric and PLC – control: overview of electric/electronic control vs pilot control of fluid power systems, PLC introduction, logic and sequencing applications using PLC, time control/delay using PLC electric and PLC – control: pressure based sequencing using PLC, collecting examples. <u>Part G – Actuators</u> definition and function of drive section, types of actuators, input/output energies of actuators, design considerations, hydraulic vs pneumatic actuators, classifications, types of loads on actuators, linear actuators, single acting cylinder function/operation/types/usage, double acting cylinder function/operation/types/usage, SAC vs DAC, comparison cylinder performance characteristics, extension and retraction force calculation, maximum force, piston velocity, piston power and effciciency. Other types of linear

	cylinders: double rod cylinder, Tandem cylinder, rodless cylinders, telescopic cylinders, impact cylinders, doublex cylinders, bellow actuators, diaphram cylinder, rotary actuators: introduction and performance, output power, running turque, turque vs pressure, power vs pressure, speed and displacement, control of torque and speed, motors vs pumps, symbols of motors, classification of motors, limited rotation actuators, vane type, piston type, indicators Part H - preliminary design circuits circuits for speed control, force control, time and sequence control.

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; **1. Lectures**: aim to deliver fundamental knowledge in relation to fluid power systems. Power point presentations are used through data show. **2. Assignments**: are arranged to provide the opportunity for students to search for methods of designing basic fluid power systems with specific tasks. **4. Seminars:** devoted make students develop their knowledge by searching for new circuit implementation. **5. Computer:** the student will be asked to use state of the art available simulating software those support the topics covered in this course.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	10% (10)	5, 6, 7, 11, 14	LO # 1, 3, 2, 4, and 6
	Assignments	8	10% (10)	2, 4, 5, 7, 10, 11, 14	LO # 1, 2, 3, 4, and 6

	Lab.	2	10% (10)	Continuous	LO # 2, and 6
	Report	1	10% (10)	14	LO # 1, 2, 4, and 6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1, 2, 4, and 6
	Final Exam	3 hr	50% (50)	16	LO # 1, 2, 4, and 6
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to fluid power systems, criteria of choosing working media, construction of electro-hydraulic/pneumatic systems, performance relations.
Week 2	Working media, power generation unit and components, reservoirs, working media conditioning, symboles used in power generation section, Identification code of fluid power circuit components.
Week 3	**DCVs:** definition, designation , classification, selection, and performance.
Week 4	**DCVs:** Usage.
Week 5	**Non-return Valves:** definition, types, check valve, pilot-check valve, logic valves, quick exhaust valve, shut-off valve.
Week 6	**FCVs:** function and types, non-pressure compensated valves, meater-in, meter-out, bleed-off circuits, one-way FCV, mechanically adjustable one-way FCV.
Week 7	**FCVs:** pressure compensated FCV, hydraulic Flow divider, time delay valves
Week 8	**Mid-term Exam**
Week 9	**PCVs:** functions and types, pressure switches, symboling of PCVs, pressure releif valve, safety valve, counter-balance PCV, Brake valve, sequence valve,
Week 10	**PCVs:** piloted releif valve, pressure regulating valves.
Week 11	**Electric control components and PLC**: overview of electric/electronic control vs pilot control of fluid power systems, PLC overview, logic and sequencing applications using PLC, time control/delay using PLC, pressure based sequencing using PLC.
Week 12	**Actuators:** definition and function of drive section, types of actuators, input/output energies of actuators, design considerations, hydraulic vs pneumatic actuators, classifications, types of loads on actuators, linear actuators, single acting cylinder function/operation/types/usage, double acting cylinder function/operation/types/usage, SAC vs DAC.
Week 13	**Actuators:** Cylinder performance characteristics, extension and retraction force calculation, maximum force, piston velocity, piston power and effciciency.
Week 14	**Actuators:** Other types of linear cylinders: double rod cylinder, Tandem cylinder, rodless cylinders, telescopic cylinders, impact cylinders, doublex cylinders, bellow actuators, diaphram cylinder.
Week 15	**Actuators:** rotary actuators: introduction and performance, output power, running turque, turque vs pressure, power vs pressure, speed and displacement, control of torque and speed, motors vs pumps, symbols of motors, classification of motors, limited rotation actuators, vane type, piston type, indicators.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introducing the commercial simulating software available in the market. Installations and usage
Week 2	Practicing on simulating software
Week 3	Single-Acting Air Cylinder, Double-Acting Air Cylinder, Two-Hand Safety Circuit, Double-Acting Air Cylinder Remote Control, Single-Acting Air Cylinder Remote Control, Interlocking Start Switch Circuit, Sequence Control of Two Air Cylinders
Week 4	One-Cycle Cylinder Reciprocation Using Pushbuttons and single solenoid valve One-Cycle Cylinder Reciprocation Using Pushbutton and single-solenoid valve One-Cycle Cylinder Reciprocation Using Pushbuttons and double solenoid valve One-Cycle Cylinder Reciprocation Using Limit Switch and single solenoid valve One-Cycle Cylinder Reciprocation Using Limit Switch and double solenoid valve Cylinder Advance or Reverse Control Using a Pushbutton and single solenoid valve Cylinder Advance or Reverse Control Using a Pushbutton and double solenoid valve
Week 5	One-Cycle Cylinder Reciprocation Using Timer and single solenoid valve One-Cycle Cylinder Reciprocation Using Timer and double solenoid valve One-Cycle Cylinder Reciprocation Using Timer, Limit switch and double solenoid valve Ex-AND Valve, Ex-OR Valve, Ex-Quick-Exhaust Valve
Week 6	Flow Control Valve, Air Cylinder Slow Advance and Rapid Reverse, Air Cylinder Used in Machining Process, Emergency Stop Circuit
Week 7	Classwork examples on meter-in, meter-out, Time Delay Valve, Air Cylinder Manual Control Advance and Delayed, Air Cylinder Two-Hand Control Advance and Automatic reverse
Week 8	**Mid-term exam**
Week 9	Air Cylinder Manual Control Advance and Pressure Control Reverse
Week 10	Sequence Valve, Ex-Pressure Switch Uses Implementation of in-class examples with simulating software
Week 11	Implementation of in-class examples with simulating software
Week 12	Continuous Cylinder Reciprocation Using Limit Switches and single solenoid valve Continuous Cylinder Reciprocation Using Limit Switches and double solenoid valve Continuous Cylinder Reciprocation Using Timer, Limit switches and double solenoid valve Continuous Cylinder Reciprocation Using Timer and single solenoid valve
Week 13	PLC in-class examples implementation
Week 14	PLC in-class examples implementation
Week 15	Review of the Lab exaperimentations
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Anthony Esposito, Fluid Power with Applications, 7th ed., 2014.	No
Recommended Texts	1) M. Galal Rabie, Fluid Power Engineering, 2009. 2) Parker Motion & Control, Fluid Power Basics, An Introduction to Hydraulics and Pneumatics, 1993. 3) Andrea Vacca, Germano Franzoni, Hydraulic Fluid Power: Fundamentals, Applications, and Circuit Design, 2021.	No
Websites	https://uomosul.edu.iq/engineering/%d9%85%d9%81%d8%b1%d8%af%d8%a7%d8%aa-%d8%a7%d9%84%d9%85%d9%88%d8%a7%d8%af-%d8%a7%d9%84%d8%af%d8%b1%d8%a7%d8%b3%d9%8a%d8%a9/ https://www.lunchboxsessions.com/explore https://www.e4training.com/index.php https://www.gfpsweb.org/ https://www.festo.com/us/en/e/technical-education/customer-support-and-services-id_31263/ https://www.fpda.org/aws/FPDA/pt/sp/home_page https://www.fluidpowerworld.com/ https://www.youtube.com/c/AirmaxPneumaticsLTD/videos https://www.ifps.org/	

Grading Scheme				
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

Module Information					
Module Title	Computer Aided Machine Design I			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 309				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGIII	**Semester of Delivery**		Six
Administering Department		MTE	**College**	COE	
Module Leader	Ahmad Wadollah Saleh Al-Sabawi		**e-mail**	ahmadalsabawi@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		MSc
Module Tutor	Shahad Waleed Ahmed		**e-mail**	shahad.ahmed@uomosul.edu.iq	
Peer Reviewer Name		Loay B. Y.	**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

Relation with other Modules			
Prerequisite module	MTE 107: Mechanics of Materials	**Semester**	Two
Co-requisites module	MTE 407: Computer Aided Machine Design II	**Semester**	Eight

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	Upon successful completion of the course, students should be able to: 1. Model basic and complex parts and components. 2. Describe the fundamental components and limitations of a modern computer numerical control (CNC) machine tool. 3. Select suitable cutting tools and process parameters for a given milling or turning operation. 4. Write, read and troubleshoot NC programs written in standard G-code format. 5. Formulate free-form curves and surfaces mathematically using a parametric expression. 6. Describe the basic principles of Hermite curve, Bezier curve, B-spline curve and NURBS curve representations

	7. Use computer-aided manufacturing (CAM) software to generate both roughing and finishing operations. 8. Describe the relative advantages and disadvantages between two and half axis, three-axis and five axis machining. 9. Work and operate typical CNC machines.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the completion of course, the student will be able to 9. Apply/develop solutions or to do research in the areas of computer aided manufacturing. 10. Deal with simple or complex part geometries. 11. Write gcode for relatively simple shapes and parts. 12. Edit and develop gcode texts that is generated by CAM software and do in – site modification on a text file format. 13. Exposed to the available basic CNC machines. 14. Choose the suitable strategy for machining, either manual or programmed. 15. Design and manufacture CNC machines from scratch. 16. Get a fundamental knowledge of the software used for CNC simulation and gcode exporting tools.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Section 1 introduction to CAM and NC programming</u> Classification of CAM systems, NC programming, gcode, rapid movement command, G0, feedrate movement command, G1, circular interpolation commands, clockwise command G2, counter clockwise command, G3, pause command, dwell command, G4, XY plane designation, G17, YZ plane designation, G18, ZX plane designation, G19, English units of inputs, G20, metric units of inputs, G21, machine zero return positon check, G27, machine zero return – primary reference point, G28, skip function, G31, threading function, G33, exact stop, G61, Absolute input of motion values, G90, incremental input of motion values, G91, feedrate per minute in/min or mm/min, G94, feedrate per revolution – in/rev or mm/rev, G95, retract motion to the initial level in a fixed cycle, G98, retract motion to the initial level in a fixed cycle, G99 [25 hrs] <u>Section 2 Canned Cycles</u> High speed deep hole drilling cycle, G73, left hand tapping cycle, G74, precision boring cycle, G76, fixed cycle cancel, G80, plain drilling cycle, G81, spot drilling cycle, G82, deep hole drilling cycle (peck drilling), G83, right hand tapping cycle, G84, boring cycle, G85. [15 hrs] <u>Section 3 CNC Milling Operations and Computer Aided Design</u> 2.5 milling, facing, slotting, gear machining, 2d pocket machining, profile machining, boring, drilling, 2d contour, 2d adaptive clearing. [25]

Learning and Teaching Strategies	
Strategies	Tools and strategies, in addition to the student – teacher interaction in – and – off class, used to deliver the course to the students are basically divided upon the following: 5. Lectures

	6. Lab works. 7. Assignments. 8. Mini projects

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	65	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	60	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to CAM
Week 2	Fundamental principles of NC programming
Week 3	Positional data
Week 4	Cutting commands I
Week 5	Cutting commands II
Week 6	Canned Cycles, part I
Week 7	Midterm Exam + Canned Cycles, part II
Week 8	Milling cycles, Part I

Week 9	Cutting conditions
Week 10	Tool offsets
Week 11	Milling cycles Part II
Week 12	Basic turning cycles, part I
Week 13	Basic turning cycles, part II
Week 14	Computer aided design, a model drawing section
Week 15	Computer aided design, a model machining section using CAM software
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Part or component modeling, section I
Week 2	Part or component modeling, section 2
Week 3	Part or component modeling, section 3
Week 4	Part or component modeling, section 4
Week 5	Part or component modeling, section 5
Week 6	Part machining, milling operation, section 1
Week 7	Part machining, milling operation, section 2
Week 8	Part machining, milling operation, section 3
Week 9	Part machining, milling operation, section 4
Week 10	Part machining, milling operation, section 5
Week 11	Part machining, turning operation, section 1
Week 12	Part machining, turning operation, section 2
Week 13	Part machining, laser cutting, section 1
Week 14	Part machining, laser cutting, section 2
Week 15	Part making, 3-d printing
Week 16	Part or component modeling, section I

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	P. Radhakrishanan, and others, CAD/CAM/CIM, 3rd Ed., New Age International Publishers, 2008	No
Recommended Texts	Peter Smid, CNC Programming Handbook, 3rd Ed., Industrial Press, Inc., 2007	No
Websites	https://ocw.mit.edu/courses/res-2-005-girls-who-build-make-your-own-wearables-workshop-spring-2015/pages/manufacturing-mechanical-design/	

Grading Scheme				
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
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MODULE DESCRIPTION FORM

Module Information					
Module Title	Microcontroller System Design			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 310				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	UGIII		**Semester of Delivery**	Six	
Administering Department	MTE		**College**	COE	
Module Leader	Mohammed Yaseen		**e-mail**	mohammed.alnuaimi@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Abdullah Murtadah		**e-mail**	Alfakhry.abdullah@gmail.com	
Peer Reviewer Name	Sa'ad Ahmed Salih		**e-mail**	kazzazs60@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to: 1. **Introduce the Core Concepts of Microcontrollers:** The course aims to impart a solid understanding of microcontrollers, their architectures, and the differences between microprocessors and microcontrollers. 2. **Foster Understanding of PIC Microcontrollers:** The course aims to provide an in-depth understanding of PIC microcontrollers, focusing

	specifically on the PIC16F84A. This includes its internal architecture, memory organization, and features. 3. **Teach Assembly Language Programming:** The course aims to equip students with the skills to write, debug, and understand Assembly language code for PIC microcontrollers, focusing on a variety of instruction types. 4. **Provide Practical Experience:** The course aims to provide students with hands-on experience with the PIC16F84A microcontroller through lab exercises and a final project, thereby encouraging practical application of theoretical knowledge. 5. **Illustrate Microcontroller Applications:** The course aims to demonstrate the wide range of applications of microcontrollers in the field of Mechatronics, showing how they enable interaction between mechanical, electrical, and computer systems. 6. **Develop Problem-Solving Skills:** The course aims to foster problem-solving skills by teaching students to apply their understanding of microcontrollers to address real-world challenges. 7. **Prepare Students for Future Learning:** The course aims to serve as a foundation for further studies or professional work in microcontroller system design or related fields. 8. **Encourage Independent Learning:** The course aims to foster a spirit of independent learning and curiosity among students, encouraging them to explore beyond the provided materials and deepen their understanding of the subject.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. **Understand Basic Microcontroller Concepts:** By the end of the course, students should understand the fundamental concepts and components of a microcontroller system, including the differences between microprocessors and microcontrollers, and the key features of RISC and CISC architectures. 2. **Grasp PIC Microcontroller Architecture:** Students should be able to explain the internal architecture of PIC microcontrollers, including the layout and functioning of the data and program memory. 3. **Understand and Apply Assembly Language Programming:** Students should be able to write and understand programs written in Assembly language for the PIC microcontroller. They should be familiar with the syntax, directives, and the use of different instructions (bit-oriented, byte-oriented, arithmetic and logic, control, shift and rotate, loop instructions). 4. **Familiarize with Microcontroller Interfacing:** Students should understand how to interface a microcontroller with peripheral devices. They should be able to design, develop, and debug microcontroller-based systems for a variety of applications. 5. **Develop Problem-Solving Skills:** Students should be able to apply their theoretical knowledge to practical problems, using their understanding of microcontrollers to develop solutions to real-world challenges. 6. **Understand the Role of Microcontrollers in Mechatronics:** By the end of the course, students should appreciate the role of

	microcontrollers in the field of Mechatronics and how they enable the interaction of mechanical, electrical, and computer systems. 7. **Gain Hands-On Experience:** Through laboratory exercises, students should gain practical experience with the PIC16F84A microcontroller, including programming, debugging, and integrating the microcontroller with other hardware components. 8. **Demonstrate Skills in a Final Project:** Students should be able to demonstrate their grasp of the course material by successfully completing a final project that requires them to design and implement a microcontroller-based system.
Indicative Contents المحتويات الإرشادية	1. **Introduction to Microcontrollers: [2hr]** • Definition and explanation of microcontrollers • Comparison between microcontrollers and microprocessors • Applications and uses of microcontrollers in various industries 2. **Microcontroller Architectures: [6hr]** • Overview of RISC and CISC architectures • Differences and applications of these architectures • Introduction to Harvard and Von Neumann architectures 3. **Internal Architecture of PIC Microcontrollers: [6hr]** • Detailed explanation of the architecture of PIC microcontrollers • Components of PIC microcontrollers: CPU, Memory, I/O Ports, Timers, etc. • Special Function Registers (SFRs) in PIC microcontrollers 4. **Memory Organization of Microcontrollers: [4hr]** • Understanding of program and data memory • Role and significance of ROM, RAM, EEPROM in microcontrollers 5. **Data Memory of PIC Microcontrollers: [6hr]** • In-depth understanding of data memory in PIC microcontrollers • Role and operation of General Purpose Registers (GPRs) 6. **Program Memory of PIC Microcontrollers: [6hr]** • Understanding of program memory and its role in the execution process • Role and operation of Program Counter • Introduction to the concept of interrupts and their operation 7. **PIC Microcontroller Assembly Programming: [8hr]** • Introduction to Assembly language programming for PIC microcontrollers • Learning the syntax, directives, and addressing modes

	• Understanding the instruction set architecture (ISA) 8. **Types of PIC Microcontroller Instructions:[8hr]** • Bit-oriented instructions • Byte-oriented instructions • Arithmetic and logic instructions • Control instructions • Shift and rotate instructions • Loop instructions 9. **Microcontroller Interfacing and Applications:[6hr]** • Understanding how to interface a microcontroller with peripheral devices • Exploration of different types of sensors and actuators, their applications, and interfacing techniques 10. **Hands-On Experiences:[8hr]** • Laboratory experiments to apply theoretical concepts • Project development for practical application of knowledge

Learning and Teaching Strategies	
Strategies	1. **Lectures:** Traditional lectures form the backbone of most courses. They should be used to deliver the theoretical aspects of microcontroller system design, and to introduce new topics and concepts. 2. **Interactive Discussions:** During lectures, try to encourage active participation from students by including interactive discussions. Asking questions, encouraging students to ask their own questions, and discussing real-world applications can make the learning process more engaging. 3. **Laboratory Sessions:** Practical lab sessions are crucial in a technical course like this. Lab exercises should be designed to complement the theory discussed in the lectures. These will provide hands-on experience with the PIC16F84A microcontroller, as well as valuable problem-solving experience. 4. **Individual and Group Projects:** Projects (both individual and group) should be used to allow students to apply what they've learned in a real-world context. This can also foster teamwork and communication skills. 5. **Self-Directed Learning:** Encourage students to learn independently. Provide them with a list of recommended readings and resources to explore. This promotes lifelong learning skills. 6. **Demonstrations:** Use demonstrations to illustrate more complex concepts or processes. For instance, showing students how to set up the

	development environment for programming the microcontroller, or demonstrating how a particular circuit works. 7. **Online Learning Resources:** Use online resources like tutorials, videos, and interactive modules to supplement the course material. This can be especially useful for complex topics that might benefit from different presentation formats. 8. **Peer Learning:** Encourage students to learn from each other, both during formal study groups and in informal settings. This can improve understanding and retention of the course material. 9. **Regular Assessments:** Regular quizzes, tests, and exams can help to reinforce learning and identify areas where students may be struggling. Provide feedback on these assessments to guide students' learning. 10. **Feedback:** Encourage feedback from students to understand what is working and what is not. This can help improve the course in real-time and make the teaching more effective. The aim of these strategies should be to promote an active, student-centered learning environment that encourages curiosity, critical thinking, and real-world problem-solving skills.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to the microcontrollers and the difference between microprocessor and microcontroller.
Week 2	The RISC and CISC architectures.
Week 3	The Internal Architecture of the PIC microcontrollers
Week 4	The memory organisation of microcontrollers.
Week 5	The Data memory of PIC Microcontrollers.
Week 6	The program memory of PIC Microcontrollers.
Week 7	**Mid-term Exam** + The PIC microcontroller assembly statement and instruction set.
Week 8	The PIC microcontroller Bit oriented instructions.
Week 9	The PIC microcontroller Byte oriented instructions.
Week 10	The PIC microcontroller arithmetic and Logic instructions.
Week 11	The PIC microcontroller control instructions.
Week 12	The PIC microcontroller shift and rotate instructions.
Week 13	The PIC microcontroller loop instructions.
Week 15	Student Project Discussion
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	**Introduction to the Development Environment and Basic I/O**
Week 2	**Exploring the PIC16F84A Architecture and Memory Organization**
Week 3	**Assembly Programming and Control Structures**
Week 4	**Use of Timers and Interrupts**
Week 5	**Serial Communication**
Week 6	**Analog-to-Digital Conversion**
Week 7	**Mini Project**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1. Martin P. Bates,"Introduction to Microelectronic Systems: The PIC 16F84 Microcontroller",Butter worth-Heinemann, 2011. 2. The Microchip Corporation Data Sheet of PIC 16F84A Microcontroller.	Yes
Recommended Texts	Martin P. Bates, "PIC Microcontrollers: An Introduction to Microelectronics, Elsevier Science & Technology, 2011.	Yes
Websites	https://www.classcentral.com/course/swayam-fluid-mechanics-and-its-applications-58461 Online Course: PIC Microcontroller: Advanced Training Course from Udemy | Class Central	

Grading Scheme				
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

Module Information					
Module Title	Numerical Methods			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 311				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	UGIII		**Semester of Delivery**	Six	
Administering Department	MTE		**College**	COE	
Module Leader	Laith Mohammed Jasim		**e-mail**	Jasiml68@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Ali Ayad Albabeli		**e-mail**	alibabily9000@gmail.com	
Peer Reviewer Name	Dr. Loay Younes Aldabbagh		**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. know why numerical methods should be learned, when they should be used, and how accurate their results are. 2. provide knowledge about numerical methods and how to apply them in solving mathematical problems that are frequently occurring in engineering sciences. 3. provide a basic understanding of the derivation, analysis, and use of these numerical methods, 4. describe, understand, and analyze the several errors and approximations in numerical methods.

	5. improve the student's skills in numerical methods with simple programming and using numerical analysis software, software package MATLAB, and other convenient numerical software such as Microsoft Excel. 6. apply gained knowledge to deal with handling large systems of equations, non-linearities, and complicated geometries that are often impossible to solve analytically.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1. understand the basics of computer arithmetic, for example, machine precision and rounding errors. 2. solve nonlinear algebraic equations and find their roots numerically by using bracketing and open methods, like False-Position and Newton's method. 3. understand the difference between the direct and indirect methods for solving systems of linear equations. Discuss the ill and well-conditioned in addition to singular systems, and how to apply the concepts of pivoting to the systems. 4. solve systems of linear equations by using the direct and indirect (iterative) methods, like Gauss elimination and Jacobi iteration method. 5. explain the difference between the regression and interpolation methods in curve fitting. 6. apply curve fitting depending on the concept of regression and interpolation for a given set of discrete data in one and two dimensions, using methods like Lagrangian and spline. 7. approximate the first and second derivatives numerically, using various finite differences such as forward, backward, and central difference approximation. 8. approximate integrals numerically using quadratures, for example, Trapezoidal and Simpson's rules. 9. Understand the difference between ordinary and partial differential equations and the difference between boundary and initial value problems, and discussion their boundary conditions. 10. solve ordinary differential equations using numerical methods such that Heun's, Runge-Kutta, and finite difference methods. 11. analyze and verify the accuracy and stability properties of the studied methods. 12. implement, in MATLAB and Microsoft Excel, numerical methods covered in the course for solving different mathematical problems.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Unit – I: Introduction - Concepts and role for the numerical method in engineering, approximations and errors, the definition of Round-off error and truncation error, absolute and relative true/approximation error. Numerical solution of Nonlinear algebraic equations - Bracketing methods (Graphical, Bisection, and False-position method). Open methods (Simple fixed-point iteration, Newton-Raphson and secant method). Introduction to MATLAB, code of Bisection and Newton-Raphson methods in MATLAB [10 hrs] UNIT- II: Numerical solution of linear algebraic equations (system) - The difference between the direct and indirect methods, singular and ill/well-conditioned system, partial and complete pivoting, convergence criteria, Jacobi iteration method, gauss-Seidel iterative method, Gauss-Seidel iterative with the relaxation factor method, Tri-diagonal system and its solution by Thomas method. code of Jacobi iteration, gauss-Seidel iterative and Thomas methods in MATLAB [10 hrs]

	UNIT- III: Curve Fitting- Classification of Curve Fitting (Regression and Interpolation), the concepts of regression, and Least Square Criterion, Linear Regression, Nonlinear Regression, popular nonlinear regression models (Exponential, Power, Growth, and Polynomial model), the linearization of the first three nonlinear models, Polynomial regression. Implement all the regression models in Microsoft Excel. Interpolation - Lagrangian Method, spline method, Cubic Spline Interpolation using Cheney and Kincaid Formula. [10 hrs] UNIT – IV: Numerical Integration- Trapezoidal Rule (equal/non-equal segment width and single/double integral), Simpson's 1/3 rule (equal/non-equal segment width and single/double integral), and Simpson's 3/8 rule (equal/non-equal segment width and single/double integral). code of Trapezoidal and Simpson's 1/3 rules in MATLAB. Numerical Differentiation- Tayler series and truncation error, the approximation of the first derivative (FDA, BDA and CDA), the approximation of the second derivative (FDA, BDA and CDA). code of the approximation of the first and second derivative in MATLAB. [10 hrs] UNIT – V: Numerical Solution of Ordinary Differential Equation (ODE)- Classification of Differential Equation (Initial Value Problem "IVP" and Boundary Value Problem "BVP"), the numerical methods for solving the IVP (Euler's, Heun's, Midpoint and Fourth-Order Runge-Kutta methods). Fourth-Order Runge-Kutta method for solving the IVP, Numerical solution for the system of ODEs or second order ODE with the above methods. The numerical methods for solving the BVP- The shooting method adaptation together with the methods of IVP to solve BVP, and finite difference method. code of the Euler's and Fourth-Order Runge-Kutta methods in MATLAB. [20 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver concepts and fundamental knowledge in relation to numerical analyses and the application of their methods to purely mathematical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of numerical methods to different practical engineering problems. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze problems and discrete data, model their equations, with knowledge obtained, and present the completed tasks. 4- Computer sessions - to develop actual computer codes to solve real problems, and thus the use of computer software to implement numerical algorithms is an important part of the subject.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction - Concepts for the numerical method in engineering, approximations and errors, Numerical solution of Nonlinear algebraic equations, introduction to MATLAB.
Week 2	Bracketing methods, Bisection, and False-position method, code of Bisection in MATLAB
Week 3	Open methods, Simple fixed-point iteration, Newton-Raphson and secant method, code Newton-Raphson methods in MATLAB, Numerical solution of linear algebraic equations, the difference between the direct and indirect methods.
Week 4	singular and ill/well-conditioned system, pivoting, Jacobi iteration method.
Week 5	gauss-Seidel iterative method, Gauss-Seidel iterative with the relaxation factor method, Thomas algorithm, code of certain methods in MATLAB
Week 6	Curve Fitting- the concepts of regression, Linear Regression, Nonlinear Regression, popular nonlinear regression models, linearization.
Week 7	**Mid-term Exam** + Polynomial regression. Implement all the regression models in Microsoft Excel.
Week 8	Interpolation - Lagrangian and spline Methods.

Week 9	Numerical Integration- Trapezoidal Rule (single/double integral), Simpson's 1/3 rule (single/double integral) code of Trapezoidal and Simpson's 1/3 rules in MATLAB.
Week 10	Simpson's 3/8 rule (single/double integral), Numerical Differentiation, Tayler series and truncation error, the approximation of the first derivative
Week 11	The approximation of the second derivative (FDA, BDA and CDA). code of the approximation of the first and second derivative in MATLAB. Numerical Solution of Ordinary Differential Equation (ODE)
Week 12	Numerical Solution of Ordinary Differential Equation (ODE)- Initial Value Problem "IVP" and Boundary Value Problem "BVP", the numerical methods for solving the IVP (Euler's, Heun's, Midpoint).
Week 13	Fourth-Order Runge-Kutta method for solving the IVP, Numerical solution for the system of ODEs with the above methods, code of the Euler's and Fourth-Order Runge-Kutta methods in MATLAB.
Week 14	The numerical methods for solving the BVP- The shooting method adaptation together with the methods of IVP to solve BVP.
Week 15	Finite difference method.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers: With Software and Programming Applications, McGraw-Hill Science/Engineering/Math; 4th edition (July 16, 2001)	Yes
Recommended Texts	Steven T. Karris, Numerical Analysis Using MATLAB and Excel, Orchard Publications; 3rd edition (February 21, 2007)	No
Websites	https://www.coursera.org/learn/numerical-methods-engineers	

Grading Scheme

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

Module Information					
Module Title	Power Electronics and Drive			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 312				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	UGIII		**Semester of Delivery**	Six	
Administering Department	MTE		**College**	COE	
Module Leader	Myasar Salim Younus		**e-mail**	myasaralattar@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Mamoon Ammar Atrakchii		**e-mail**	Maamoin91@gmail.com	
Peer Reviewer Name	Dr. Firas Ahmed		**e-mail**	dr.firasaldurze@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Understand the principle of power electronics science and its relation with other electric and electronic science 2. Fundamental the power electronics switches (devices) and their rated, characteristics, and application 3. Illustrate the type of triggering circuit, snubber circuit 4. Understanding the types of power electronics circuits (power converters) and their relations each other's 5. Understand the power converters of (ac to dc) type or rectifiers, operation principles, equation, circuit schemes for different topologies, and its input and output wave form

	6. Understand the power converters of (ac to ac) type or rectifiers, operation principles, equation, circuit schemes for different topologies, and its input and output wave form 7. Understand the power converters of (dc to dc) type or rectifiers, operation principles, equation, circuit schemes for different topologies, and its input and output wave form 8. Understand the power converters of (dc to ac) type or rectifiers, operation principles, equation, circuit schemes for different topologies and its input and output wave form 9. Understand pulse width modulation techniques, application, 10. Understand switch mode power supply
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Has the ability to recognize the power switches types 2. Use his knowledge to choose a to build a power conversion circuit for different types of application 3. Has the ability to analyze the characteristic power switches 4. Use his knowledge to choose a to build a triggering circuit for power converters 5. Understanding the principle of designing an electric system containing power electronics device 6. be able to understand the types of power supply and its application and characteristics
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – power electronics principles and switches</u> Introduction to power electronics science, its applications, principles limitation, circuits types, also introduce the types of power electronics switches like (diodes, transistors, thyristors, [8 hrs] Thyristor triggering circuit, snubber circuit. [8 hrs] <u>Part B – principle of rectifiers</u> Type of ac to dc convertors, single and multi -phase, controlled, semi controlled and fully controlled rectifiers, input /output wave form, average, rms voltage and current, [10 hrs] <u>Part C – ac-ac voltage controller</u> Type of ac to ac convertors, single and multi -phase, voltage controller, mode of converter (phase and integral type mode) [8 hrs] <u>Part D –dc – ac convertors (invertors)</u> Type of dc to ac convertors, single multi—phase invertors, multi levels type invertors, resonance type invertors. [12 hrs] <u>Part E – dc – dc convertors (choppers)</u> Types of dc chopper, principle operation of chopping, buck type copper, boost type, buck-boost type [10 hrs] <u>Part F – pulse width modulation</u> Pulse width modulation (PWM) types, operation principles. [4 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to power electronics k 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of power electronics to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze fluid systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	power electronics switches types (diodes, transistors, thyristors)

Week 2	power electronics switches types (diodes, transistors, thyristors)
Week 3	Triggering circuit types
Week 4	Snubber circuit type
Week 5	Single phase uncontrolled rectifiers (half wave, full wave bridge, full wave center tapped)
Week 6	three phase uncontrolled rectifiers (half wave, full wave bridge, full wave center tapped)
Week 7	Single phase-controlled rectifiers (half wave, full wave bridge, full wave center tapped)
Week 8	three phase-controlled rectifiers (half wave, full wave bridge, full wave center tapped)
Week 9	Type of ac-to-ac convertors, single phase voltage controller
Week 10	ac to ac convertors, multi- phase voltage controller
Week 11	ac to ac convertors, mode of converter (phase and integral type mode)
Week 12	Types of dc chopper, principal operation of chopping, buck type copper,
Week 13	dc chopper, boost type, buck-boost type
Week 14	dc chopper, buck-boost type
Week 15	Pulse width modulation (PWM) types, operation principles
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to lab instrument and measurements
Week 2	Diode characteristics
Week 3	Triggering circuit for thyristor
Week 4	PWM circuit
Week 5	Introduction to MATLAB software
Week 6	MATLAB Simulink with power electronics circuit
Week 7	single phase uncontrolled rectifier (half wave)
Week 8	single phase uncontrolled rectifier (full wave) bridge type
Week 9	single phase uncontrolled rectifier (half wave) using MATLAB
Week 10	single phase uncontrolled rectifier (full wave) bridge type using MATLAB
Week 11	Three phase rectifiers half wave using MATLAB
Week 12	Dc chopper buck converter using MATLAB
Week 13	Dc chopper boost converter using MATLAB

Week 14	Ac voltage rectifiers single phase using MATLAB
Week 15	Ac voltage rectifiers three phase using MATLAB

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Power Electronics Semiconductor Devices, THIRD EDITION Robert Perret2009, John Wiley & Sons, Power Electronics. Daniel W. Hart,.2010 McGraw-Hill	no
Recommended Texts	POWER ELECTRONICS HANDBOOK, J. David Irwin, Auburn,2001Academic Press	no
Websites	https://www.coursera.org/specializations/power-electronics?action=enroll	

Grading Scheme				
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

Module Information					
Module Title	Modern Control Systems			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 401				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGIV	**Semester of Delivery**		Seven
Administering Department		MTE	**College**	COE	
Module Leader	Firas Ahmed Majeed		**e-mail**	dr.firasaldurze@uomosul.edu.iq	
Module Leader's Acad. Title		Lecture	**Module Leader's Qualification**		Ph.D.
Module Tutor	Ahmed Abdulkareem Muhammad		**e-mail**	Ahmedmechatronics93@gmail.com	
Peer Reviewer Name		Dr.Aws Hazim Saber Anaz	**e-mail**	aws.anaz@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to This course is an introductory course on linear control systems based on the state-space models. The main goal of the course is to provide students with basic tools in modeling, analysis and design for control and estimation. The analysis in this course includes stability, controllability, observability, while the design methods are divided

	into pole placement for state feedback and observer design, and optimal methods such as linear quadratic regulator. Students will also learn how to apply the theory to engineering problems with MATLAB. The course will cover both continuous-time and discrete-time systems, as well as both time invariant and time-varying systems. Simple examples from mechanical and electrical engineering will be used to show the applicability of the theory. This course will give the basic knowledge for advanced control courses, such as nonlinear control, optimal control, digital control, sampled-data control and system identification.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 1- Construct state space models of dynamic systems. 2- Explain basic control concepts such as controllability, observability, poles and zeros, stability 3- Explain concepts of full-state control systems 4- Explain concepts of optimal control systems 5- Explain concepts of digital controllers 6- Simulate state space systems in MATLAB/Simulink 7- Have had experience with designing control systems
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Introduction to State Space Modelling [4 hrs] Linearisation of Non-linear Differential Equation [8 hrs] Construction of State Space Models [4 hrs] Modelling Multiple DOF Systems [6 hrs] Conversion between SS to TF and back again: Control canonical, observer canonical form [4 hrs] Solution to state equations, poles, zeros and stability [4 hrs] Controllability and Observability [8 hrs] Feedback Control & Pole Placement [4 hrs] Observers (Estimators) [4 hrs] Optimal Control (LQR) [8 hrs] Optimal Observers (Kalman-Bucy Filters, LQG) [8 hrs] Reduced Order Observers [8 hrs] Compensators [4 hrs] Reference Input & Command Tracking [4 hrs] Digital Control: Sampling & Quantization [4 hrs]

	Digital Control Design by Emulation [4 hrs] Summary [4 hrs] Computer lab-based tutorials using MATLAB/SIMULINK and Quanser QuaRC (12 tutorials)

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to modern control systems and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of modern control systems to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze modern control systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Summative assessment	**Final Exam**	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Meaning of a state, State variables, State equations
Week 2	State space representation of systems, non uniqueness of state variables
Week 3	Eigenvalues of a system, Invariance of eigenvalues, Diagonalization of a matrix
Week 4	Solving linear time-invariant state equations
Week 5	Transfer function and Transfer matrix
Week 6	Controllability and Observability
Week 7	**Mid-term Exam**
Week 8	Control system design via pole placement
Week 9	Design of state observers
Week 10	Stability
Week 11	Liapunov stability analysis
Week 12	Optimal control
Week 13	Quadratic optimal control problem
Week 14	Intriduction of Digital Control
Week 15	Sampling & Quantization
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Study of open loop and closed loop time/ frequency responses of first/second order LTI system
Week 2	Conversion of transfer functions to state model of LTI system and vice versa
Week 3	Determine State Space Model of a given system and determine its controllability and observability.
Week 4	Analysis of Zero order hold and first order hold circuits.
Week 5	Conversion of transfer functions to state model of discrete time system.

Week 6	To determine state transition matrix of a given system.
Week 7	Study of operation of a stepper motor interface with microprocessor.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Dorf and Bishop “Modern Control Systems”	Yes
Recommended Texts	Franklin G. F., Powell J. D., Workman M., "Digital Control of Dynamic Systems"	Yes
Websites	https://www.coursera.org/learn/ engineering	

Grading Scheme				
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

Module Information					
Module Title	Industrial Automation			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 402				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGIV	**Semester of Delivery**		Seven
Administering Department		MTE	**College**	COE	
Module Leader	Dr. Ali A. Abdulla Alkurukchi		**e-mail**	ali.alkurukchi@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Teba Hani Fathi		**e-mail**	teba96mecha@gmail.com	
Peer Reviewer Name		Dr. Saad S. Ahmed	**e-mail**	kazzazs60@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aim of the "Industrial Automation" module is to provide students with a comprehensive understanding of automation systems in industrial settings. The module aims to develop students' knowledge and skills in industrial automation, including the architecture of automation systems, sensing and actuation components, control systems, and programming of programmable logic controllers (PLCs). By the end of the module, students will be well-equipped to succeed in the dynamic field of industrial automation.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of the module, students will be able to: 1. Demonstrate an understanding of the benefits of automation in industrial settings and its pivotal role in production systems. 2. Differentiate between industrial automation and information technology, and analyze the advantages of automation across various industries. 3. Comprehend the architecture of automation systems, including the functional elements and their roles. 4. Identify and analyze industrial sensors and actuators, their characteristics, and their applications in automation systems. 5. Explain the principles of industrial control systems and their integration into automation architectures. 6. Develop programming skills for programmable logic controllers (PLCs) and apply them to control industrial processes. 7. Utilize formal modeling techniques for effective sequence control design in industrial automation. 8. Apply the acquired knowledge and skills to design and implement automation systems for specific industrial applications.
Indicative Contents المحتويات الإرشادية	The module will cover the following indicative contents: 1. Introduction to Industrial Automation • Benefits of automation in industrial settings • Distinction between industrial automation and information technology • Role of automation in production systems 2. Architecture of Automation Systems • Functional elements of automation systems • Integration of sensing and actuation components 3. Industrial Sensors and Actuators • Types and characteristics of industrial sensors • Applications of industrial actuators • Selection criteria for sensors and actuators 4. Industrial Control Systems • Principles of control theory • Control strategies and feedback mechanisms • Integration of control systems in automation architectures 5. Programming of Programmable Logic Controllers (PLCs) • Introduction to PLCs and their applications • Programming languages for PLCs (e.g., ladder logic) • Troubleshooting and debugging PLC programs 6. Sequence Control Design • Formal modeling techniques for sequence control design • Tools and methods for effective sequence control 7. Application of Automation Systems • Case studies and examples of automation systems in various industries • Design and implementation of automation systems for specific industrial applications

Learning and Teaching Strategies

Strategies	1. Lectures: Traditional lectures can be used to deliver key theoretical concepts, principles, and frameworks related to industrial automation. Lectures provide a structured approach to disseminating information to students. 2. Practical Lab Sessions: Hands-on practical lab sessions are essential for students to apply their theoretical knowledge and develop practical skills in industrial automation. These sessions can involve working with programmable logic controllers (PLCs), sensors, actuators, and control systems to design and implement automation solutions. 3. Case Studies: Case studies can be used to explore real-world applications of industrial automation. Students can analyze and discuss case studies to understand the challenges, benefits, and solutions employed in different industries. This promotes critical thinking and problem-solving skills. 4. Group Projects: Group projects encourage collaborative learning and enable students to apply their knowledge to solve complex automation problems. Students can work in teams to design and implement automation systems, present their solutions, and receive feedback from peers and instructors. 5. Simulations and Virtual Labs: Using simulation software or virtual labs allows students to practice and experiment with automation systems in a safe and controlled environment. These tools can simulate real-world scenarios, enabling students to develop skills in system modeling, control programming, and troubleshooting. 6. Interactive Discussions: Interactive discussions, such as seminars or group discussions, provide opportunities for students to actively engage with the course material. They can share their perspectives, ask questions, and participate in debates to deepen their understanding of industrial automation concepts. 7. Guest Lectures and Industry Visits: Inviting guest speakers from industry or organizing visits to industrial automation facilities provide students with valuable insights into real-world applications, industry trends, and challenges. These experiences help bridge the gap between academia and industry. 8. Self-Directed Learning: Encouraging students to take responsibility for their learning through self-directed study is important. Providing resources like textbooks, academic papers, online materials, and recommending additional readings enables students to explore topics beyond the core curriculum and further develop their understanding. 9. Formative Assessments and Feedback: Regular formative assessments, such as quizzes, assignments, or presentations, allow students to evaluate their progress and receive constructive feedback. This helps identify areas for improvement and promotes active learning. 10. Independent Study and Research: Encouraging students to undertake independent study and research projects fosters critical thinking and a deeper understanding of specific topics within industrial automation.

	Students can explore emerging trends, conduct experiments, or analyze existing research to enhance their knowledge.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction, The major advantages of using automation, Automation Lab. Example,
Week 2	Industrial Automation vs. Industrial Information Technology, Role of automation in industry, Automation Advantages, Industrial Product Life Cycle,
Week 3	Economy of Scale and Economy of Scope, Production Systems Types, Types of Automation Systems
Week 4	Architecture of Industrial Automation Systems, The Functional Elements of Industrial Automation

Week 5	Sensing and Actuation Elements, Industrial Sensors and Instrument Systems. Industrial Actuator Systems,
Week 6	Industrial Control Systems, The Architecture of Elements: The Automation Pyramid
Week 7	Mid-Term Exam
Week 8	Introduction to Sequence/Logic Control and Programmable Logic Controllers, Industrial Example of Discrete Sensors and Actuators, Programmable Logic Controllers (PLC),
Week 9	Comparing Logic and Sequence Control with Analog Control, PLC Evolution , PLC >> Application Areas, PLCs Architecture, Communications processors, Expansion units, Input/output Units, Programmers
Week 10	The Software Environment and Programming of PLCs, Structure of a PLC Program, The cyclic execution of PLC Programs,
Week 11	The Relay Ladder Logic (RLL) Diagram, Example: Forward Reverse Control
Week 12	The Function Chart (IEC), The Statement List (STL), Typical Operands of PLC Programs, Internal Variable Operands or Flags,
Week 13	Timers(On delay, Off delay, Fixed pulse width timer, Retentive Timer, Non-Retentive Timer), Counter, User defined Data, Addressing, Operation Set.
Week 14	Formal Modelling of Sequence Control Specifications and Structured RLL Programming, motivation example Industrial stamping process,
Week 15	Steps in Sequence Control Design, Design of RLL Program, state transition logic, state logic, output logic,
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to Automation Lab.
Week 2	Introduction to plc logo, expansion, and its code
Week 3	Logo Soft comfort development environment 01
Week 4	Logo Soft comfort development environment 02
Week 5	Logo Soft comfort development environment 03
Week 6	Motor starter using plc logo
Week 7	**Mid-term Exam**.
Week 8	Traffic light example
Week 9	Introduction to Mitsubishi FX1n20MR, and GX work2
Week 10	Conveyer Belt
Week 11	Traffic Light
Week 12	Building scene in Factory IO
Week 13	Tank filling System: factory IO, plc logo

Week 14	Conveyer Belt: factory IO, plc logo
Week 15	Final Lab Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	M. Groover, “Automation, Production Systems, and Computer Integrated Manufacturing” 3rd edition.	No
Recommended Texts		
Websites		

Grading Scheme				
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

Module Information					
Module Title	Robotics			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☒**Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 403				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UGIV		**Semester of Delivery**	Seven	
Administering Department	MTE		**College**	COE	
Module Leader	Zead Mohammed Yosif		**e-mail**	zmyousif@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Abdullah Murtadha Alfakhrey		**e-mail**	alfakhrey.abdullah@gmail.com	
Peer Reviewer Name	Saad Zaghlul Saeed		**e-mail**	saeeds70@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Apply knowledge of mathematics, science, and solve engineering problems in robotics. 2. Understand techniques for studying motion of robots and their components. 3. Develop the ability to analyze and understand the dynamics of robots (position, velocity, acceleration, force and torque) characteristics.

	4. Understand motion control of robotic system. 5. Develop the ability to systematically design robots to perform a specified task. 6. Provide students with a broad introduction to mobile robots and autonomous systems. 7. Understand techniques for studying mobile robot navigation and path planning strategies
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Understand the transformation of position, velocity and acceleration. 2. Calculate the forewords kinematics to obtain Cartesian coordinates as a function of joint variables. 3. Obtain the joint variables from desired Cartesian coordinates using inverse kinematics. 4. Understand the velocity propagation from link to another towards the tip. 5. Obtain the joint torque or force as a function of robot's configuration. 6. Obtain the dynamic equations of any robot arm. 7. Transform high-level tasks into trajectories that the robot can follow to achieve. 8. Design a controller for trajectory tracking. 9. Understand basic mobile robot kinematics, common mobile robot types. 10. Understand the parts of mobile robot navigation systems. 11. Understand and apply path planning and navigation algorithms.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – manipulator kinematics Introduction to robotics: Types of joints used in robots Mechanisms, Descriptions (position, orientations, and frames), Link-connection description, derivation of link homogeneous transformations. [18 hrs] Kinematics: Forward kinematics, inverse kinematics of robotic manipulators, algebraic solution, geometric solution. Example of industrial robot. [12 hrs] Part B - manipulator dynamics Differential kinematic equations, Linear and rotational velocity of rigid bodies, velocity propagation from link to link. Manipulator Jacobian, singularities, force relations. [16 hrs] Dynamics: Iterative Newton-Euler dynamic formulation. Trajectory generation: Cubic polynomials, Linear segment with parabolic bade (LSPB). [14 hrs] Part C – motion control Linear Control of manipulator: Feedback and closed-loop control, second order linear systems, control-law portioning, trajectory-following control, computed torque method. [16 hrs] Part D – mobile robot Kinematics Mobile robots: Mobile Robot Mechanical Architectures, Mobility and Maneuverability, Vehicle Stability, Wheeled Vehicles, Tracked Vehicles, Legged Vehicles. Kinematics: forward and inverse kinematics. [16 hrs] Part E – mobile robot path planing

	Path planning algorithms based on A-star, Dijkstra, probabilistic roadmaps (PRM), and rapidly exploring random trees (RRT). Laboratory experiments were prepared. [20 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to robotics and the application of the theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of robotics to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze robots with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to robotics: Types of joints used in robots Mechanisms, Descriptions (position, orientations, and frames).
Week 2	Link properties: Link-connection description, Derivation of link transformations.
Week 3	Manipulator Kinematics: Example of industrial robot.
Week 4	Joint's angle: Inverse kinematics of serial robots. Example of industrial robot.
Week 5	Linear and rotational velocity of rigid bodies, velocity propagation from link to link.
Week 6	JACOBIANS: SINGULARITIES, Forces: Static force in manipulators.
Week 7	**Mid-term Exam** + Dynamics: Newton's equation, Euler's Equation, Iterative Newton-Euler dynamic formulation, an example of closed –form dynamic equations of manipulator's dynamic equations.
Week 8	Trajectory generation: Cubic polynomials, Linear segment with parabolic bade (LSPB).
Week 9	Linear Control of manipulator: Feedback and closed-loop control, second order linear systems.
Week 10	Control-law partitioning, trajectory following control, computed torque method.
Week 11	Mobile robots: Mobile Robot Mechanical Architectures, Mobility and Maneuverability, Vehicle Stability, Wheeled Vehicles, Tracked Vehicles, Legged Vehicles.
Week 12	Mobile robot kinematics: Forward and inverse kinematics
Week 13	path planning algorithms based on A-star, Dijkstra
Week 14	probabilistic roadmaps (PRM)
Week 15	rapidly exploring random trees (RRT).
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction: Safety, instructions, brief descriptions for devices and equipments.
Week 2	Servo motors in robot arms
Week 3	Construction of sequence and steps for robot arm motion
Week 4	LabVIEW and NXT MINDSTROM
Week 5	Forward and Inverse Kinematics for 2-DOF robot arm
Week 6	Construction and Control of Mobile robot using NXT-LabVIEW

Week 7	**Mid-term Exam**
Week 8	Sensing obstacle using Touch sensor
Week 9	Sensing obstacle using ultrasonic sensor
Week 10	Sensing obstacle using light sensor
Week 11	Avoiding obstacle using ultrasonic sensor
Week 12	Analyzing Mobile robot kinematics (Forward and inverse kinematics)
Week 13	Applying Mobile robot path planning techniques
Week 14	Programming Lab-Volt Robot Using RoboCIM
Week 15	Programming Lab-Volt Robot Using Teach Pendent
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Introduction to robotics mechanics and control, John J. Craig, SI. Units. Third ed., 2005	Yes
Recommended Texts	Robotics - Modelling, Planning and Control, Bruno Siciliano • Lorenzo Sciavicco • Luigi Villani • Giuseppe Oriolo , 2009. Introduction to Autonomous Mobile Robots, second edition , by Roland Siegwart, Illah Reza Nourbakhsh and Davide Scaramuzza	Yes No
Websites	Introduction to Robotics & Artificial Intelligence | Udemy http://ais.informatik.uni-freiburg.de/teaching/ss21/robotics/ Mobile Robtoics EE565 / CS5313 (lums.edu.pk)	

Grading Scheme				
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

Module Information					
Module Title	Computer Interface			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 404				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGIV	**Semester of Delivery**		Seven
Administering Department		MTE	**College**	COE	
Module Leader	Dr. Ali A. Abdulla Alkurukchi		**e-mail**	ali.alkurukchi@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
Peer Reviewer Name		Dr. Zeyad M. Yousif	**e-mail**	Zmyousif@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. To provide students with a comprehensive understanding of computer interfaces and their role in facilitating communication between humans and computers. 2. To develop practical skills in designing, implementing, and evaluating effective computer interfaces for a variety of applications.

	3. To foster critical thinking and problem-solving abilities in the context of computer interface design and user-centered interaction.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: 1. Demonstrate a deep understanding of computer interface concepts, theories, and principles. 2. Design and develop user-centered computer interfaces that meet usability and user experience standards. 3. Apply appropriate tools, technologies, and programming languages to implement computer interfaces. 4. Analyze and evaluate the performance, usability, and accessibility of computer interfaces. 5. Apply critical thinking and problem-solving skills to address challenges in computer interface design and implementation. 6. Communicate effectively and work collaboratively in multidisciplinary teams for interface development projects.
Indicative Contents المحتويات الإرشادية	1. Introduction to computer interfaces: • Definition, characteristics, and importance of computer interfaces. • Overview of human-computer interaction (HCI) principles and theories. • Historical evolution and emerging trends in computer interface design. 2. User-centered design and interface requirements: • Understanding user needs, requirements, and context of use. • User research methods, persona development, and user-centered design approaches. • Interface prototyping and iterative design techniques. 3. Interaction design and interface elements: • Design principles for effective interaction design. • Navigation and information architecture in computer interfaces. • Interface elements, including menus, buttons, forms, and visual representations. 4. Programming for interface development: • Programming languages and frameworks for interface implementation. • User interface (UI) programming concepts. • Integration of backend systems and data handling in computer interfaces.

Learning and Teaching Strategies	
Strategies	1. Lectures: The module will include interactive lectures delivered by subject matter experts to introduce students to the theoretical concepts, principles, and emerging trends in computer interfaces. Lectures will provide an overview of key topics and theories, supported by real-world examples and case studies.

	2. Practical Sessions: Practical sessions will be conducted to provide hands-on experience in designing, implementing, and evaluating computer interfaces. These sessions will involve the use of relevant software tools, programming languages, and design frameworks. Students will have the opportunity to apply theoretical knowledge in practical scenarios, solve interface design problems, and develop their technical skills. 3. Workshops and Seminars: Workshops and seminars will be organized to encourage active learning and critical thinking. These sessions will involve group discussions, brainstorming activities, and case study analysis to explore interface design principles, methodologies, and best practices. Guest speakers from industry or academia may be invited to share their expertise and insights. 4. Group Projects: Students will work on group projects that require collaborative work to design and develop computer interfaces. This will provide an opportunity to apply knowledge and skills in a practical setting, while also fostering teamwork, communication, and project management skills. Group projects may involve conducting user research, prototyping interfaces, and usability testing. 5. Individual Assignments: Individual assignments will be given to students to encourage independent thinking, research skills, and critical analysis. These assignments may involve interface design critiques, literature reviews, or the development of individual interface components. Feedback and guidance will be provided to support students' learning and improvement. 6. Practical Demonstrations: Practical demonstrations will be conducted to showcase examples of well-designed computer interfaces. These demonstrations may include interactive prototypes, live interface implementations, or case studies of successful interfaces. Students will have the opportunity to analyze and evaluate the effectiveness of these interfaces based on usability, user experience, and accessibility criteria. 7. Self-directed Learning: Students will be encouraged to engage in self-directed learning through independent study, recommended readings, and exploration of online resources. This will allow students to deepen their understanding of interface design concepts, explore emerging trends, and further develop their skills and knowledge. Online learning platforms, tutorials, and relevant research papers will be made available to support self-directed learning. 8. Assessment: Various assessment methods will be employed to evaluate students' learning outcomes, including individual and group assignments, practical projects, presentations, and examinations. The assessments will be designed to assess students' understanding of theoretical concepts, their ability to apply knowledge in practical scenarios, and their critical thinking and problem-solving skills. Feedback will be provided to students to support their learning and development.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.33
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.67
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to computer interface and Data Acquisition.
Week 2	Analog Signal Transmission, Wire and cable options, Noise and Ground, Zero and Span Cct (Inverting Summer, Instrument Amplifier)
Week 3	Signal Conditioning, Isolation Amplifier, Transformer-coupled Amplifiers, Optically Coupled Amplifiers.
Week 4	Analog to Digital and Digital to Analog Conversion: Sample and Hold circuits, Analog, multiplexers/demultiplexers.
Week 5	Analog to digital Converters, Digital to analog Converters, Examples of sensors with signal

	conditioned output.
Week 6	Microprocessor Addressing System: Memory Mapped Addressing, I/O Addressing.
Week 7	**Mid-term Exam**.
Week 8	Address decoder Design, Assembly Language for I/O
Week 9	Programmable Peripheral Interface (PPI), Advantage, Addressing
Week 10	PPI Examples
Week 11	Computer Parallel Port: Architecture
Week 12	Computer Parallel Port: programming and examples
Week 13	Computer Serial Port: Architecture
Week 14	Computer serial Port: programming and examples
Week 15	Computer Game Port: Architecture, programming, and examples
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to LabVIEW
Week 2	Digital output using data acquisition card and GUI development (LabVIEW)
Week 3	Digital input using data acquisition card and GUI development (LabVEW)
Week 4	Building temperature controller using data acquisition card PC (LabVEW)
Week 5	Building servo motor controller using data acquisition card and PC
Week 6	Building dc motor controller using data acquisition card and PC
Week 7	Building dc motor controller using data acquisition card and PC
Week 8	**Mid-term Exam**.
Week 9	Introduction to Programming PPI using MTS-86C
Week 10	Programming output / input ports using PPI and MTS-86C (1)
Week 11	Programming output / input ports using PPI and MTS-86C (2)
Week 12	Programming parallel ports(Centronic) using PC
Week 13	Esp32 and remoteXY development environment toward IOT(1)
Week 14	Esp32 and remoteXY development environment toward IOT(2)
Week 15	Esp32 and remoteXY development environment toward IOT(3)
Week16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	- PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control by Kevin James, - Industrial Control Electronics by Michael Jacob	No
Recommended Texts		
Websites		

Grading Scheme				
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

Module Information					
Module Title	Artificial Intelligence			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 405				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGIV	**Semester of Delivery**		Seven
Administering Department		MTE	**College**	COE	
Module Leader	Aws Anaz		**e-mail**	aws.anaz@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
Peer Reviewer Name		Dr. Rafid Ahmed	**e-mail**	rafidahmedkhalil@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 4. To let the students be aware of radically different Artificial Intelligence Approaches from the conventional ones, 5. To describe when/how and why we need Artificial Intelligence 6. learn how to implement different Artificial Intelligence Approaches

	7. Understand why Artificial Intelligence Approaches should be learned, when they should be used, and how accurate their results are. 8. Apply Artificial Intelligence Approaches in Mechatronics real world applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course, students should be able to: 12. Gain an overview of artificial intelligence, machine learning, and computational intelligence. 13. Understand the concepts of neural networks and different learning methods. 14. Choose artificial intelligence approaches effectively for real-life problems. 15. Implement AI applications in mechatronic engineering.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Unit – I: Introduction to Intelligence [2 hrs]. Introduction to Artificial Neural Networks, Neuron Model [8 hrs]. UNIT- II: Feedforward Neural Networks, Derivation of Error Backpropagation (EBP) Training Algorithm, Improving the Convergence Properties of EBP, Second Order Training Schemes. Radial Basis Function Neural Networks, CNN, Unsupervised Learning [30 hrs]. UNIT- III: Fuzzy Logic, Membership Functions. Standard Fuzzy Systems (SFS), Adaptive Neuro-Fuzzy Inference Systems (ANFIS) [20 hrs]. UNIT – IV: Introduction to Genetic Computing, Encoding and Decoding, Operators: Mutation, Crossover, Offspring generation, Particle Swarm Optimization, Applications of Particle Swarm Optimization [20 hrs]. UNIT – V: AI applications in Mechatronics [10 hrs].

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver concepts and fundamental knowledge in relation to Artificial Intelligence Approaches and their application. 2- Project - is deployed to illustrate the application of fundamental knowledge of Artificial Intelligence Approaches to different practical engineering problems. 3- Assignments - are arranged to provide the opportunity for students to search for information, and analyze problems. 4- Lab sessions - to develop actual computer codes to solve real problems, and thus the use of computer software to implement Artificial Intelligence Approaches.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	32	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Intelligence.
Week 2	Introduction to Artificial Neural Networks, Neuron Model.
Week 3	Feedforward Neural Networks, Derivation of Error Backpropagation (EBP) Training Algorithm.
Week 4	Improving the Convergence Properties of EBP, Second Order Training Schemes.
Week 5	Radial Basis Function Neural Networks.
Week 6	Unsupervised Learning. Deep learning.
Week 7	**Mid-term Exam** + Convolutional Neural Networks (CNN).
Week 8	Fuzzy Logic, Membership Functions.
Week 9	Standard Fuzzy Systems (SFS), Adaptive Neuro-Fuzzy Inference Systems (ANFIS).
Week 10	Intelligent Control: Fuzzy control, and Fuzzy PID controller.

Week 11	Introduction to Genetic Computing, Encoding and Decoding, Operators: Mutation, Crossover, Offspring generation.
Week 12	Particle Swarm Optimization.
Week 13	Applications of Particle Swarm Optimization.
Week 14	AI applications in Mechatronics.
Week 15	Project presentation and submission.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Single perceptron implementation
Week 2	Classification using Single perceptron
Week 3	Regression using Single perceptron
Week 4	MLP Implementation
Week 5	ANN for Classification
Week 6	ANN for regression
Week 7	CNN in image classification
Week 8	Fuzzy logic control
Week 9	Fuzzy controller
Week 10	Fuzzy PID controller
Week 11	ANFIS modeling
Week 12	ANFIS in regression
Week 13	Path planning using evolutionary algorithm
Week 14	Genetic algorithm implementation
Week 15	Mobile Robot navigation using Particle Swarm Optimization

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation" (IEEE Press Series on Computational Intelligence) 1st Edition by James Keller, Derong Liu, and David Fogel.	No

Recommended Texts	Liu, Jinkun. Intelligent control design and MATLAB simulation. Singapore: Springer, 2018.	No
Websites	https://classroom.google.com/c/NDA4Mjg2NDkyNjU5?cjc=i4awuuy	

Grading Scheme				
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

Module Information					
Module Title	Capstone Project I			**Module Delivery**	
Module Type	Core			☐ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 406				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	UGIV	**Semester of Delivery**		Seven	
Administering Department	MTE	**College**		COE	
Module Leader		**e-mail**			
Module Leader's Acad. Title		**Module Leader's Qualification**			
Module Tutor		**e-mail**			
Peer Reviewer Name		**e-mail**			
Scientific Committee Approval Date	2024-2025	**Version Number**	1.0		

Relation with other Modules			
Prerequisite module	None	**Semester**	None
Co-requisites module	MTE 412: Project II	**Semester**	Eight

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1- Practical application of the materials taken during the previous years 2- Learning to use correct calculations and analyze results 3- Prepare to invest the study information and apply it in the work site
Module Learning Outcomes	On completion of the course, students should be able to: 16. an ability to identify, evaluate and solve engineering problems utilizing the acquired principal knowledge of engineering, science, and

مخرجات التعلم للمادة الدراسية	mathematics. 17. an ability to design an integrated system and its various components and processes to produce solutions that fulfill the need of society. 18. an ability to communicate effectively using oral, written, and graphic forms with different levels of audiences. solve systems 19. an ability to acquire new engineering knowledge and skills in the mechatronics engineering fields. 20. an ability to function on multi-disciplinary teams to analyze, solve problems, and deadline commits.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Unit – I: An introduction to the project, defining the business idea, implementation stages, and proceeding with the theoretical side of the project [15 hrs] UNIT- II: Practical application of theoretical outputs [15 hrs] UNIT- III: Analyze the practical results and write the outputs and the most important recommendations [15hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aims to introduce the basic concepts and knowledge regarding forces analysis and the application of its methods to purely mathematical examples. 2- Tutorials - These are posted to illustrate the application of basic knowledge of equilibrium theory used to solve various practical engineering problems. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze problems and discrete data, model their equations, with knowledge obtained, and present the completed tasks. 4-Computer courses - to develop actual computer codes to solve real problems, therefore the use of computer programs for force analysis and component calculation is an important part of the subject.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.46

الحمل الدراسي غير المنتظم للطالب خلال الفصل			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

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

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Introduction to the project
Week 2	Introduction to the project
Week 3	Gathering the required information and working on the theoretical part of the project
Week 4	Gathering the required information and working on the theoretical part of the project
Week 5	Continue with the theoretical part of the project
Week 6	Continue with the theoretical part of the project
Week 7	**Mid-term Exam**
Week 8	The practical side of the project
Week 9	The practical side of the project
Week 10	The practical side of the project
Week 11	The practical side of the project
Week 12	The practical side of the project
Week 13	The practical side of the project
Week 14	The practical side of the project

Week 15	The practical side of the project
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Engineering Mechanics, STATICS, Bedford A. and Fowler W., PEARSON, Prentice Hall, 5th Edition, 2008. 3. Vector Mechanics for Engineers, STATICS, Beer F. P. , Johnston E. R., Mazurek D. F.,	Yes
Recommended Texts	Vector Mechanics for Engineers, STATICS, Beer F. P. , Johnston E. R., Mazurek D. F., Cornwell P. J. and Eisenberg E. R., McGraw-Hill, 9th Edition, 2010.	Yes
Websites	https://www.coursera.org/learn/ engineering mechanic	

Grading Scheme				
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

Module Information					
Module Title	Computer Aided Machine Design II			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 407				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		UGIV	**Semester of Delivery**		Eight
Administering Department		MTE	**College**	COE	
Module Leader	Ahmad Wadollah Saleh Al-Sabawi		**e-mail**	ahmadalsabawi@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		MSc
Module Tutor	Shahad Waleed Ahmed		**e-mail**	shahad.ahmed@uomosul.edu.iq	
Peer Reviewer Name		Loay B. Y.	**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**		1.0

Relation with other Modules			
Prerequisite module	MTE 309: Computer Aided Machine Design I	**Semester**	Six
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	Upon successful completion of the course, students should be able to: 10. Model basic and complex parts and components. 11. Describe the fundamental components and limitations of a modern computer numerical control (CNC) machine tool. 12. Select suitable cutting tools and process parameters for a given milling or turning operation. 13. Write, read and troubleshoot NC programs written in standard G-code format.

	14. Formulate free-form curves and surfaces mathematically using a parametric expression. 15. Describe the basic principles of Hermite curve, Bezier curve, B-spline curve and NURBS curve representations 16. Use computer-aided manufacturing (CAM) software to generate both roughing and finishing operations. 17. Describe the relative advantages and disadvantages between two and half axis, three-axis and five axis machining. 18. Work and operate typical CNC machines.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the completion of course, the student will be able to 1. Apply/develop solutions or to do research in the areas of computer aided manufacturing. 2. Deal with simple or complex part geometries. 3. Write gcode for relatively simple shapes and parts. 4. Edit and develop gcode texts that is generated by CAM software and do in – site modification on a text file format. 5. Exposed to the available basic CNC machines. 6. Choose the suitable strategy for machining, either manual or programmed. 7. Design and manufacture CNC machines from scratch. 8. Get a fundamental knowledge of the software used for CNC simulation and gcode exporting tools.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Section 1 introduction to CAM and NC programming</u> Classification of CAM systems, NC programming, gcode, rapid movement command, G0, feedrate movement command, G1, circular interpolation commands, clockwise command G2, counter clockwise command, G3, pause command, dwell command, G4, XY plane designation, G17, YZ plane designation, G18, ZX plane designation, G19, English units of inputs, G20, metric units of inputs, G21, machine zero return positon check, G27, machine zero return – primary reference point, G28, skip function, G31, threading function, G33, exact stop, G61, Absolute input of motion values, G90, incremental input of motion values, G91, feedrate per minute in/min or mm/min, G94, feedrate per revolution – in/rev or mm/rev, G95, retract motion to the initial level in a fixed cycle, G98, retract motion to the initial level in a fixed cycle, G99 [25 hrs] <u>Section 2 Canned Cycles</u> High speed deep hole drilling cycle, G73, left hand tapping cycle, G74, precision boring cycle, G76, fixed cycle cancel, G80, plain drilling cycle, G81, spot drilling cycle, G82, deep hole drilling cycle (peck drilling), G83, right hand tapping cycle, G84, boring cycle, G85. [15 hrs] <u>Section 3 CNC Milling Operations and Computer Aided Design</u> 2.5 milling, facing, slotting, gear machining, 2d pocket machining, profile machining, boring, drilling, 2d contour, 2d adaptive clearing. [25]

Learning and Teaching Strategies	
Strategies	

	Tools and strategies, in addition to the student – teacher interaction in – and – off class, used to deliver the course to the students are basically divided upon the following: 9. Lectures 10. Lab works. 11. Assignments. 12. Mini projects

Student Workload (SWL)

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

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to CAM
Week 2	Fundamental principles of NC programming
Week 3	Positional data
Week 4	Cutting commands I

Week 5	Cutting commands II
Week 6	Canned Cycles, part I
Week 7	Midterm Exam + Canned Cycles, part II
Week 8	Milling cycles, Part I
Week 9	Cutting conditions
Week 10	Tool offsets
Week 11	Milling cycles Part II
Week 12	Basic turning cycles, part I
Week 13	Basic turning cycles, part II
Week 14	Computer aided design, a model drawing section
Week 15	Computer aided design, a model machining section using CAM software
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Part or component modeling, section I
Week 2	Part or component modeling, section 2
Week 3	Part or component modeling, section 3
Week 4	Part or component modeling, section 4
Week 5	Part or component modeling, section 5
Week 6	Part machining, milling operation, section 1
Week 7	Part machining, milling operation, section 2
Week 8	Part machining, milling operation, section 3
Week 9	Part machining, milling operation, section 4
Week 10	Part machining, milling operation, section 5
Week 11	Part machining, turning operation, section 1
Week 12	Part machining, turning operation, section 2
Week 13	Part machining, laser cutting, section 1
Week 14	Part machining, laser cutting, section 2
Week 15	Part making, 3-d printing

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	P. Radhakrishanan, and others, CAD/CAM/CIM, 3rd Ed., New Age International Publishers, 2008	No
Recommended Texts	Peter Smid, CNC Programming Handbook, 3rd Ed., Industrial Press, Inc., 2007	No
Websites	https://ocw.mit.edu/courses/res-2-005-girls-who-build-make-your-own-wearables-workshop-spring-2015/pages/manufacturing-mechanical-design/	

Grading Scheme				
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

Module Information					
Module Title	Special Topics in Mechatronics			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 408				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	UGIV		**Semester of Delivery**	Eight	
Administering Department	MTE		**College**	COE	
Module Leader	Rafid ahmed Khalil		**e-mail**	myasaralattar@uomosul.edu.iq	
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor	Amena Fawzy		**e-mail**	enaminafawzy@gmail.com	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to 1. Understand the Fundamental of Nano technology, and Nano materials with its application 2. Present the embedded system which used to control the complicated electrical and mechanical system 3. Understanding the operation principle of the electrical vehicle and its characteristics, mode of operation, development, 4. Understand the SCADA system which used to monitoring and controlling the industrial operation

	5. Understanding the concept of Autotronics as a branch of mechatronics that deals with integration of electronics system in automobiles 6. Knowing the concept of Bio mechatronics which consist of biology – mechanics and electronics 7. Introduce the principle of reconfigurable robot. 8. Introduced the concept of renewable energy used as a sustainable resource used to reduce the carbonic emissions
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. an ability to characterized Nano technology used in modern mechatronics application 2. an ability to design monitoring and controlling system using SCADA 3. An ability to understand the design and building an electric vehicle and connect these concept with the autotropic branch as a field of mechatronics 4. an ability to understand the relation among the electrical, mechanical and vital elements as combination of new mechatronics design 5. to encourage the used to use the renewable sources 6. Understanding the principle of reconfigurable robots which used in different field like medical, industrial, agriculture etc.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Nano technology</u> Nanotechnology systems and applications typically involve the study and manipulation of materials and devices at the nanoscale level (1 to 100 nanometers). Indicative contents of this topic could include an overview of nanotechnology, nanomaterials synthesis and characterization, nanoelectronics, nanomedicine, nanosensors, nanophotonics, nanomagnetics, and their applications in various fields such as energy, electronics, healthcare, and environmental science, [6 hrs] <u>Part B –</u> Embedded systems Embedded systems design and applications involve the development and implementation of computer systems with dedicated functions within larger mechanical or electrical systems. Indicative contents of this topic may include microcontrollers, microprocessors, real-time operating systems, firmware development, system-on-chip (SoC) design, hardware/software co-design, low-power design techniques, interfacing with sensors and actuators, and applications in areas like automotive systems, consumer electronics, industrial automation, and IoT devices [6 hrs] <u>Part C –</u> Electric vehicles Electric vehicles (EVs) refer to automobiles that are powered by electric motors instead of internal combustion engines. Indicative contents of this topic may cover various aspects of EVs, such as battery technologies, electric motor design, power electronics, charging infrastructure, energy management systems, regenerative braking, range estimation, and overall system integration. It could also include discussions on the environmental impact of EVs, government policies, and emerging trends in the electric transportation industry. [6 hrs] <u>Part D –</u> SCADA

	SCADA (Supervisory Control and Data Acquisition) Systems are used to monitor and control industrial processes and infrastructure. Indicative contents of this topic may include components of SCADA systems, such as remote terminal units (RTUs), programmable logic controllers (PLCs), human-machine interfaces (HMIs), communication protocols, data acquisition, control algorithms, and cybersecurity considerations. It could also cover applications in fields like power generation, water treatment, oil and gas, manufacturing, and building automation. [6 hrs] Part E – Autotronics Autotronics Engineering combines automotive technology with electronics, encompassing the design, development, and integration of electronic systems in automobiles. Indicative contents of this topic may include engine management systems, electronic fuel injection, ignition systems, anti-lock braking systems (ABS), traction control systems (TCS), vehicle communication networks (CAN, LIN), automotive sensors, actuators, diagnostics, and electronic control units (ECUs). It covers the electrical and electronic systems that improve vehicle performance, safety, and comfort [5 hrs] Part F – Biomechatronics Biomechatronics is an interdisciplinary field that combines biology, mechanics, electronics, and computer science to develop prosthetics, exoskeletons, and robotic systems that interact with and augment human capabilities. Indicative contents of this topic may include biomechanics, sensors, signal processing, human-machine interfaces, control systems, artificial muscles, neural interfaces, rehabilitation engineering, and applications in fields such as healthcare, assistive technologies, and human augmentation. [5 hrs] Part g – Reconfigurable robots Reconfigurable robots are robotic systems designed to adapt and reconfigure their physical structure or control strategies to perform various tasks or respond to changing environments. Indicative contents of this topic may include modular robotics, self-reconfiguration mechanisms, kinematics, dynamics, control algorithms, sensing and perception, planning and coordination, and applications in areas like search and rescue, space exploration, manufacturing, and swarm robotics. [5 hrs] Part g – Renewable energy Renewable energy refers to energy generated from natural resources that are continually replenished, such as solar power, wind power, hydropower, geothermal energy, and biomass. Indicative contents of this topic may include various types of renewable energy technologies, their principles of operation, power generation, energy storage systems, grid integration, environmental impact assessment, policy and regulatory frameworks, and the economic viability of renewable energy sources as alternatives to fossil fuel [5 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to mechatronics branch, renewable energy 2- Tutorial sessions - are deployed to illustrate the application of fundamental knowledge of mechatronics branch, renewable energy to different practical exercises. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze fluid systems with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered

Week 1	**Nanotechnology systems and applications**
Week 2	
Week 3	**Embedded systems design and applications**
Week 4	
Week 5	**Electric vehicle**
Week 6	
Week 7	**SCADA Systems**
Week 8	
Week 9	**Autotronics Engineering**
Week 10	
Week 11	**bio mechatronics**
Week 12	
Week 13	**reconfigurable robot**
Week 14	
Week 15	**Renewable energy**
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	W. Bolton,"Mechatronics", 6th Edition,Pearson Education Limited, 2016.	no

Recommended Texts		no
Websites	Well known Scientific Website about the Topics	

Grading Scheme				
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

Module Information					
Module Title	Engineering Management			**Module Delivery**	
Module Type	Basic			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 409				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	UGIII		**Semester of Delivery**	Eight	
Administering Department	MTE		**College**	COE	
Module Leader	Mohammed Falah Mohammed Kanna		**e-mail**	mohammed.falah_kanna@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**		
Peer Reviewer Name	Dr. Loay Aldabbagh		**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to: 1. To introduce students to the fundamental concepts and objectives of Engineering Management. 2. Introduce students to various technical and economic studies relevant to project feasibility, including production costs, plant performance appraisal, and productivity analysis. 3. Familiarize students with the principles and practices of administrative and production organization in industrial enterprises.

	4. Develop students' knowledge and skills in using operations research techniques to optimize production processes. 5. Enable students to analyze and optimize resource allocation in engineering management scenarios. 6. Cultivate an understanding of quality control principles and their application in engineering management.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 1. Demonstrate a clear understanding of the concepts and objectives of engineering management. 2. Apply technical and economic analysis methods to evaluate project feasibility and make informed decisions. 3. Analyze and evaluate production costs, plant performance, and productivity measures. 4. Understand the principles of administrative and production organization and their application in industrial enterprises. 5. Apply operations research techniques, including linear programming, to optimize production processes. 6. Develop skills in solving transportation and allocation problems to obtain optimal solutions and effectively manage resources. 7. Evaluate quality control principles and techniques and their application in ensuring product and process quality. 8. Apply time measurement studies and network planning techniques for project implementation, allocate resources effectively, and manage industrial costs. 9. Apply quality control principles and ensure reliability in an industrial context.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **UNIT – I:** Introduction - An introduction to the concept of industrial engineering as a branch of engineering management and its objectives, what is the key applications of operations research in the industrial field, encompassing methods, theories, analyses, and models. [2 hrs.] **UNIT- II:** It includes the study of production costs (variable and fixed), the use of the project profitability ratio, the size and value of the break-even point, the safety limit ratio, and the project amortization (payback) period for the invested capital period. Break-even point analysis, the relationship between cost and profit, the volume of production, types of productivity, methods of measuring it (conversion factor method and monetary method), and ways to increase it will also be discussed. Then the benefits of studying the work and its main steps are discussed, as well as measuring the content of the work and determining the standard time. [2 hrs.] **UNIT- III:** It includes the study of organizations types, parallel management levels, technological organization and its types, and the production cycle. [2 hrs.] **UNIT – IV:** In this unit, operations research will be covered, and the basic requirements of linear programming and its formulas (general, canonical, and standard), how to convert between them, how to formulate the model mathematically and solve the linear programming model using the graphical, simplified, M-technique, and the Two- Phase technique methods. Added to that, addressing either profit maximization, revenue

	maximization, cost minimization, or time reduction will be discussed. The module will provide insights into how to find the optimal solution for these specific cases. [6 hrs.] **Mid-term Exam. [2 hrs.]** **UNIT – V:** This unit focuses on transportation and allocation models, specifically addressing the cost-effective transportation problem. This problem will be presented as a specific instance of linear programming models, and the module will explore four methods to obtain the initial solution: the Northwest Corner method, the Least Cost method, the RAM (Russel's Approximation Method), and the VAM (Vogel's Approximation Method). Once the initial solution is obtained, it will be assessed and enhanced using either the Multipliers method or the Stepping Stone method to attain the optimal solution. The problem will be defined as a special case of linear programming models, addressing either profit maximization, revenue maximization, cost minimization, or time reduction. The module will provide insights into how to find the optimal solution for these specific cases. [8 hrs.] **UNIT – VI:** The unit will cover the definition of network planning diagrams and how to draw them, as well as the identification of critical paths (CP) and critical time. Additionally, the module will explore the methodology of Program Evaluation and Review Technique (PERT) for assessing and reviewing programs. Techniques for accelerating and delaying network plans, with the objective of achieving the minimum possible time and cost for project implementation, will also be discussed. [4 hrs.] **UNIT – VII:** In this unit, students will learn about the concept of sequencing models, which involves scheduling tasks on a single machine. The module will cover the identification of the shortest processing time (SPT) and the longest processing time (LPT) for optimal scheduling. Additionally, you will explore the Processing of n jobs through two machines, three machines, and the completion of tasks on multiple machines. The objective is to understand different sequencing strategies based on the number of machines involved and the completion of a specific number of tasks. [2 hrs.] **UNIT – X:** In this unit, students will learn about the concept of quality control, which involves ensuring that products or processes meet predefined quality standards. The comprehensive inspection method and sampling techniques will be discussed. Quality control charts will be introduced for monitoring the central tendency and variability of a process, including control charts for the mean and range. Control charts for standard deviation and the proportion of nonconforming units will also be explored. The module will also delve into the concept of quality levels and various sampling methods, such as single, double, and multiple sampling, used for inspection purposes. [2 hrs.]

Learning and Teaching Strategies	
Strategies	The Learning and Teaching Strategies for this module may include: 1. Lectures: The module will involve traditional lectures delivered by the instructor to present key concepts, theories, and principles related to engineering

	management. This format allows for the dissemination of essential information and theoretical foundations. 2. Case Studies: Case studies can be used to provide real-world examples and practical applications of the concepts covered in the module. Analyzing and discussing case studies helps students understand how engineering management principles are applied in various scenarios and industries. 3. Group Discussions: Group discussions can be conducted to encourage active participation and engagement among students. This strategy fosters collaborative learning, allows for the exchange of ideas and perspectives, and promotes critical thinking and problem-solving skills. 4. Assessments: Various forms of assessments, such as assignments, quizzes, and examinations can be used to evaluate students' understanding and application of the module content. These assessments provide feedback to both students and instructors, facilitating the monitoring of progress and the identification of areas for improvement.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	42	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction - Concepts and objectives of Engineering Management.
Week 2	Technical and economic studies for project feasibility, production costs, plant performance appraisal (productivity, and work study).
Week 3	Administrative and production organization of industrial enterprises.
Week 4	Using operation research in production: Linear programming formulas, and Formulation of the model.
Week 5	Using operation research in production: Solve the linear programming model (Graphical method, and Simplex method).
Week 6	Using operation research in production: Solve the linear programming model (M-technique, and the Two- Phase technique methods).
Week 7	Mid-term Exam
Week 8	Allocation of resources: Transportation Model, the least cost transportation problem, methods for finding an acceptable initial basic solution (Northwest corner method, and the least cost method).
Week 9	Allocation of resources: Methods for finding an acceptable initial basic solution (Vogel's Approximation Method (V.A.M.), and Russel's Approximation Method (R.A.M.).
Week 10	Quality Control and production inspection method: Optimal Solution (Stepping Stone method, and Multipliers method).
Week 11	Industrial costs and controllable cost techniques: Assignment model (minimized, and maximized).
Week 12	Time measurement studies for production operations: Network planning (Critical Path, and program Evaluation and Review Technique (PERT)).
Week 13	Time measurement studies for production operations: Network planning (time studies for production operations (finding the lowest possible time and cost for project implementation (3-6)).
Week 14	Method time studies for production operations: Processing n jobs through 1 to m machines.
Week 15	Quality Control and Reliability
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	3. د. عادل عبد المالك " الهندسة الصناعية "– دار الكتب للطباعة والنشر - جامعة البصرة - الطبعة الأولى 2000	

	4. د. خليل العاني ، د. إسماعيل إبراهيم القزاز ، د. عادل عبد المالك آوريال " إدارة الجودة الشاملة ومتطلبات الأيزو 2000:9001 " الطبعة الأولى 2001 ، مطبعة الأشقر- بغداد. 5. Hamdy A. Taha " Operations Research: an introduction" 6th edition (1997), Prentice-Hall. 6. Prem Kumar Gupta and D.S. Hira " Operations Research: an introduction" 2nd edition (1989) S. Chand & Company LTD, NewDelhi. Charles E. Ebeling "An Introduction to Reliability and Maintainability Engineering " (1997) , McGraw-Hill.	
Recommended Texts	1. د. مازن بكر عادل وأخرون " بحوث العمليات للإدارة الهندسية " جامعة الموصل 1986 2. Phillips,D.T.;Ravindran,A.;Solberg ,J." Operations Research : Principles and Practice " (1976) John Wiley	
Websites	https://www.classcentral.com/course/swayam-fluid-mechanics-and-its-applications-58461	

Grading Scheme				
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

Module Information					
Module Title	Design of Mechatronics Systems			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 410				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	UGIV		**Semester of Delivery**	Eight	
Administering Department	MTE		**College**	COE	
Module Leader	Saad Ahmed Saleh Al Kazzaz		**e-mail**	kazzazs60@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**		
Peer Reviewer Name	Sayf A. Majed		**e-mail**	sayf@uomosul.edu.iq	
Scientific Committee Approval Date	2024-2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	The aims of the module are to develop the knowledge and skills necessary to adopt an interdisciplinary approach to mechatronic system design. Topics covered include the concepts of mechatronic systems, their primary components, and how they are designed in a systematic manner.
Module Learning Outcomes	**On completion of the course, students should be able to:** 1. design part of a mechatronic system 2. get and maintain the big picture in a multidisciplinary development project

مخرجات التعلم للمادة الدراسية	3. use systems engineering methods, tools and thinking in a multidisciplinary development project 4. implement a mechatronic design problem in a structured manner 5. integrate knowledge from previous modules 6. communicate with mechatronic specialists 7. frame and evaluate a visibility on application of systems engineering
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Unit – I: Introduction to mechatronics systems, components and their applications in different subject such as consumer electronics, home appliance, automobiles, aero lance and …. etc. Modeling of systems components; mechanical, electricals, electromechanical, sensors…. etc are implemented using different modelling methods. Block Diagram Modeling can be implemented by Direct Method, Analogy Approach and Modified Analogy Approach. [10 hrs] UNIT- II: Modeling Mechanical Translational Systems- Mechanical Rotational System are presented with examples. The Models of Electrical-Mechanical Coupling are introduced using analogy approach and final block diagram model achieved. The fluid system components as apart of mechatronics systems are also modeled and examples give the students the required skills to deal with such system. [10 hrs] UNIT- III: Sensors and transducer Sensitivity Analysis and Influence of Component variation are discussed to obtain system uncertainty. Empirical data-based modelling; Linear time invariant models; Model structure selection; Model parameter identification/estimation. Analysis and simulation of a range of mechanical/electrical transducers and actuators for analogue/ digital interfaces such as; pressure/heat/chemical/electromechanical/optical. [10 hrs] UNIT – IV: Electronic interface design between the digital controller and the analogue/digital mechatronic. Mathematical Modeling of a DC motor in Simulink. Modelling different types of mathematical models for an industrial dynamic process. Mechanical/Electrical analysis-based modelling; Modeling of different types of control system for different parts in industries. [10 hrs] UNIT – V: Two exit practical mechatronics systems are introduced, analyze and studies. Modeling, simulation, prototyping, on-line modeling is performed going to system implementation. [20 hrs]
Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver concepts and fundamental knowledge in relation to mechatronics system components and design concepts. 2- Laboratory - to perform practical implementation under guidance of lab instructor. The students perform the experiments in groups in MATLAB. 3- Assignments - are arranged to provide the opportunity for students to search for information, analyze problems, model their equations, with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus	
	Material Covered
Week 1	Introduction to mechatronics systems, Applications in Mechatronics
Week 2	Block Diagram Modeling -Direct Method- Analogy Approach- Modified Analogy Approach
Week 3	Modeling Electrical Systems.
Week 4	Modeling Mechanical Translational Systems- Mechanical Rotational System.
Week 5	Electrical-Mechanical Coupling.
Week 6	Modeling of fluid systems.
Week 7	**Mid-term Exam**
Week 8	Sensors and transducer Sensitivity Analysis—Influence of Component Variation.
Week 9	Empirical data-based modelling; Linear time invariant models; Model structure selection; Model parameter identification/estimation.

Week 10	Analysis and simulation of a range of mechanical/electrical transducers and actuators for analogue/ digital interfaces such as; pressure/heat/chemical/electromechanical/optical.
Week 11	Electronic interface design between the digital controller and the analogue/digital mechatronic.
Week 12	Modelling different types of mathematical models for an industrial dynamic process; Mechanical/Electrical analysis-based modelling;
Week 13	Modeling of different types of controllers.
Week 14	Case study I
Week 15	Case Study II
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to MATLAB Simulink.
Week 2	Self-Learning Assignment -MATLAB & Simulink on-ramp
Week 3	Mathematical Modeling of a series RLC circuit and Simulation in Simulink
Week 4	Mathematical Modeling of a Mass-Spring-Damper system in Simulink
Week 5	Virtual Reality World Models of Dynamic Systems
Week 6	Free lab for students' practices and report discussion
Week 7	Mid-term Exam
Week 8	Mathematical Modeling of a DC motor in Simulink
Week 9	Physical Modeling of a DC motor in Simulink Using Simscape
Week 10	Modeling of a Mechanism Using Simscape Multibody
Week 11	Modeling and Analyzing of a Simple Pendulum Using Simscape Multibody
Week 12	Import CAD Model into Simscape Multibody
Week 13	Gathering sensor data using data acquisition card in different modes
Week 14	Free lab for students practice and report discussion
Week 15	Final paratactical Exam

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

Required Texts	Mechatronics System Design, Second Edition, SI by Devdas Shetty and Richard A. Kolk	Yes
Recommended Texts	1- Introduction to Mechatronics and Measurement Systems, by David G. Alciatore and Michael B. Histand. 2- Mechatronics with Experiments, Second Edition, by Sabri Cetinkunt, 2007	No
Websites	https://www.coursera.org/learn/	

Grading Scheme				
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

Module Information					
Module Title	Computer Aided Manufacturing (CAM)			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 411				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		UGIV	**Semester of Delivery**		Eight
Administering Department		MTE	**College**	COE	
Module Leader	Ahmad Wadollah Saleh Al-Sabawi		**e-mail**	ahmadalsabawi@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		MSc
Module Tutor	Mamoon Ammar Atrakchii			Maamoin91@gmail.com	
Peer Reviewer Name		Dr. Omar Waleed	**e-mail**	omarmaaroof@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims أهداف المادة الدراسية	Upon successful completion of the course, students should be able to: 19. Model basic and complex parts and components. 20. Describe the fundamental components and limitations of a modern computer numerical control (CNC) machine tool. 21. Select suitable cutting tools and process parameters for a given milling or turning operation. 22. Write, read and troubleshoot NC programs written in standard G-code format. 23. Formulate free-form curves and surfaces mathematically using a parametric expression.

	24. Describe the basic principles of Hermite curve, Bezier curve, B-spline curve and NURBS curve representations 25. Use computer-aided manufacturing (CAM) software to generate both roughing and finishing operations. 26. Describe the relative advantages and disadvantages between two and half axis, three-axis and five axis machining. 27. Work and operate typical CNC machines.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the completion of course, the student will be able to 9. Apply/develop solutions or to do research in the areas of computer aided manufacturing. 10. Deal with simple or complex part geometries. 11. Write gcode for relatively simple shapes and parts. 12. Edit and develop gcode texts that is generated by CAM software and do in – site modification on a text file format. 13. Exposed to the available basic CNC machines. 14. Choose the suitable strategy for machining, either manual or programmed. 15. Design and manufacture CNC machines from scratch. 16. Get a fundamental knowledge of the software used for CNC simulation and gcode exporting tools.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Section 1 introduction to CAM and NC programming</u> Classification of CAM systems, NC programming, gcode, rapid movement command, G0, 263ederate movement command, G1, circular interpolation commands, clockwise command G2, counter clockwise command, G3, pause command, dwell command, G4, XY plane designation, G17, YZ plane designation, G18, ZX plane designation, G19, English units of inputs, G20, metric units of inputs, G21, machine zero return positon check, G27, machine zero return – primary reference point, G28, skip function, G31, threading function, G33, exact stop, G61, Absolute input of motion values, G90, incremental input of motion values, G91, 263ederate per minute in/min or mm/min, G94, 263ederate per revolution – in/rev or mm/rev, G95, retract motion to the initial level in a fixed cycle, G98, retract motion to the initial level in a fixed cycle, G99, <u>Section 2 Canned Cycles</u> High speed deep hole drilling cycle, G73, left hand tapping cycle, G74, precision boring cycle, G76, fixed cycle cancel, G80, plain drilling cycle, G81, spot drilling cycle, G82, deep hole drilling cycle (peck drilling), G83, right hand tapping cycle, G84, boring cycle, G85, <u>Section 3 CNC Milling Operations and Computer Aided Design</u> 2.5 milling, facing, slotting, gear machining, 2d pocket machining, profile machining, boring, drilling, 2d contour, 2d adaptive clearing,

Learning and Teaching Strategies	
Strategies	

	Tools and strategies, in addition to the student – teacher interaction in – and – off class, used to deliver the course to the students are basically divided upon the following: 13. Lectures 14. Lab works. 15. Assignments. 16. Mini projects

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to CAM
Week 2	Fundamental principles of NC programming
Week 3	Positional data
Week 4	Programming motion commands

Week 5	**Mid-term Exam**
Week 6	Canned Cycles, part I
Week 7	Canned Cycles, part II
Week 8	Milling cycles, Part I
Week 9	Cutting conditions
Week 10	Tool offsets
Week 11	Milling cycles Part II
Week 12	Basic turning cycles, part I
Week 13	Basic turning cycles, part II
Week 14	Computer aided design, a model drawing section
Week 15	Computer aided design, a model machining section using CAM software
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Part or component modeling, section I
Week 2	Part or component modeling, section 2
Week 3	Part or component modeling, section 3
Week 4	Part or component modeling, section 4
Week 5	Part or component modeling, section 5
Week 6	Part machining, milling operation, section 1
Week 7	Part machining, milling operation, section 2
Week 8	Part machining, milling operation, section 3
Week 9	Part machining, milling operation, section 4
Week 10	Part machining, milling operation, section 5
Week 11	Part machining, turning operation, section 1
Week 12	Part machining, turning operation, section 2
Week 13	Part machining, laser cutting, section 1
Week 14	Part machining, laser cutting, section 2
Week 15	Part making, 3-d printing

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	P. Radhakrishanan, and others, CAD/CAM/CIM, 3rd Ed., New Age International Publishers, 2008	No
Recommended Texts	Peter Smid, CNC Programming Handbook, 3rd Ed., Industrial Press, Inc., 2007	No
Websites	https://www.classcentral.com/course/swayam-fluid-mechanics-and-its-applications-58461	

Grading Scheme				
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

Module Information					
Module Title	Capstone Project II			**Module Delivery**	
Module Type	Core			☐ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MTE 412				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		UGIV	**Semester of Delivery**		Eight
Administering Department		MTE	**College**	COE	
Module Leader			**e-mail**		
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name		Dr. Loay Aldabbagh	**e-mail**	loayaldabbagh@uomosul.edu.iq	
Scientific Committee Approval Date		2024-2025	**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	MTE 406: Project I	**Semester**	Seven
Co-requisites module	None	**Semester**	None

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The aims of the module are to 9. To understand concepts of mechatronics engineering

أهداف المادة الدراسية	10. To contribute students to complete conceptual design of a comprehensive study in up-to-date engineering's topics. 11. Covers developments in the field of engineering. 12. To analyze and solve the engineering problem 13. Write and present technical reports.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of the course students should be able to: 7. Define a problem from mechatronics engineering perspective 8. Develop solution alternatives for problems 9. Extract useful information from literature 10. Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams. 11. Complete conceptual design step of a project 12. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. 13. Write well organized thesis and reports. 14. Get skills in design and perform practical implementation of projects 15. Propose future works for further developments 16. determine the feasibility of engineering projects, establish goals, plan tasks, and formulate schedules and budgets for the attainment of objectives.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Determination of the risks and possible failures and developing precautions. As well as, Evaluation of solution methods and choosing an appropriate single method [12 hrs] Confirmation of project based on commercial marketing statement. [6 hrs] The student will learn the Initialization of simulations of analytical models And choosing a suitable simulation tool based on project conception and acquire the key skills of the simulation tool [12 hrs] Perform model-based project, Perform the practical work based on simulation results [12 hrs] Collect and analyze the experimental data and compare it with the simulated once Write the report including conclusions and future works [6 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the discussions, while at the same time refining and expanding their critical thinking skills. This will be achieved through; 1- Lectures - aim to deliver fundamental knowledge in relation to economic engineering and theories to practical examples. 2- Tutorial sessions - are deployed to illustrate the fundamental knowledge of economic engineering.

	3- Assignments - are arranged to provide the opportunity for students to search for information, analyze economic theories with knowledge obtained, and present the completed tasks.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Determination of risks and possible failures and developing precautions
Week 2	Determination of risks and possible failures and developing precautions
Week 3	Evaluation of solution methods and choosing a appropriate single method
Week 4	Evaluation of solution methods and choosing a appropriate single method
Week 5	Confirmation of project based on commercial marketing statement
Week 6	Confirmation of project based on commercial marketing statement
Week 7	Initialization of simulations of analytical models

Week 8	Choose a suitable simulation tool based on project conception
Week 9	Acquire the key skills of the simulation tool
Week 10	Perform model-based project
Week 11	Perform the practical work based on simulation results
Week 12	Perform the practical work based on simulation results
Week 13	Perform the practical work based on simulation results
Week 14	Collect and analyze the experimental data and compare it with the simulated once
Week 15	Write the report including conclusions and future works
Week 16	Present conceptual design report

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		
Recommended Texts		
Websites	https://uomosul.edu.iq/engineering/%d9%85%d8%b4%d8%a7%d8%b1%d9%8a%d8%b9-%d8%a7%d9%84%d8%aa%d8%ae%d8%b1%d8%ac-4/	

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