MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Foundations of Mathematics I**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**MS 101**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level		UGI	**Semester of Delivery**		1
Administering Department		Math	**College**	CCSM	
Module Leader	Nabeel Ezzulddin Arif		**e-mail**	nabarif@tu.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Rana Hazim Jasim		**e-mail**	rana.hazim@tu.edu.iq	
Peer Reviewer Name		Azher Abbas Mohammad	**e-mail**	drazh64@tu.edu.iq	
Scientific Committee Approval Date		2025\9\4	**Version Number**	1.2	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module	**MS 107** Foundations of Mathematics II	**Semester**	2

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	It is highly beneficial that students master previous mathematics concepts, applications, and skills, prior to learning algebra and other higher level mathematical courses such as: 1- The student's acquisition of the concept of statements, mathematical logic, and methods of dealing with them algebraically 2- Clarifying the concept of groups, relationships, applications, types and theories related to them 3- Giving the student experience in dealing with basic numbers 4 - Knowledge of the origin of natural numbers
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion, students will have the knowledge and skills to: 1- Explain the fundamental concepts from the foundations of mathematics and its role in modern mathematics and applied contexts. 2 -Demonstrate accurate and efficient use of logical and set theoretical techniques. 3- Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from the foundations of mathematics.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Part A – Mathematical Logic is the study of formal logic within mathematics. Major subareas include model theory, proof theory, set theory, and recursion theory. Research in mathematical logic commonly addresses the mathematical properties of formal systems of logic such as their expressive or deductive power. However, it can also include uses of logic to characterize correct mathematical reasoning or to establish foundations of mathematics. [12 hours] Part B- Set Algebra The algebra of sets, defines the properties and laws of sets, the set-theoretic operations of union, intersection, and complementation and the relations of set equality and set inclusion. It also provides systematic procedures for evaluating expressions, and performing calculations, involving these operations and relations.

	Any set of sets closed under the set-theoretic operations forms a Boolean algebra with the join operator being *union*, the meet operator being *intersection*, the complement operator being *set complement*, the bottom being and the top being the universe set under consideration. [16 hours] Part C- The Relations Relations and its types concepts in mathematics foundation are one of the important topics of set theory. Sets, relations and functions all three are interlinked topics. Sets denote the collection of ordered elements whereas relations and functions define the operations performed on sets. The relations define the connection between the two given sets. Also, there are types of relations stating the connections between the sets. Hence, here we will learn about relations and their types in detail. Study types of relations:Empty Relation, Universal Relation, Identity Relation, Inverse Relation, Reflexive Relation, Symmetric Relation, Transitive Relation, Equivalence Relation then study the classes of equivalence with examples [16 hours] Part D- Mapping Mapping in complex plane with their properties especially a geometrical properties study of all types of mapping : injective mapping, bijective mapping, surjective mapping, inverse mapping then their theories and examples. [16 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course is characterized by the fact that it needs a special approach that depends mainly on the development of engineering thinking and the mathematical approach in thinking. It also depends on prior courses ino real analysis, chaos, and some imagination. Teaching is mainly based on the home

	works that are given at the end of each week, and the student notes the interdependence between the serial topics of this course, in addition to assigning the student (or a group of students) to write one report and represent it as a seminar for the purpose of training in the use of scientific resources and the method of writing a subject in mathematics.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	107	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	2, 7,12	LO #1-3 , LO# 9 - 11
	Assignments	3	5% (5)	4, 8,11	LO # 3, 4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 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)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	**المنطق الرياضي** (Mathematical Logic) . العبارات الرياضية (Mathematical statements): الجمل المركبة (Compound statements)، النفي (Negation).
Week 2	الوصلات (Connectives): اقتران (Conjunction)، الانفصال (Disjunction)، العبارات الشرطية والثنائية الشرطية (Conditional and biconditional statements).

Week 3	التكافؤ المنطقي (Logical equivalence)، التحصيل (Tautology)، التناقض (Contradiction).
Week 4	• جبر العبارات (Algebra of statements): القوانين الذاتية (Idempotent laws)، التجميعية (Associatively)، التبادلية (Commutativity)، التوزيع (Distributivity)، المحايد (Identity)، المتممة (Complimentary)، قوانين دي مورغان (De Morgan's laws) .
Week 5	، المجموعات المتساوية (Belong)، الانتماء (Subsets)، المجموعات الجزئية (Set)الممجموعة (Equal sets) Disjoint، الانفصال (Complement)، المتممة (Intersection)، التقاطع (Union)الاتحاد (Partition)، التجزئة ()
Week 6	، مجموعة(Universal set)، المجموعة الشاملة (Empty set)المجموعة الخالية Exam and القوى (Power Set).
Week 7	**Midterm Exam +** جبر المجموعات (Algebra of sets) القانون الذاتي (Idempotent law)، القانون التبادلي (Commutative law)، القانون التجميعي (Associative law)، قانون التوزيع (Distributive law)، قانون دي مورغان (De Morgan's law). الضرب الديكارتي للمجموعات (Cartesian product of sets).
Week 8	**التطبيقات** (Mappings) مفاهيم تعاريف أساسية (Basic concepts and definitions): المجال (Domain)، المجال المقابل (Codomain)، المدى (Range)، الرسم البياني للتطبيقات (Graph of the mapping).
Week 9	، التطبيقات (Onto mappings)، التطبيقات المتباينة (1-1 mappings)التطبيقات المتقابلة 1-1 (Equality of mapping)، تساوي التطبيقات (Bijective mapping)المتقابلة 1-1 والمتباينة.
Week 10	، التطبيق (Identity mapping): التطبيق المحايد (Types of mapping)أنواع التطبيقات ، توسيع التطبيق (Restriction of mapping)، تقييد التطبيق (Constant mapping)الثابت (Absolute value function)، تطبيق القيمة المطلقة (Extension of mapping)
Week 11	(Composition mapping and inverse mapping)تركيب ومعكوس التطبيقات

Week 12	Exam, (Direct images and inverse images under رسم التطبيقات ومعكوساتها mapping).
Week 13	**عدد العناصر في المجموعات والحساب**(Cardinality, Cardinal Numbers, Arithmetic on Cardinal Numbers)
Week 14	المجموعات المنتهية وغير المنتهية(Finite and infinite sets
Week 15	المجموعات القابلة للعد والغير قابلة للعد (Countable and uncountable sets).
Week 16	**Final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر:لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. **Introduction to the foundations of mathematics, Wildel R. ,2nd 1965,New York** 2. **أسس الرياضيات*,هادي جابر مصطفى وآخرون جامعة البصرة، العراق 1983 الجزئين الأول والثاني**	Yes
Recommended Texts	**مقدمة في أسس الرياضيات* عادل غسان نعوم و باسل عطا الهاشمي,1 جامعة بغداد – العراق (2000)**	yes

Websites	https://www.math.tamu.edu/~florent/teaching/lecture_notes/220lecture_notes.pdf

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

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

Calculus I

تفاضل وتكامل 1

Module Information معلومات المادة الدراسية					
Module Title	**Calculus I**			**Module Delivery**	
Module Type	C			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	MS 102				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	UGI		**Semester of Delivery**	1	
Administering Department	Math		**College**	CCSM	
Module Leader	Zeyad Mohammed Abdullah		**e-mail**	Zeyaemoh1978@tu.edu.iq	
Module Leader's Acad. Title	Asst.prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Hanan nazar sabbar		**e-mail**	Hanan.sabbar@tu.edu.iq	
Peer Reviewer Name	Akram Salim Mohammed		**e-mail**	akr_tel@tu.edu.iq	
Scientific Committee Approval Date	4/9/2025		**Version Number**	1.2	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	Calculus II, Advanced Calculus	**Semester**	2, 3

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The goal of studying differential calculus at university is to enable students to gain a deep understanding of this fundamental element of mathematics and its applications in different fields. By studying differential calculus, students learn how to calculate derivatives and understand the concept of a derivative as the instantaneous rate of change of a function. Students can apply the concepts of calculus to solve practical problems, analyze the behavior of functions, determine critical points, least and largest values of functions, and estimate changes of variable quantities. In addition, the study of differential calculus provides a foundation for the study of other topics in mathematics, science, and engineering, such as integration, calculus in multiple variables, and the solution of differential equations. Learning differential calculus aims to develop students' analytical thinking and mathematical reasoning capabilities and provide them with powerful mathematical tools to deal with complex technical and scientific problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Deep understanding of concepts: Students are expected to gain a deep understanding of basic concepts in differential calculus. Students should be able to understand the concept of a derivative and its meaning as the rate of change of a function, as well as the concept of inverse differential and integration of functions. 2. Numerical and Application Skills: Students should acquire strong skills in calculating and using derivatives in solving applied calculus problems. They should be able to compute the derivative of a variety of functions and apply it in analyzing the behavior of functions, identifying critical points, and estimating absolute values and variable ratios. 3. Analytical Thinking: By studying differential calculus, students are expected to develop abilities in analytical thinking and mathematical reasoning. They should be able to analyze mathematical problems and draw conclusions based on learned mathematical concepts and tools. 4. Applications in Other Fields: Students should have the ability to apply the concepts of differential calculus in other fields such as science, engineering, and economics. They learn how to represent real phenomena by functions and use differential calculus to analyze these phenomena and derive practical results. 5. Use of Technology: Students should have the ability to use appropriate technology such as mathematical calculation programs and
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: 1. Introduction to calculus: includes the definition of a derivative and the concept of a derivative as the instantaneous rate of change of a function. Students are exposed to the basic rules of calculus and related concepts. 2. The basic rules of differentiation: It includes studying the basic rules of differentiation such as the rule of differentiation rules, the rule of

	differentiation of constants, the rule of differentiation of forces, and other rules of differentiation of known functions. 3. Higher Derivatives: Students learn how to calculate higher derivatives, how to work with recursive differentiation, and how to use differential rules related to it. 4. Applications in differential calculus: Students explore the practical applications of calculus in different fields such as physics, engineering, and computer science. Practical examples of solving various differential problems are presented. 5. Relative and Total Differential: Students learn the concept of relative differential and total differentiation and how to calculate them. They are exposed to its applications in analyzing the behavior of functions and estimating variable changes. 6. Practical Applications of Calculus: Students are introduced to the use of differential calculus in solving problems in mathematical modeling, economic analysis, statistics, and other fields.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Student interaction: Active participation and interaction between students and the lecturer or teacher is encouraged. Small group discussions or collaborative sessions can be organized to solve various differential problems. Technology, such as online forums or distance learning tools, can be used to encourage communication and collaboration among students. 2. Practical Application and Projects: The course should include practical activities and application projects that allow students to apply differential concepts and skills in real-world contexts. For example, teams can be formed to solve multidimensional differential problems or applications in fields such as engineering and medical science. 3. Use of Technology: Calculus software and mathematical applications can be used to enhance interaction and interactive learning. Students can use graphing software or computer mathematics programs to analyze functions and graph their curves. 4. Provide examples and practical exercises: A wide range of examples and practical exercises covering various differential calculus concepts should be provided. Students can practice solving the exercises

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
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	107	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	7.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5, 10,12	LO #1-3 , LO# 9 - 11
	Assignments	3	5% (5)	2, 12,3	LO # 3, 4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 and 11
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-8
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to function, domain, range .

Week 2	Invers functions, even and odd function .
Week 3	Graph the functions
Week 4	Limits
Week 5	Continuous
Week 6	Exponential Functions , Logarithm Functions, Trigonometric functions.
Week 7	**Mid-term exam** + Trigonometric functions.
Week 8	Derivatives
Week 9	Rules of differentiation
Week 10	Applications of Derivatives.
Week 11	The mean value theorem
Week 12	The derivative and extrema
Week 13	Derivatives of Exponential Functions , Logarithm Functions
Week 14	Derivatives of Trigonometric functions.
Week 15	Derivatives of inverse functions
Week 16	**Preparatory week before the final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر: لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	

Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Courant, R., John, F., Blank, A. A., & Solomon, A. (1965). *Introduction to calculus and analysis* (Vol. 1). New York: Interscience Publishers. 2. Tall, D. (1996). Functions and calculus. *International handbook of mathematics education*, *1*, 289-325. 3. Tall, D. (1996). Functions and calculus. *International handbook of mathematics education*, *1*, 289-. 4. Marsden, J., & Weinstein, A. (1985). *Calculus I*. Springer Science & Business Media. 5. *Thomas' Calculus*, Early Transcendental, 12th ed. 6. Calculus and Analytic Geometric, Durfee. W.H ,1971 New York (3).	No
Recommended Texts	Grossman, Stanley I. *Calculus*. Academic Press, 2014.	No
Websites	https://books.google.iq/books?hl=ar&lr=&id=0aziBQAAQBAJ&oi=fnd&pg=PP1&dq=calculus+book&ots=a1k4tINdCZ&sig=tmAQQ_yHi9mTDBLcx-qi7hy9uo8&redir_esc=y#v=onepage&q=calculus%20book&f=false	

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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Topic in Mathematics**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**MS 103**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		UGI	**Semester of Delivery**		1
Administering Department		Math	**College**	CCSM	
Module Leader	Firas Adel Fawzi			Firasadil01@tu.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Dr.
Module Tutor	Omer Abdulrazzaq Abdullah		**e-mail**	omerabdulrazzaqa@tu.edu.iq	
Peer Reviewer Name		Akram Salim Mohammed	**e-mail**	akr_tel@tu.edu.iq	
Scientific Committee Approval Date		2025\9\4	**Version Number**	1.2	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1-Acquisition of the student to the concept of phrases and mathematical logic and ways to deal with them algebraically. 2- Clarifying the concept of groups, relationships, functions and the links between them and the theories related to them. 3- Giving the student experience in dealing with matrices of all kinds and performing various operations on them.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The Intended Subject Specific Learning Outcomes. On successful completion of the module students: (a) should have a reasonable understanding of the definitions and terms relating to topic in mathematics introduced in the module; (b) should have a reasonable understanding of the statements, proofs and implications of the basic theorems given in the module (sufficiently well to be able to construct simple proofs of related results); (c) should have confidence and reasonable skill in calculating with matrices and in specific vector spaces, etc. using the theorems derived during the module and with relatively little guidance ; (d) should have developed a critical appreciation of the central role of topic in Mathematics and in its applications; (e) should be able to present simple arguments and conclusions in topic in mathematics with reasonable clarity; (f) should be aware of the possibilities for using Maple to solve simple problems just beyond the range of "hand calculation". The Intended Generic Learning Outcomes. On successful completion of the Module students will have: -developed their problem-solving skills in relation to topic in mathematics . -have acquired a reasonable facility in numerical and symbolic calculation with matrices and other related constructs in topic in mathematics . -have furthered their time-management and organisational skills, as evidenced by the ability to plan and implement efficient and effective modes of working. -have furthered their study skills in an area that lies at the heart of most advanced Mathematics,

	Statistics and applications of these areas and is therefore valuable for continuing professional development.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following:. Part A – Systems of Linear Equations Introduction to Systems of Linear Equations, Gaussian Elimination, Consistent and Inconsistent Systems. [12 hours] Part B- Matrices Matrices and Matrix Operations, Square Matrices, Determinants, Inverses, More Systems of Linear Equations [16 hours] Part C- Eigenvectors Eigenvalues, Eigenvectors and Diagonalization [16 hours] Part D- introduction to Complex number ℂ Introduction to complex numbers and their properties, Recognition of complex numbers, . [16 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course is characterized by the fact that it needs a special approach that depends mainly on the development of engineering thinking and the mathematical approach in thinking. It also depends on prior courses ino real analysis, chaos, and some imagination. Teaching is mainly based on the home works that are given at the end of each week, and the student notes the interdependence between the serial topics of this course, in addition to assigning the student (or a group of students) to write one report and represent it as a seminar for the purpose of training in the use of scientific resources and the method of writing a subject in mathematics.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5, 10,12	LO #1-3 , LO# 9 - 11
	Assignments	3	5% (5)	2, 12	LO # 3, 4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 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) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Linear, coherent and inconsistent systems.
Week 2	Homogeneous equations and their solutions
Week 3	Matrices and some of their types
Week 4	Algebraic operations on matrices.
Week 5	Algebraic properties of operations on matrices
Week 6	transposed matrix
Week 7	The abbreviated classroom format class equivalence
Week 8	Matrix inverse and how to find it
Week 9	anomalous and non anomalous matrices,
Week 10	Determinants are their properties
Week 11	Use the propagation method by coefficients to find the value of the determinants
Week 12	Gramer's method for solving linear systems
Week 13	Introduction to complex numbers and their properties
Week 14	Polynomials and their properties
Week 15	The relationship of coefficients of polynomials with their roots
Week 16	**Preparatory week before the final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities

المنهاج الاسبوعي للمختبر: لا توجد فعاليات مختبرية

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

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1- Introduction to Linear Algebra with Applications, Bernard Coleman, translated by Adel Ghassan Naoum and Basil Atta Al-Hashemi, first edition 1990 University of Baghdad-Iraq	Yes
Recommended Texts	1- Mathematical Methods, Riyad Shakir Naoum and others, first edition 1985, Basra University – Iraq. 2- Matrices, Adel Zainal Al-Bayati, first edition 1978, Al-Mustansiriya University - Iraq	No
Websites		

Grading Scheme

مخطط الدرجات

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	General Physics			Module Delivery	
Module Type	E			☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	MS 104				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	UGI		Semester of Delivery	1	
Administering Department	Math		College	CCSM	
Module Leader	Abdelwahhab Mohammed Abdelwahhab		e-mail	abdulwahhab.elnajjar@tu.edu.iq	
Module Leader's Acad. Title	Asistant Lecturer		Module Leader's Qualification	Master	
Module Tutor	Samer Abdulkader Saleh		e-mail	samer.a.salih@tu.edu.iq	
Peer Reviewer Name	Omer Abdulrazzaq Abdullah		e-mail	omerabdulrazzaqa@tu.edu.iq	
Scientific Committee Approval Date	2025\9\4		Version Number	1.2	

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

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

Module Aims أهداف المادة الدراسية	1 Ability to understand the concept of **scalar and vector quantities**. 2 Ability to comprehend the concept of **force and its types**. 3 Ability to identify and explain the concept of **inertia in motion**. 4 Ability to recognize and understand **Newton's laws of motion**. 5 Ability to understand the concept of **friction and its types**.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. The student distinguishes between **scalar and vector quantities** in terms of concept, representation, and physical applications. 2. The student derives and explains **Newton's laws of motion** and applies them to physical problems and systems. 3. The student explains the **concept of force** and classifies the different types of forces, providing illustrative examples for each type. 4. The student clarifies the **concept of inertia** and its role in motion, and relates it to the state of motion of a body. 5. The student explains the **concept of circular motion** and defines **velocity and acceleration** in a simple manner 6. The student defines the **concept of friction**, distinguishes between its different types, and analyzes its effect on motion.
Indicative Contents المحتويات الإرشادية	The indicative content includes the following: **Part A – Physical Quantities** Definition of physical quantities; classification of quantities into scalar and vector quantities; geometric representation of vectors; addition and subtraction of vectors; resolution of vectors into components; applications and problem-solving related to scalar and vector quantities. **10 hours** **Part B – Newton's Laws of Motion**

	The three laws of Newton; interpretation of the laws in different physical systems; application of Newton's laws to the motion of bodies; solving numerical problems and various exercises. **16 hours** **Part C – Force and Inertia** Concept of force in physics; types of forces (contact forces and field forces); representation of forces and resultant force; concept of inertia and its relation to motion; illustrative examples and exercises. **16 hours** **Part D – Friction** Definition of the force of friction; types of friction (static friction, kinetic friction, and rolling friction); factors affecting friction; advantages and disadvantages of friction; practical applications and numerical problems. **18 hours**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course is characterized by its need for a special approach that relies primarily on developing geometric thinking and the mathematical approach to physical reasoning. Active learning is encouraged by engaging students in problem-solving activities, discussions, and hands-on exercises, which enhances conceptual understanding and retention. Physical concepts are connected to real-world applications to demonstrate their relevance and practicality, using examples from various fields to make the material more relatable. Visual aids and diagrams are employed to help students visualize physical concepts, promoting deeper

	understanding. Students are provided with ample opportunities to apply mathematical concepts through practical exercises, which helps develop their analytical and problem-solving skills. Their understanding is regularly assessed through quizzes, assignments, and in-class activities, with constructive feedback offered to help identify areas for improvement and enhance learning. Timely feedback is provided to address misconceptions and clarify doubts, with additional support available through office hours, tutoring sessions, or online resources to ensure students receive assistance when needed.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	60	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	120		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	25% (25)	5, 10,12	LO #1 , LO# 2-3 , LO# 6

	Assignments	3	5% (5)	3, 8,13	LO # 1-2, LO# 3-4
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5-6
Summative assessment	Midterm Exam	2 hr	10% (10)	9	LO # 1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
المادة المغطاة	
Non-vector numerical quantities	اسبوع 1
Non-vector numerical quantities / definitions and examples	اسبوع 2
Addition, subtraction, and multiplication of vectors / various examples of vectors	اسبوع 3
Displacement, velocity, and acceleration	اسبوع4
Motion along a straight line	اسبوع 5
Free-falling bodies – projectiles	اسبوع 6
Various questions	اسبوع 7
Force – equilibrium – Newton's first law	اسبوع 8
Resultant of parallel forces – center of gravity – Newton's second law – applications of Newton second law	اسبوع 9
Friction – linear momentum – collision – center of mass	اسبوع 10
Circular motion – centripetal force	اسبوع 11
Rotational motion with uniform angular acceleration	اسبوع1 2

Newton’s law of rotational motion	اسبوع 13
Types of motion	اسبوع 14
Definitions and examples	اسبوع 15
Preparatory week before the final exam	اسبوع 16

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر:لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	ـ الفيزياء الجامعية / الميكانيك وخواص المادة والحركة الموجية والحرارة تأليف :- د. رحيم عبد	No

	د. عبد السلام عبد الأمير عباس د. طالب ناهي الخفاجي فياض عبد اللطيف نجم	
Recommended Texts	College physics 10th edition, Raymond A. Serway, Chris Vuille, John Hughes	No
Websites		

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Arabic Language 1**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOT 001**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	UGI		**Semester of Delivery**	1	
Administering Department	Math		**College**	CCSM	
Module Leader	Bushra Adel Saleh		**e-mail**	Bushra.a.salih@st.tu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Msc.	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2025\9\4		**Version Number**	1.2	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	UOT011	**Semester**	4

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	**1-** Developing students' ability to interpret and analyze Qur'anic verses correctly by identifying the lexical meanings of words, and instilling Islamic principles through the study and explanation of the Noble Prophetic Hadiths. **2-** Strengthening students' linguistic competence. **3-** Introducing students to the heritage of Arabic literature through selected poems and highlighting their values and meanings. **4-** Providing students with comprehensive knowledge of the fundamentals of the

	Arabic language and enabling them to express themselves correctly. **5-** Clarifying the importance of Arabic grammar rules. **6-** Enhancing students' linguistic proficiency and identifying common language errors. **7-** Learning the basic grammatical rules and applying them correctly. **8-** Studying the Arabic verb in terms of soundness and weakness (regular and weak verbs). **9-** Learning punctuation marks and their use. **10-** Learning the rules of writing the hamza. **11-** "Say and do not say": common mistakes made by speakers and writers. **12-** Developing language skills: refining linguistic taste and improving students' style.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the module, students will be able to: 1. Interpret and analyze Qur'anic verses correctly through lexical understanding. 2. Recognize Islamic principles through the study of Hadith. 3. Demonstrate improved linguistic ability. 4. Identify key aspects of Arabic literary heritage. 5. Apply the fundamental rules of the Arabic language in correct expression. 6. Understand the importance of grammar. 7. Recognize and avoid common language errors. 8. Use basic grammatical rules correctly. 9. Distinguish between types of Arabic verbs (sound and weak). 10. Use punctuation marks properly. 11. Apply the rules for writing the hamza. 12. Identify common errors in spoken and written Arabic. 13. Show improved linguistic taste and stylistic performance.
Indicative Contents المحتويات الإرشادية	Each topic is allocated **2 hours**: • Interpretation and analysis of selected Qur'anic verses • Prophetic Hadith and Islamic values • Development of linguistic ability • Selections from Arabic poetry • Fundamentals of the Arabic language and correct expression • Importance of grammar • Common language errors • Basic grammatical rules and their application • Arabic verbs (sound and weak) • Punctuation rules • Rules of writing the hamza • "Say and do not say" (common mistakes) • Improving linguistic taste and style

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy adopted in delivering this module is to encourage students to actively participate in correct spoken and written Arabic, while simultaneously developing and expanding their critical thinking skills. This will be achieved through interactive classes, educational programs, and simple activities that attract students' interest.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	**50**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5 ,7,10	LO #1, #2 and #10, #11
	Assignments	3	5% (5)	2 ,8,12	LO #3, #4 and #6, #7
	Projects / Lab.				
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Surah Al-Baqarah (260–263)
Week 2	Surah Al-Hajj (1–5)
Week 3	Hadith on knowledge and noble morals
Week 4	Poem of Antarah ibn Shaddad

Week 5	Bā’iyyah of Ibn Al-Rumi (7 verses)
Week 6	Solar and lunar letters
Week 7	Exam
Week 8	Punctuation rules
Week 9	Rules of writing the hamza
Week 10	Verb conjugation (sound and weak)
Week 11	Derivatives (active and passive participles)
Week 12	Common linguistic errors
Week 13	Parts of speech and their inflectional signs
Week 14	Mubtada’ and Khabar and the particles that affect them
Week 15	Subject and agent substitute
Week 16	Final exam

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• The Holy Qur’an and its exegesis • Books of Hadith • *Jāmiʿ al-Durūs al-ʿArabiyyah* – Mustafa Al-Ghalayini	yes
Recommended Texts	*Al-Jumla al-ʿArabiyya: Taʾlīfuha wa Aqsāmuha* – Dr. Fadil Al-Samurai	yes
Websites	https://www.almrsal.com/post/923401	

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

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

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Democracy and Human rights			Module Delivery	
Module Type	B			☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	UOT004				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level	UGI		Semester of Delivery	1	
Administering Department	Computer Science		College	CCSM	
Module Leader	Saad Hussein ali		e-mail	Saad.h.ali@tu.edu.iq	
Module Leader's Acad. Title	Assistant Legturer		Module Leader's Qualification	Master	
Module Tutor			e-mail		
Ahmad Maher Salh	e-mail				
Scientific Committee Approval Date	4/9/2025		Version Number	1.2	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	• The ability to understand the basic concept of democracy. • The ability to understand the historical origins of the two concepts. • Recognizing the sources characteristics and features of democracy. • Gaining insight into democracy in Islam. • Understanding the impact of technological development.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**The teaching and learning strategy was designed to ensure that students acquire comprehensive knowledge coveing the course curriculum thereby achieving the main objective of the progrom- enabling students to grasp and understand the fundamental concepts of human rights and democracy as well as to become familiar with the sources safeguards and international conventions related to these concepts this knowledge aims to be utilized in addressing negative phenomena within society and in maintaining social stability and peace.**

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المن	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 تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	25% (25)	4 , 10	2-5, 7-9
	Assignments	3	5% (5)	3,7,10	1, 3, 5,8,9,10
	Projects	1	10% (10)	14	18
	Report				
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	40% (40)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week No.	
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	

Week 12	
Week 13	
Week 14	
Week 15	

Delivery Plan (Weekly Lab. Syllabus): المنهاج الاسبوعي للمختبر:	
Week No.	
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?

Required Texts		No
Recommended Texts		No
Websites		

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Foundations of Mathematics II**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**MS 107**				
ECTS Credits	7				
SWL (hr/sem)	**175**				
Module Level		UGI	**Semester of Delivery**		2
Administering Department		Math	**College**	CCSM	
Module Leader	Nabeel Ezzulddin Arif		**e-mail**	nabarif@tu.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Rana hazem jassem		**e-mail**	rana.hazim@tu.edu.iq	
Peer Reviewer Name		Azher Abbas Mohammad	**e-mail**	drazh64@tu.edu.iq	
Scientific Committee Approval Date		2026\1\10	**Version Number**		1.2

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**MS 101** Foundations of Mathematics I	**Semester**	1
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	It is highly beneficial that students master previous mathematics concepts, applications, and skills, prior to learning algebra and other higher level mathematical courses such as: A- That the student be acquainted with the most important basics of mathematics, such as its mathematical systems, how to build them, and the relationship between them b- The student will be familiar with the establishment of the integral numbers C- The student will be familiar with the construction of rational, real and complex number fields D- The student realizes the basis of the operations he performs on numbers, especially the integral numbers, through studying his introduction to the theory of numbers
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion, students will have the knowledge and skills to: 1- Explain the fundamental concepts from the foundations of mathematics and its role in modern mathematics and applied contexts. 2 -Demonstrate accurate and efficient use of logical and set theoretical techniques. 3- Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from the foundations of mathematics. 4- That the student be acquainted with the most important basics of mathematics, such as its mathematical systems and how to establishment of the natural numbers, integral numbers rational numbers, real numbers and complex numbers
Indicative Contents	Indicative content includes the following:

المحتويات الإرشادية	Part A – Relations **Relations and its types** concepts in mathematics foundation are one of the important topics of set theory. Sets, relations and functions all three are interlinked topics. Sets denote the collection of ordered elements whereas relations and functions define the operations performed on sets. The relations define the connection between the two given sets. Also, there are types of relations stating the connections between the sets. Hence, here we will learn about relations and their types in detail. Study equivalence relation then study the classes of equivalence and properties of equivalent classes , with examples [12 hours] Part B- Natural numbers Natural numbers appear to us as the simplest numbers. They seem to be the fundamental blocks of mathematics. But they are not. Nearly all mathematical theories are rather based on **set theory**. In these theories, all mathematical objects are sets. The way they interact is then defined by the axioms of the theory. In this context, natural numbers exist only if these axioms allow the construction of sets which perfectly match what we would expect from natural numbers. Study their theories and example [16 hours] Part C- integral numbers We have seen how we can start with an algebraic system the (informal) system of Z integers and create new "algebraic systems" Z_m whose members are actually equivalence classes. We are going to use this same idea creating a new system whose members are equivalence classes to carefully define a new, formal algebraic system Z. [16 hours] Part D- Mapping In mathematics, we often don't really care what something "is" in some fundamental sense, but what its properties are. In this way, we may view the real numbers as any complete, ordered field R which contains the rational numbers as an ordered subfield then show their theories and examples.[16

	hours)

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	This course is characterized by the fact that it needs a special approach that depends mainly on the development of engineering thinking and the mathematical approach in thinking. It also depends on prior courses ino real analysis, chaos, and some imagination. Teaching is mainly based on the home works that are given at the end of each week, and the student notes the interdependence between the serial topics of this course, in addition to assigning the student (or a group of students) to write one report and represent it as a seminar for the purpose of training in the use of scientific resources and the method of writing a subject in mathematics.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	97	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	2, 7,12	LO #1-3 , LO# 9 - 11
	Assignments	3	5% (5)	4, 8,11	LO # 3, 4, LO#8 -10
	Projects / Lab.				

	Report	1	10% (10)	12	LO # 5, 9 and 11
Summative assessment	**Midterm Exam**	2 hr	10% (10)	9	LO # 1-8
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**. العلاقات** (Relations) أنوع العلاقات (Type of relations): انعكاسية (Reflexive)، متناظرة (Symmetric)، متعدية (Transitive)، شبه-متناظرة (Anti-symmetric). علاقات التكافؤ (Equivalence relations)، صفوف التكافؤ (Equivalent classes)، خصائص صفوف التكافؤ (Properties of equivalent classes)، التجزئة (Partition)
Week 2	**. الترتيب** (Ordering) الترتيب الجزئي والترتيب التام (Partial order and total order). أصغر وأكبر عنصر (Least and greatest elements). المجموعة المقيدة (Bounded set): القيد الأعلى (Upper bound)، القيد الأدنى (Lower bound)، أقل قيد أعلى (Least upper bound)، أكبر قيد أدنى (Greatest lower bound). المجموعة الكاملة (Complete set). مجموعات مرتبة جيدًا (Well-ordered sets)
Week 3	**. مجموعة الاعداد الطبيعية** ℕ (The Set of Natural Numbers ℕ) • بديهيات بيانو (Peano's Axioms). • العمليات الجبرية على الاعداد الطبيعية (Arithmetic of the natural number): الجمع (Addition)، الطرح (Subtraction)، الضرب (Multiplication). • الخصائص (Properties): قوانين التجميع للجمع والضرب (Associative law of addition and multiplication)، القانون التبادلي للجمع والضرب (Commutative law of addition and multiplication)، قانون التوزيع (Distribution law)، قانون الحذف في الجمع والضرب (Cancelation law of addition and multiplication). • الترتيب في الاعداد الطبيعية (Ordering on ℕ)، مبدا الترتيب الحسن في الاعداد الطبيعية (Well ordering of ℕ).

Week 4	**مجموعة الاعداد الصحيحة $\mathbb{Z}$** (The Set of Integer Numbers $\mathbb{Z}$). • بناء مجموعة الأعداد الصحيحة (Construction of the set of integers). • الجمع والضرب على مجموعة الأعداد الصحيحة (The addition and multiplication on integers). • خصائص الجمع والضرب للاعداد الصحيحة (Properties): قوانين التجميع للجمع والضرب (Associative law of addition and multiplication)، القانون التبادلي للجمع والضرب (Commutative law of addition and multiplication)، قانون التوزيع (Distribution law)، قانون الحذف في الجمع والضرب (Cancelation law of addition and multiplication). • مبدا الترتيب على الاعداد الصحيحة (Ordering on $\mathbb{Z}$).
Week 5	**مجموعة الاعداد النسبية $\mathbb{Q}$** (The Set of Rational Numbers $\mathbb{Q}$) • بناء مجموعة الأعداد النسبية (Construction of the rational numbers). الجمع والضرب على مجموعة الاعداد النسبية وخواصها (Addition and multiplication on $\mathbb{Q}$ and its properties).)
Week 6	، كثافة (Ordering on) $\mathbb{Q}$ المجموعة الترتيب على مجموعة الاعداد النسبية Exam and الاعداد النسبية (Density of $\mathbb{Q}$)
Week 7	**مجموعة الاعداد الحقيقية $\mathbb{R}$** (The Set of Real Numbers $\mathbb{R}$) **+ Midterm Exam** خاصية كمال الاعداد الحقيقية (Completeness property of real numbers)
Week 8	**خصائص اضافية لمجموعة الاعداد الصحيحة** (Additional Properties of the Integer Numbers) قابلية القسمة والأعداد الأولية (Divisibility and primes).
Week 9	القاسم المشترك الاعظم والمضاعف المشترك الأصغر (Greatest common divisor and least common multiple). المبرهنة الأساسية في الحساب (The fundamental theorem of arithmetic)
Week 10	**مجموعة الاعداد العقدية $\mathbb{C}$** (The Set of Complex Numbers $\mathbb{C}$) الجمع والضرب في مجموعة الاعداد العقدية (Addition and multiplication on complex numbers).
Week 11	العملية الثنائية (Binary Operation).

Week 12	Exam and (Basic Concepts in Group Theory) **مفاهيم اساسية في نظرية الزمر**
Week 13	التعاريف الاساسية(Basic definitions) الزمر :(Groups) ، الزمر التبادلية (Commutative group)، الزمر الجزئية (Subgroup)، رتبة الزمرة (Order of group)
Week 14	(Basic Concepts in Ring Theory) **. مفاهيم اساسية في نظرية الحلقة** التعاريف الاساسية (Basic definitions): الحلقات (Rings)، الحلقة التبادلية (Commutative ring)،
Week 15	**مفاهيم اساسية في الحقل**(Basic Concepts in the field)
Week 16	**Preparatory week before the final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities

المنهاج الاسبوعي للمختبر:لا توجد فعاليات مختبرية

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

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	1. Introduction to the foundations of mathematics , Wildel R. ,2nd 1965,New York	Yes

	2. أسس الرياضيات*,هادي جابر مصطفى وآخرون الجزئين الأول والثاني 1983 جامعة البصرة، العراق	
Recommended Texts	1,مقدمة في أسس الرياضيات* عادل غسان نعوم و باسل عطا الهاشمي (2000) جامعة بغداد – العراق	yes
Websites	https://www.math.tamu.edu/~florent/teaching/lecture_notes/220lecture_notes.pdf	

Grading Scheme

مخطط الدرجات

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

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

Calculus II

تفاضل وتكامل 2

Module Information معلومات المادة الدراسية					
Module Title	**Calculus II**			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	MS108				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level		UGI	**Semester of Delivery**		2
Administering Department		Math	**College**	CCSM	
Module Leader	Zeyad Mohammed Abdullah		**e-mail**	Zeyaemoh1978@tu.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Abdelwahhab Mohammed Abdelwahhab		e-mail	abdulwahhab.elnajjar@tu.edu.iq	
Peer Reviewer Name		Ahmed Maher	**e-mail**		
Scientific Committee Approval Date		10/1/2026	**Version Number**	1.2	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**MS 102** Calculus I	**Semester**	1
Co-requisites module	**MS 201** Advanced Calculus	**Semester**	3

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Understanding the basic concepts: The study of differential and integral calculus aims to enhance students' understanding of the basic concepts in this mathematical field. Students learn about derivatives, integrals, and mathematical functions and how to interpret and use them to solve mathematical problems. 2. Developing arithmetic skills: Studying differential and integral arithmetic works to develop students' arithmetic skills. Students learn how to calculate derivatives and integrals and solve problems related to calculus. 3. Practical Applications: Studying differential and integral calculus helps in introducing students to the practical applications of this course in different fields. Students learn how to use calculus to solve problems in physics, engineering, economics, and other fields. 4. Developing mathematical thinking: Studying differential and integral calculus develops students' abilities in mathematical thinking and analysis. Students learn how to apply mathematical concepts in solving complex problems and understand the relationships between variables. 5. Prepare for academic and professional disciplines: Calculus is essential for many scientific, engineering and economic disciplines. The study of this course aims to qualify students and prepare them for related disciplines, enabling them to continue in the fields of research
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Solid and comprehensive understanding of the basic concepts of calculus. Students learn about the derivative, the rules of calculus and their related applications. 2. Mathematical analysis and critical thinking: Students develop mathematical analysis and critical thinking through studying this course. Students learn how to analyze complex mathematical problems and apply computational concepts and tools to solve them. 3. Calculus and Calculus Skills: Students gain practical calculus and calculus skills by solving a variety of mathematical problems. Students will be able to calculate derivatives and integrals and use appropriate techniques for solving. 4. Practical applications: Studying differential and integral calculus helps develop students' abilities to use these concepts in solving practical problems and real-world applications. Students learn how to use calculus in different fields such as physics, engineering, and economics.

	5. Preparation for advanced subjects: Study of differential and integral calculus provides the strong foundation needed for students to continue in relevant advanced subjects. This subject is a prerequisite for advanced mathematical and engineering courses
Indicative Contents المحتويات الإرشادية	1. The concept of unlimited integration and integration. 2. Integration rules and the basic property of integration. 3. Integration of exponential, radical, trigonometric, and logarithmic functions. 4. Integration by substitution and division by part. 5. Integration applications in calculating areas and volumes of geometric shapes and work calculation. 6. differential equations: 7. First order differential equations. 8. High order differential equations and their analytical solutions. 9. Practical applications of differential equations in various fields such as physics, engineering and economics. 10. Convergence of Calculus: 11. Central convergence, right convergence, and left convergence. 12. Parenthesis convergence, series, and final convergence. 13. Indefinite integrals: 14. Integration of functions defined by forms.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Student interaction: Active participation and interaction between students and the lecturer or teacher is encouraged. Small group discussions or collaborative sessions can be organized to solve various differential problems. Technology, such as online forums or distance learning tools, can be used to encourage communication and collaboration among students. 2. Practical Application and Projects: The course should include practical activities and application projects that allow students to apply differential concepts and skills in real-world contexts. For example, teams can be formed to solve multidimensional differential problems or applications in fields such as engineering and medical science. 3. Use of Technology: Calculus software and mathematical applications can be used to enhance interaction and interactive learning. Students can use graphing software or computer mathematics programs to analyze functions and graph their curves. 4. Provide examples and practical exercises: A wide range of examples and practical exercises covering various differential calculus concepts should be provided. Students can practice solving the exercises

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	138	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5, 10,12	LO #1-3 , LO# 9 - 11
	Assignments	2	5% (5)	2, 12	LO # 3, 4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 and 11
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-8
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Parametric Equations
Week 2	Curves defined by Parametric Equations
Week 3	Calculus with parametric curves
Week 4	Tangents and Arc length; exclude Area and Surface Area
Week 5	Polar Coordinates with applications
Week 6	Graph polar coordinates and Areas
Week 7	**Mid-term exam** and length in polar coordinates
Week 8	Sequences & series
Week 9	The Integral Test and Estimates of Sums The Comparison Tests
Week 10	Alternating Series Absolute Convergence, Ratio and Root Tests Strategy for testing series
Week 11	Power Series Representation of functions as Power Series Taylor and Maclaurin Series (no Multiplication and Division) Application of Taylor polynomials (only Approximating functions by polynomials
Week 12	Vectors , Cross Product
Week 13	Dot Product and Orthogonality
Week 14	Component and Projection
Week 15	Equations of Lines and Planes in Space
Week 16	**Preparatory week before the final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر:لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Courant, R., John, F., Blank, A. A., & Solomon, A. (1965). *Introduction to calculus and analysis* (Vol. 1). New York: Interscience Publishers. 2. Tall, D. (1996). Functions and calculus. *International handbook of mathematics education*, *1*, 289-325. 3. Tall, D. (1996). Functions and calculus. *International handbook of mathematics education*, *1*, 289-. 4. Marsden, J., & Weinstein, A. (1985). *Calculus I*. Springer Science & Business Media. 5. *Thomas' Calculus*, Early Transcendental, 12th ed. 6. Calculus and Analytic Geometric, Durfee. W.H ,1971 New York (3).	No
Recommended Texts	Grossman, Stanley I. *Calculus*. Academic Press, 2014.	No

Websites	https://books.google.iq/books?hl=ar&lr=&id=0aziBQAAQBAJ&oi=fnd&pg=PP1&dq=calculus+book&ots=a1k4tINdCZ&sig=tmAQQ_yHi9mTDBLcx-qi7hy9uo8&redir_esc=y#v=onepage&q=calculus%20book&f=false

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

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Linear Algebra**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**MS 109**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		UGI	**Semester of Delivery**		2
Administering Department		Math	**College**	CCSM	
Module Leader	Ali Shebl Ajeel		**e-mail**	ali.shebl@tu.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Akram Salim Mohammed		**e-mail**	akr_tel@tu.edu.iq	
Peer Reviewer Name	Omer Abdulrazzaq Abdullah		**e-mail**	omerabdulrazzaqa@tu.edu.iq	
Scientific Committee Approval Date		2026\1\10	**Version Number**		1.2

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To introduce students to the fundamental concepts and techniques of linear algebra. 2. To develop students' understanding of vector spaces and their properties.To provide students with the tools and skills necessary for solving systems of linear equations. 3. To enhance students' ability to manipulate and perform operations on vectors and matrices. 4. To introduce students to the concept of linear transformations and their applications. 5. To develop students' understanding of eigenvalues and eigenvectors and their role in various applications. 6. To provide students with the knowledge and skills to perform matrix computations, such as matrix factorizations. 7. To develop students' ability to apply linear algebra in real-world problems and applications, such as data analysis, computer graphics, and optimization. 8. To enhance students' mathematical reasoning, logical thinking, and problem-solving skills. 9. To prepare students for advanced courses in mathematics, physics, engineering, computer science, and other disciplines where linear algebra plays a significant role.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Demonstrate a thorough understanding of fundamental concepts and techniques in linear algebra, such as vectors, matrices, and systems of linear equations. 2. Apply appropriate methods to solve systems of linear equations, including Gaussian elimination, matrix inverses, and matrix factorizations. 3. Perform operations on vectors and matrices, including addition, scalar multiplication, matrix multiplication, and matrix transformations. 4. Identify and analyze properties of vector spaces and subspaces, and apply these concepts in solving problems. 5. Apply knowledge of linear transformations to understand and analyze their properties, including invertibility, kernel, and image. 6. Understand and apply the concepts of eigenvalues and eigenvectors, including diagonalization of matrices and solving differential equations. 7. Use appropriate matrix factorizations, such as LU decomposition and QR decomposition, to solve problems and analyze the properties of matrices. 8. Apply linear algebra techniques to practical applications, such as data analysis, image processing, optimization, and computer graphics. 9. Demonstrate proficiency in mathematical reasoning, logical thinking, and problem-solving skills within the context of linear algebra.

	10. Communicate mathematical ideas and solutions effectively, both orally and in written form, using appropriate mathematical language and notation.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Part A – Fundamental concepts and Vectors and vector Spaces Vector Spaces and Subspaces: This section introduces the fundamental concepts of vector spaces and subspaces. It covers the definition of vector spaces, their properties, and provides examples of vector spaces and subspaces. Null Spaces, Column Spaces, and Linear Transformations: This section focuses on the null space and column space of a matrix, which are important subspaces associated with linear transformations. It discusses their definitions, properties, and their relationship to the solutions of linear systems. Additionally, it explores the concept of linear transformations and their connection to vector spaces. **[12 hours]** Part B- Eigenvalues and Eigenvectors Eigenvalues and Eigenvectors: This section introduces eigenvalues and eigenvectors of matrices. It explains their definitions and properties, including their relationship to linear transformations. The Characteristic Equation and Diagonalization: This section discusses the characteristic equation of a matrix, which is used to find its eigenvalues. It explains how to compute the characteristic polynomial and solve for the eigenvalues. Additionally, it covers the concept of diagonalization, where a matrix is represented as a diagonal matrix using its eigenvectors. **[16 hours]** Part C- Orthogonality and Least Squares Orthogonality: This section introduces the concept of orthogonality in vector spaces and inner product spaces. It covers the definition of orthogonal vectors and orthogonal sets, as well as their properties. Inner Product Spaces and Orthogonal Projections: This section focuses on inner product spaces, which are vector spaces equipped with an inner product. It discusses the properties of inner products and introduces examples of inner product spaces. Additionally, it explores orthogonal projections, which are used to find the closest approximation to a vector within a subspace. **[24 hours]** Part D- Symmetric Matrices and Quadratic Forms Diagonalization of Symmetric Matrices: This section explores the diagonalization of symmetric matrices, which have special properties. It explains how to find the eigenvalues and eigenvectors of symmetric matrices and their applications in solving systems of equations. Quadratic Forms and Positive Definite Matrices: This section

	discusses quadratic forms, which are expressions involving squares of variables. It explores the properties of quadratic forms and their relationship to symmetric matrices. It also covers positive definite matrices and their significance in optimization and eigenvalue problems. **[10 hours]**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Active Learning: Students are actively engaged in the learning process through problem-solving activities, group discussions, and hands-on exercises. This approach encourages students to actively participate in exploring and understanding the fundamental concepts of linear algebra. By actively working through problems, students develop a deeper understanding of the subject matter and improve their problem-solving skills. Real-World Applications: The course connects the principles of linear algebra to real-world applications, demonstrating their relevance and practicality. Through examples from various fields such as engineering, computer science, and physics, students can see how linear algebra is applied to solve real-world problems. This helps students understand the importance of linear algebra in practical contexts and motivates their learning. Visual Representations: Visual aids, diagrams, and graphs are utilized to help students visualize abstract concepts in linear algebra. Visual representations enhance understanding and enable students to grasp the geometric interpretations of vectors, matrices, and transformations. This visual approach facilitates the comprehension of complex ideas and fosters a deeper understanding of the subject matter. Practice and Feedback: Students are provided with ample opportunities to apply their knowledge through practical exercises, problem sets, and projects. Regular formative assessments, including quizzes and assignments, allow students to receive feedback on their progress and identify areas for improvement. This iterative feedback process helps students refine their understanding and reinforces their learning.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5, 10,12	LO #1-3 , LO# 9 - 11
	Assignments	3	5% (5)	2, 7,12	LO # 3, 4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 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) المنهاج الاسبوعي النظري	
	Material Covered

Week 1	Introduction to Vectors and Vector Spaces
Week 2	Vector Addition and its Applications
Week 3	Subspaces and Linear Independence
Week 4	Bases and Dimension of Vector Spaces
Week 5	Rank of Matrices and Linear Transformations.
Week 6	Linear Transformations and Transformation Matrix
Week 7	**Mid-term exam**
Week 8	Eigenvalues and Eigenvectors and Characteristic Equation and Diagonalization
Week 9	Applications of Eigenvalues and Eigenvectors
Week 10	Symmetric Matrices and Quadratic Forms
Week 11	Complex Eigenvalues
Week 12	Orthogonality and Least Squares
Week 13	Inner Product Spaces and Orthogonal Sets
Week 14	Orthogonal Projections and the Gram-Schmidt Process
Week 15	Least Squares Problems and their Applications
Week 16	**Preparatory week before the final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر: لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	

Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Kolman, B., & Beck, R. E. (1995). *Elementary linear programming with applications*. Gulf Professional Publishing. 2. Anton, H., & Rorres, C. (2013). *Elementary linear algebra: applications version*. John Wiley & Sons.	No
Recommended Texts	Larson, R. (2016). *Elementary linear algebra*. Cengage Learning.	No
Websites	Library Genesis (libgen.is)	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
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Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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

MODULE DESCRIPTION FORM

Module Information					
Module Title	**Principles of Statistics**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 111**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level		UGI	**Semester of Delivery**		2
Administering Department		MS	**College**		CCSM
Module Leader	Hanan Nazar Sabbar		**e-mail**		Hanan.sabbar@tu.edu.iq
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		Master
Scientific Committee Approval Date		2026\1\10	**Version Number**		1.2

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	• **Graphical Representation: Histograms, Frequency Polygons, and Frequency Curves.** • **Measures of Central Tendency: Arithmetic Mean (Grouped and Ungrouped**

	data), Theorems, and the Median. • Harmonic and Geometric Mean: Definitions and Examples. • Measures of Dispersion: Mean Deviation, Variance, and Standard Deviation (Grouped and Ungrouped data). • Coefficient of Variation and Standard Score: Examples and Raw Moments about Zero. • Central Moments: Moments about the Mean, Kurtosis, and Coefficient of Variation. • Combinations and Permutations: Theoretical Rules and Examples.
Module Learning Outcomes	• Basic Concepts: Introduction to Statistics (Definitions + Examples). • Tabular Presentation: Cumulative Distributions and their types. • Graphical Representation: Histograms, Frequency Polygons, and Frequency Curves. • Measures of Central Tendency: Arithmetic Mean (Grouped and Ungrouped data) with Theorems and Examples. • Harmonic and Geometric Mean: Definitions and Examples. Measures of Dispersion: Mean Deviation, Variance, and Standard Deviation (Grouped and Ungrouped data). • Coefficient of Variation and Standard Score: Examples and Raw Moments about Zero. • Central Moments: Moments about the Mean, Kurtosis, Coefficient of Variation, and Combinations and Permutations with Examples.
Indicative Contents	• Basic Concepts: Introduction to Statistics (Definitions + Examples) [5 Hours]. • Tabular Presentation: Cumulative Distributions and their types [5 Hours]. • Graphical Representation: Histograms, Frequency Polygons, and Frequency Curves [5 Hours]. • Measures of Central Tendency and Dispersion: Arithmetic Mean (Grouped and Ungrouped data) with Theorems and Examples, Median, Harmonic Mean, and Geometric Mean. Mean Deviation, Variance, and Standard Deviation for Grouped and Ungrouped data [5 Hours]. • Advanced Measures and Probability: Coefficient of Variation, Standard Score, Raw Moments about Zero, Central Moments (Types + Examples), Kurtosis, Combinations, and Permutations [6 Hours]. • Practical Application: Understanding, interpreting, and applying statistical results in real-life scenarios [6 Hours].

Learning and Teaching Strategies

Strategies	The primary strategy adopted for delivering this unit is to encourage student participation in solving exercises, while simultaneously enhancing and expanding critical thinking skills. This will be achieved through interactive lectures and tutorials, as well as by exploring simple experiments and sampling activities tailored to the students' interests.

Student Workload (SWL)			
Structured SWL (h/sem) **Regular Student Workload During the Semester**	63	**Structured SWL (h/w)** **Regular Weekly Student Workload**	3
Unstructured SWL (h/sem) **Irregular Student Workload During the Semester**	37	**Unstructured SWL (h/w)** **Irregular Weekly Student Workload**	3
Total SWL (h/sem) **Total Student Workload During the Semester**	100		

Module Evaluation

		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5, 7, 10	LO #1, #2 and #7, #8
	Assignments	3	5% (5)	2, 8, 12	LO #3, #4 and #5, #6, #8
	Projects / Lab.				
	Report	1	10% (10)	9	LO #5, #7 and #8
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO #1 - #8
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Week 1: Introduction to the Concept of Statistics (Definitions + Examples)**
Week 2	**Week 2: Tabular Presentation of Cumulative Distributions and Their Types**
Week 3	**Week 3: Graphical Representation (Histograms, Frequency Polygons, and Frequency Curves)**
Week 4	**Week 4: Measures of Central Tendency (Arithmetic Mean for Grouped and Ungrouped Data with Theorems and Examples)**
Week 5	**Week 5: The Median.**
Week 6	**Week 6: Harmonic Mean for Grouped and Ungrouped Data with Examples.**
Week 7	**Week 7: Geometric Mean for Grouped and Ungrouped Data (Definition and Examples).**
Week 8	**Week 8: Mean Deviation for Grouped and Ungrouped Data.**
Week 9	**Week 9: Variance for Grouped and Ungrouped Data.**
Week 10	**Week 10: Coefficient of Variation and Standard Score with Examples.**
Week 11	**Week 11: Raw Moments about Zero for Grouped and Ungrouped Data (Definition and Examples).**
Week 12	**Week 12: Central Moments about the Mean for Grouped Data with Examples.**
Week 13	**Week 13: Central Moments about the Mean for Unground Data with Examples.**
Week 14	**Week 14: Kurtosis and Coefficient of Variation with Examples.**
Week 15	**Week 15: Combinations and Permutations with Examples.**
Week 16	**Final Examination**

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	**Principles of Statistics** **Author: Khashaa Al-Rawi**	Yes
Recommended Texts	Wolfram Alpha	No
Websites		

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Computer Applications I**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOT003**				
ECTS Credits	**3**				
SWL (hr/sem)	**75**				
Module Level	UGI		**Semester of Delivery**	2	
Administering Department	Math		**College**	CCSM	
Module Leader	Noor Walid Khalid		e-mail	noor.w.khalid22ms@tu.edu.iq	
Module Leader's Acad. Title	Asst. Lecturer		**Module Leader's Qualification**	Master	
Module Tutor	Ahmed Maher Salih		**e-mail**	Ahmed.m.salih@tu.edu.iq	
Peer Reviewer Name	Ahmed Maher		**e-mail**		
Scientific Committee Approval Date	2026\1\10		**Version Number**	1.2	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	**UOT031** Computer Applications II	**Semester**	4

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	This course aims to allow the students to utilize fundamental computer tasks and identify and discuss the hardware components of the computer system. In addition, teach students how to create and use word processor and create a presentation. Furthermore, gaining the ability to conduct research on the internet and surf the web. Finally, introduction to artificial intelligence.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Learning Outcomes** 1. **Demonstrate Proficiency in Fundamental Computer Tasks** Students will be able to perform essential computer operations, including file management, basic troubleshooting, and navigation of operating systems. 2. **Identify and Explain Computer Hardware Components** Students will gain the ability to recognize and describe the functions of key hardware components, such as the CPU, RAM, storage devices, and peripheral devices. 3. **Create and Use Word Processing Documents and Presentations** Students will acquire practical skills in using word processors to create professional documents and presentation software to design visually engaging and informative presentations. 4. **Conduct Effective Research and Navigate the Internet** Students will develop the ability to utilize search engines and online resources effectively for research purposes, while adhering to ethical and safe browsing practices. 5. **Understand Basic Concepts of Artificial Intelligence** Students will be introduced to fundamental concepts of artificial intelligence, including its applications, ethical considerations, and impact on various industries.
Indicative Contents المحتويات الإرشادية	**Indicative Contents** 1. **Introduction to Computers** o Overview of computer systems o Types of computers (desktops, laptops, tablets, etc.)

	○ Basic computer terminology 2. **Hardware and Software** ○ Identification and functions of hardware components (CPU, RAM, storage, input/output devices) ○ Introduction to software: system software vs. application software 3. **Word Processing and Presentations** ○ Creating, formatting, and editing documents using word processors ○ Designing professional presentations with multimedia elements 4. **Internet Basics and Research Skills** ○ Introduction to web browsers and search engines ○ Conducting research effectively ○ Evaluating online information for credibility and reliability 5. **Introduction to Artificial Intelligence** ○ Definition and history of AI ○ Real-world applications of AI (e.g., virtual assistants, robotics, machine learning) ○ Ethical considerations in AI development and usage

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	- Board

	- Computer - Presentation software - Exchanging experiences among colleagues.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	5,7, 11	#LO 1-3, #LO 3-5
	Assignments	3	5% (5)	3,7, 12	#LO 3-5, #LO 1-4
	Report	1	10% (10)	14	#LO 1-5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	11	#LO 1-3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

Week No.	Material Covered
Week 1	Introduction to Computer: concepts of hardware and software with their components: concept of computing, data, and information, connecting I/O device and peripherals to CPU.
Week 2	Computer Components: Computer Portions, Hardware Parts, I/O units, Memory types
Week 3	Computer Components (cont.): Basic CPU Components, computer ports, personal computer, personal computer (features and types)
Week 4	Operating system and Graphical user interface GUI: Operating system, basic of common operating systems. The user interface , using mouse techniques
Week 5	Operating System and Graphical User Interface GUI(Cont.): Use of Common Icons, Status Bar, Using Menu and Menu-selection, Concept of Folders and Directories, Opening and closing of different Windows; Creating Short cuts.
Week 6	Word Processing: Word Processing Basics; Basic Features of Word Processors, Opening and Closing of documents, Text creation and Manipulation; Formatting Text and Paragraphs, Using Templates for Document Creation.
Week 7	Word Processing (Cont.): Creating and Managing Tables, Utilizing Styles and Themes, Spell Check and Grammar Tools, Using Headers and Footers.
Week 8	Spread Sheet: Introduction to Spreadsheet Software, Creating and Formatting Worksheets. Sorting and Filtering Data, Using Formulas and Functions.
Week 9	Spread Sheet (Cont.): Using Formulas and Functions, Using Pivot Tables for Data Analysis, Data Validation and Error Checking, Data Visualization: Creating Charts and Graphs.
Week 10	Presentation Software: Introduction to Presentation Software, Overview of Popular Presentation Tools, creating a New Presentation, Using Templates and Themes, Inserting and Formatting Text and Images, Transition and Animation Effects.
Week 11	Presentation Software (Cont.): Using Speaker Notes and Timers,, Advanced Features: Hyperlinks and Action Buttons, Troubleshooting Common Presentation Issues, Future Trends in Presentation Technology.

Week 12	Introduction to Internet and Web Browsers (Cont.): World Wide Web; Web Browsing software's, Search Engines; Understanding URL; Domain name; IP Address.
Week 13	Introduction to Internet and Web Browsers (Cont.): World Wide Web; Web Browsing software's, Search Engines; Understanding URL; Domain name; IP Address.
Week 14	Communications and Emails: Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails; Document collaboration.
Week 15	Introduction to Cloud Computing and Services: Definition of Cloud Computing and its concept, Cloud-Based Office Suites (Office 365 and Google Workspace), Google Docs, Google Sheets, Google Drive, Google Meet.

Delivery Plan (Weekly Lab. Syllabus): المنهاج الاسبوعي للمختبر:	
Week 1	**identifying hardware components (CPU, RAM, storage, etc.)**
Week 2	**Exploring memory types: RAM vs. storage, and understanding I/O units.**
Week 3	**Identifying and classifying personal computer types and features.**
Week 4	**Practicing basic mouse and keyboard techniques.**
Week 5	**Creating shortcuts, opening/closing multiple windows, and using the status bar.**
Week 6	**formatting text, using basic templates, and paragraph alignment.**
Week 7	**Applying styles, themes, headers, and footers in documents.**
Week 8	**Creating worksheets and formatting cells.**
Week 9	**Advanced functions: IF, VLOOKUP, Pivot Tables.**
Week 10	**data validation, error checking, and creating charts and graphs.**
Week 11	**Designing a simple presentation using templates and themes.**
Week 12	**Adding speaker notes and using timers.**

Week 13	**Navigating a web browser and performing basic searches.**
Week 14	**Exploring browser settings and managing bookmarks.**
Week 15	**Creating and managing an email account.**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	اساسيات الحاسوب – الخضر علي الخضر	No
Recommended Texts	**Ahmed banfa "introduction to AI"**	No
Websites		

Grading Scheme

مخطط الدرجات

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**English Languish I**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture**	
Module Code	**UOT002**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level		UGI	**Semester of Delivery**		2
Administering Department		Math	**College**	CCSM	
Module Leader	Ayham Mahmoud Al-Abbad		**e-mail**	ayham.m.abbad@tu.edu.iq	
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		M.A
Module Tutor			**e-mail**		
Peer Reviewer Name		Mundher A. Khalil	**e-mail**	mun880088@tu.edu.iq	
Scientific Committee Approval Date		2026\1\10	**Version Number**		1.2

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module	**UOT021** English Languish II	**Semester**	3

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The module aims at: 1. improving written skills through practice of writing descriptions, reports andother subject specific texts. 2. improving spoken interaction and production through the practice and production of presentations of science-related topics. 3. getting some specific terminology needed to study Mathematics. developing grammatical and lexical range and accuracy so that communicationhas a degree of fluency.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Knowledge of specific English terminology in Mathematics. 2. Improve the communication skills and specialist English language knowledgeof science students and professionals. 3. Enable students to communicate in English more confidently and effectivelyin their work or study environment. Develop the learners' language skills with practical reading and writing skills - such as applying for research funding or writing for publications - as well as with speaking and listening skills including 'describing and reporting Problemswith experiments' and 'presenting at a conference'.
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following:** - Teaching students how to communicate each other in English by using the fourskills: speaking, listening, reading and writing. The use of different examples from the everyday life, dialogues, conversations and the weekly compositions are useful for more development. [60 hours]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Clear focus on grammar. 2. Balanced, integrated-skills syllabus. 3. New content engages learners with fresh topics. 4. More speaking opportunities. 5. Boosting student's motivation to study – the Student Book e-book comes to life with extra digital features to engage students and enhancetheir learning experience: Watch video straight from the page and complete interactive activities with automated marking; Listen to audiofor authentic listening practice, slow it down for improved comprehension, and voice record to practice speaking and

	pronunciation; Add notes, use the pen and highlighter tool to annotate the page, and save voice recordings; Easily navigate using bookmarks, jump to page, and the search tool. 6. Encouraging students to study anytime, anywhere – ready to go activities for inside or outside the classroom, accessible on any device,both online and offline. 7. . Connecting students to a world-famous dictionary – quickly look up thedefinitions of words and phrases from the Oxford Learner's Dictionarieswith helpful pronunciation guidance, at the right level.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعاً

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	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	2, 7,12	LO #1-3 , LO# 9 - 11
	Assignments	3	5% (5)	4, 8,11	LO # 3, 4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 and 11

Summative assessment	**Midterm Exam**	2 hr	10% (10)	9	LO # 1-8
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction – Am, Is and Are – This is , How are You? Good morning – What's this? - Numbers 1-10 – Plurals.
Week 2	Countries – He , She, They, His and Her – Where he is from? - Numbers 11-30.
Week 3	Jobs – Is, Am and Are – Negative and Questions – Personal Information – Social Expressions.
Week 4	Family and Friends – Possessive S – Has and Have.
Week 5	Sports – Drinks – Present Simple – I, We, You and They - A and An - Language and
Week 6	Nationalities - Numbers and Prices.
Week 7	The Time - Present Simple He and She – Always, Sometimes and Never – Words that
Week 8	go together – Days of the week.
Week 9	Question words – Me, Him, Us and Them – This and That – Adjectives – Can I?
Week 10	Rooms and Furniture – There is and There are – Prepositions – Directions.
Week 11	Saying years – Was and Were born – Past Simple – Irregular Verbs – Have, Do and Go
Week 12	– When's your birthday?
Week 13	Past Simple – Regular and Irregular – Questions and Negatives – Sport and Leisure –
Week 14	Going sightseeing.
Week 15	Can and Can't – Adverbs – Adjective + Noun – Everyday problems.
Week 16	I'd like – Some and Any – In a restaurant – Signs all around.

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الأسبوعي للمختبر: لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. New Headway Beginner Student's Book (2002) byJohn and Liz Soars. 2. New Headway English Course (2002) by Julia Starr Keddle.	Yes
Recommended Texts	Any helping test on net.	No
Websites	https://test-english.com/grammar-points/	

Grading Scheme

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Advanced Calculus**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 201**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	UGII		**Semester of Delivery**	4	
Administering Department	Math		**College**	CCSM	
Module Leader	Zeyad Mohammed Abdullah		**e-mail**	Zeyaemoh1978@tu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Samer Abdulqader Alsammarraie		**e-mail**	Samer.A.Salih@tu.edu.iq	
Scientific Committee Approval Date	4/09/2025		**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**Advanced Calculus II**	**Semester**	2
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Identify the basic concepts in moments and centers of masses. 2. Learn to find moments and centers of masses by double and triple integrals. 3. Learn about the relationship between linear integrals and Crane's theorem. 4. Learn the basic concepts of divergence and rotation. 5. Use the Stokes case to find the work done on vectors.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Recognize the fundamental principles associated with moments and centers of masses. 2. Acquire the skills to determine moments and centers of masses using double and triple integrals. 3. Gain an understanding of the correlation between linear integrals and Crane's theorem. 4. Familiarize yourself with the fundamental ideas behind divergence and rotation. 5. Employ the Stokes case as a method to calculate the work performed on vectors.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A - Masses and Moments Masses and Moments in two and three Dimensions. Mass, First Moments, Center of Mass, Moments of Inertia (second moments), 2- Masses and Moments in Two and Three Dimensions (Polar, Cylindrical and Spherical Coordinates [25 hrs] Part B - Integrals Line Integral, Green's Theorem and Surface Area. Divergence and Circulation, Flux (Divergence and Stokes's Theorem). [32 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	

Student Workload (SWL) الحمل الدراسي للطالب			
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 تقييم المادة الدراسية				
	Time/Nu	**Weight (Marks)**	**Week Due**	**Relevant Learning**

		mber			Outcome
Formative assessment	Quizzes	3	25% (25)	5,7, 10	LO #1, 2, 10 and 11
	Assignments	3	5% (5)	3,8,12	
	Projects / Lab.				
	Report	1	10% (10)	13	LO # 5, 8 and 10
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)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Double Integrals
Week 2	Masses and Moments in two Dimensions
Week 3	Mass, First Moments, Center of Mass, Moments of Inertia (second moments),
Week 4	Radius of gyration, Centroid.
Week 5	Triple integrals
Week 6	Masses and Moments in two Dimensions
Week 7	Masses and Moments in Two and Three Dimensions
Week 8	Masses and Moments in (Polar, Cylindrical and Spherical Coordinates
Week 9	Line Integral
Week 10	Green's Theorem
Week 11	Surface Area
Week 12	Divergence and Circulation
Week 13	Flux
Week 14	The Divergence Theorem
Week 15	Stokes's Theorem
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

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

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Thomas, George Brinton, Maurice D. Weir, Joel Hass, Frank R. Giordano, and Recep Korkmaz. Thomas' calculus. Vol. 12. Boston: Pearson, 2010.	Yes
Recommended Texts	Thomas, George Brinton, Ross L. Finney, Maurice D. Weir, and Frank R. Giordano. Thomas' calculus. Reading: Addison-Wesley, 2003.	No
Websites		

Grading Scheme
مخطط الدرجات

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Ordinary Differential Equations**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 202**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	UGII		**Semester of Delivery**	3	
Administering Department	Math		**College**	CCSM	
Module Leader	Esraa Habeeb Khaleel		**e-mail**	Esraa.h.khaleel@tu.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Hind Khaled Kolaib		**e-mail**	Hind.Khaled@tu.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2025\9\4		**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	**MS 205** Partial Differential Equations	**Semester**	4

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	6. To learn the basics of differential equations. 7. To learn the classification and types of differential equations. 8. Training the student on methods and strategies for solving differential equations. 9. Identify the applications of differential equations in different fields such as physics, chemistry, and engineering sciences. 10. Understanding the basic concepts of differential equations. 11. Gaining the ability and skill to use methods of solving first-order differential equations and dealing with them. 12. learning the linear homogeneous and non-homogeneous differential equations with constant coefficients of nth order. 13. learning the Linear differential equations with variable coefficients, like the Euler equation, and the method of solving this equation.
Module Learning Outcomes	1. Identify and classify ordinary differential equations based on order, linearity, and other fundamental properties. 2. Solve first-order differential equations using standard methods such as separation of variables, exact equations, and Bernoulli equations. 3. Apply solution techniques for second-order linear differential equations with constant coefficients, including both homogeneous and non-homogeneous cases. 4. Use advanced analytical methods such as the method of undetermined coefficients and the method of variation of parameters to find particular solutions. 5. Analyze and interpret mathematical models represented by differential equations in physical, biological, or engineering contexts. 6. Employ basic numerical or computational tools (when appropriate) to obtain approximate solutions when analytical solutions are difficult or impossible to obtain.
Indicative Contents	1. Fundamental Concepts of Ordinary Differential Equations: Definitions, classification of differential equations, order and degree, linearity and nonlinearity, existence and uniqueness of solutions. 2. First-Order Differential Equations: Analytical solution methods including: separation of variables, linear first-order equations, exact equations and integrating factors, and Bernoulli. 3. Second-Order Linear Differential Equations with Constant Coefficients: Homogeneous equations, characteristic roots (distinct, repeated, and complex), construction of the general solution. 4. Non-Homogeneous Second-Order Linear Differential Equations: Complementary and particular solutions, method of undetermined coefficients, method of variation of

	parameters, and the principle of superposition. 5. Higher-Order Linear Differential Equations: Solution structure, reduction of order, and extension of second-order methods to higher orders. 6. Systems of First-Order Linear Differential Equations: Matrix formulation, eigenvalue and eigenvector methods, fundamental matrices, and general solution of linear systems. 7. Series Solutions of Differential Equations: Power series methods around ordinary points, introduction to the Frobenius method for singular points. 8. Laplace Transform Techniques: Fundamental properties, inverse Laplace transforms, application to initial value problems, step functions, impulse functions, and convolution. 9. Applications and Mathematical Modelling: Formulation and analysis of models arising in physical, biological, and engineering sciences, including population dynamics, mechanical oscillations, and electrical circuits. 10. Introduction to Numerical Methods for Ordinary Differential Equations: Basic approximation techniques such as Euler's method, improved Euler method, and Runge–Kutta methods (as applicable).

Learning and Teaching Strategies

Strategies	The primary strategy for delivering this module will be to encourage students' participation in the exercises while refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials, and simple experiments that involve sampling activities that students find enjoyable.

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem)	63	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	87	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative	**Quizzes**	3	25% (25)	4, 7, 10	

assessment	**Assignments**	3	5% (5)	5, 9,12	
	Projects / Lab.				
	Report	1	10% (10)	13	
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	
	Final Exam	3 hr	50% (50)	16	
Total assessment			100% (100)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	**Definition of ordinary differential equations, order, and degree of the equation**
Week 2	Linear and nonlinear differential equations (classifications)
Week 3	Solving the differential equation using the separation of variables method, the homogeneous method, the linear method, and the Bernoulli equation.
Week 4	Basic principles of homogeneous and inhomogeneous second-order differential equations, solving the homogeneous second-order differential equation, and various examples.
Week 5	Solving the second-order non-homogeneous differential equation using the undetermined coefficient method. Solving the second-order non-homogeneous differential equation using the variation of parameters method
Week 6	Homogeneous differential equations of higher degrees and finding the general solution to them. Inhomogeneous differential equations and finding the general solution to them.
Week 7	Introduction to the Laplace transform and its properties, inverse Laplace transform.
Week 8	Solution methods, direct laws, and the inverse displacement method.
Week 9	Partial fraction method, convolution theory.
Week 10	Solving differential equations using the Laplace transform.
Week 11	Review the types of differential equations and methods for solving them, along with solving a variety of examples
Week 12	Review the types of differential equations and methods for solving them, along with solving a variety of examples.
Week 13	The general concept of sequences.
Week 14	Study of power series and their convergence.
Week 15	Using power series to solve the differential equation at the normal point and using it at the abnormal point using the Frobenius method and the Bessel equation.

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**1. Dennis G. Zill — "A First Course in Differential Equations with Modeling Applications"** **2. George F. Simmons — "Differential Equations with Applications and Historical Notes"**	YES
Recommended Texts	**1. Dennis G. Zill — "A First Course in Differential Equations with Modeling Applications"** **2. George F. Simmons — "Differential Equations with Applications and Historical Notes"**	YES
Websites		

Grading Scheme
مخطط الدرجات

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Probability and Statistics**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 203**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		UGII	**Semester of Delivery**		3
Administering Department		Math	**College**	CCSM	
Module Leader	Reem Taha Abdalqader		**e-mail**	reemalhwez84@tu.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		master
Module Tutor	Dhabiaa.Mahmood Ali		**e-mail**	Dhabiaa.m.ali@tu.edu.iq	
Peer Reviewer Name		**Mundher Abdullah**	**e-mail**	mun880088@tu.edu.iq	
Scientific Committee Approval Date		2025\9\4	**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module	**MS 307** Mathematical Statistics II	**Semester**	6

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. **Clarifying the basic concepts of probability.** 2. **Introducing Bayes' theorem and conditional probability.** 3. **Studying discrete distributions and learning how to find the expectation and variance.** 4. **Studying continuous distributions and learning how to find the expectation and variance, as well as studying the related theorems.** 5. **Studying the probability density function (PDF), the probability mass function (PMF), and the joint probability density function.**
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. **Students will be able to state the basic definitions** related to probability theory. 2. **Students will be able to understand the introduction and fundamental concepts of probability.** 3. **Students will be able to distinguish between the Probability Density Function (PDF), the Probability Mass Function (PMF), and the Joint Probability Density Function**, with various illustrative examples. 4. **Students will be able to identify discrete probability distributions and their types**, and study examples along with theorems related to **expectation and variance**. 5. **Students will be able to describe the method used in solving probability problems.** 6. **Students will be able to explain the mathematical formulation of the method.** 7. **Students will be able to summarize the steps involved in solving the method.** 8. **Students will be able to apply the method to numerical problems.** 9. **Students will be able to tabulate and discuss the obtained results.**
Indicative Contents المحتويات الإرشادية	1. **Introduction and basic definitions of probability** (10 hours). 2. **Study of Bayes' theorem and conditional probability** (10 hours). 3. **Introduction to discrete probability distributions and their types** (10 hours). 4. **Study of examples of discrete distributions with theorems related to expectation and variance** (10 hours). 5. **Introduction to continuous probability distributions**, with emphasis on the **Normal distribution and the Standard Normal distribution**, with illustrative examples (12 hours). 6. **Study of Moment Generating Functions (MGF) and Probability Generating Functions (PGF) for distributions**, and an introduction to the **Probability Density Function (PDF), Probability Mass Function (PMF), and Joint Probability Density Function**, with various examples (10 hours.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy adopted in delivering this course is to **encourage students to actively participate in exercises**, while simultaneously **developing and enhancing their critical thinking skills**. This will be achieved through **interactive lectures and tutorial sessions**, as well as by considering **simple experimental activities**, including sampling exercises that engage students and relate to their interests.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
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 تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment التقييم التكويني	**Quizzes**	3	25% (25)	4 -5-8-10	LO #1, #2 and #7, #8
	Assignments	3	5% (5)	6 -12	LO #3, #6, #8
	Projects / Lab.				
	Report	1	10% (10)	13	LO #5, #7 and #8
Summative	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #8

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Introduction to Probability** • Definition of probability and its basic concepts. • Sample space and events. • Basic rules (axioms) of probability.
Week 2	**Rules of Probability** • Addition law of events. • Multiplication law of events. • Independent and dependent events.
Week 3	**Probability, Combinatorial Analysis, and Probability Using Diagrams** • Probability and its applications. • Combinatorial analysis (permutations and combinations). • Solving probability problems using diagrams (such as tree diagrams).
Week 4	**Bayes' Theorem** • Definition of Bayes' theorem. • The mathematical formula of Bayes' theorem. • Applications of Bayes' theorem in solving probability problems.
Week 5	**Random Variables** • Definition of a random variable. • Discrete random variables. • Continuous random variables.
Week 6	**Probability Distribution Functions** • Distribution function of a **discrete random variable**. • Distribution function of a **continuous random variable**.

	• The **difference between the two functions**.
Week 7	**Expected Value, Moments, and Variance** • **Definition of the expected value (mean).** • **Moments of a random variable.** • **Definition and calculation of the variance.**
Week 8	**Skewness, Kurtosis, and Moment Generating Function** • **Definition of skewness.** • **Definition of kurtosis.** • **Moment Generating Function (MGF) and its applications.**
Week 9	**Conditional Expectation, Conditional Variance, Correlation, and Regression**
Week 10	**Discrete Uniform Distribution, Bernoulli Distribution, and Binomial Distribution**
Week 11	**Geometric Distribution, Hypergeometric Distribution, and Poisson Distribution**
Week 12	**Uniform Distribution, Bernoulli Distribution, and Exponential Distribution**
Week 13	**Gamma Distribution and Beta Distribution**
Week 14	**Normal Distribution**
Week 15	**Cauchy Distribution and Chi-Square Distribution**
Week 16	**Final Exam**

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

Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts النصوص المطلوبة	**Basel Younis Dhnoon – Probability and Statistics**	yes
Recommended Texts	**Schaum's Outline of Probability and Statistics**	yes
Websites		

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance أداء مذهل
	B - Very Good	جيد جدا	80 - 89	Above average with some errors فوق المتوسط مع بعض الأخطاء
	C - Good	جيد	70 - 79	Sound work with notable errors العمل السليم مع أخطاء ملحوظة
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings عادل ولكن مع نواقص كبيرة
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria العمل يلبي الحد الأدنى من المعايير
Fail Group	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded مطلوب المزيد من العمل ولكن الائتمان الممنوح

(0 – 49)	**F –** Fail	راسب	(0-44)	Considerable amount of work required قدر كبير من العمل المطلوب

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Group Algebra**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 204**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		UGII	**Semester of Delivery**		3
Administering Department		Math	**College**	CCSM	
Module Leader	Ali Shebl Ajeel		**e-mail**	ali.shebl@tu.edu.iq	
Module Leader's Acad. Title		Instructor	**Module Leader's Qualification**		Dr.
Module Tutor	Omer Abdulrazzaq Abdullah		**e-mail**	omerabdulrazzaqa@tu.edu.iq	
Peer Reviewer Name		Akram Salim Mohammed	**e-mail**	akr_tel@tu.edu.iq	
Scientific Committee Approval Date		2025\9\4	**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	MS 207 Rings Algebra	**Semester**	4

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Giving the student definitions of groups and their examples and theorems. 2. Make the student distinguish between groups, cyclicgroups, and subgroups 3. The ability to describe different theorems to study the types and characteristics of group .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Know the concept of algebraic structure, especially groups 2. Identify examples of non-commutative groups 3. How to find subgroups 4. How to find division groups with Lagrange's theorem 5. Study the concept of group homomorphism.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Chapter 1 Definition of semi-group and group with some examples , Definition of abelian group and cyclic group with some examples , Cyclic group , Some fundamental theorems of group , Dirct product Group . [15 hrs] Chapter 2 Definition of sub-group and center of group with some examples and theorems , Product of two sub-group and some theorems , Normal sub-group and Quotient Groups , Lagrange theorem's and index of sub-group . [15 hrs] Chapter 3 Homomorphisms of Definition and examples , Kernel of function, Isomorphism and basic properties , The fundamental Theorems Factor theorem and First theorem , [12 hrs] Chapter 4 Integer group modulo n, (Congruent modulon) groups of Zn and theorems . [15 hrs] Chapter 5 Symmetric group of G with theorems .[15 hrs]

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

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative	**Quizzes**	3	25% (25)	5,8,10	LO #1, 2, 3

assessment	**Assignments**	3	5% (5)	2, 7,12	LO # 1-4
	Projects / Lab.				
	Report	1	10% (10)	10	L0 # 4
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Definition and Elementary Properties of group
Week 2	Definition of semi-group and group with some examples
Week 3	Definition of abelian group and cyclic group with some examples
Week 4	الزمر المولدة (Cyclic group)
Week 5	Some fundamental theorems of group
Week 6	Dirct product Group
Week 7	Definition of sub-group and center of group with some examples and theorems
Week 8	Product of two sub-group and some theorems
Week 9	Normal sub-group and Quotient Groups
Week 10	Lagrange theorem's and index of sub-group
Week 11	Homomorphisms of Definition and examples
Week 12	Kernel of function, Isomorphism and basic properties

Week 13	The fundamental Theorems Factor theorem and First theorem
Week 14	(Congruent modulon) groups of Zn and theorems
Week 15	Symmetric group of G with theorems
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

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

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	Abstract Algebra, David, M. Burton, 1988..	Yes
Recommended Texts	The Theory of Groups, Macdonald, Qxford. The Theory of Groups, Rotman, J.J., 2nd, Baton	No

Websites	

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**English languish II**			**Module Delivery**	
Module Type	**E**			☒ **Theory** ☒ **Lecture**	
Module Code	**UOT021**				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level	UGII		**Semester of Delivery**	3	
Administering Department	Math		**College**	CCSM	
Module Leader	Ayham Mahmoud Al-Abbad		**e-mail**	ayham.m.abbad@tu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	M.A	
Module Tutor			**e-mail**		
Peer Reviewer Name	Ahmed M. Salih		**e-mail**	ahmed.m.salih@tu.edu.iq	
Scientific Committee Approval Date	2025\9\4		**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**UOT002** English	**Semester**	2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The module aims at: 1. Develop Communication Skills: Enable students to engage in basic conversations, express opinions, and ask questions on familiar topics in both formal and informal settings, enhancing their confidence in speaking and listening. 2. Strengthen Grammar and Vocabulary: Build a solid foundation of essential grammar structures and expand vocabulary, allowing students to form correct sentences and improve their understanding of written and spoken English. 3. Improve Reading and Writing Abilities: Help students comprehend short texts on common academic and everyday topics and develop writing skills to produce structured paragraphs, emails, and simple essays.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Demonstrate Basic Oral Communication: By the end of the module, students will be able to participate in short conversations, express ideas, and respond appropriately in discussions on familiar topics, using correct pronunciation and basic grammar structures. 2. Comprehend and Analyze Short Texts: Students will be able to read and understand short written texts, identifying main ideas and key details in both academic and general contexts, and respond to comprehension questions with increased accuracy. 3. Write Structured Paragraphs: Students will be able to write coherent and grammatically correct paragraphs and simple essays, demonstrating the ability to organize thoughts, use appropriate vocabulary, and apply basic punctuation rules.
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following:** - Teaching students to communicate with one another in English by integrating the four skills—speaking, listening, reading, and writing. Using real-life examples, dialogues, conversations, and weekly writing assignments will further enhance their language development. [60 hours]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Task-Based Learning: Incorporate real-world tasks such as role-plays, group discussions, and problem-solving activities to help students practice English in practical, meaningful situations. 2. Integrated Skill Activities: Design lessons that blend speaking, listening, reading, and writing skills, such as listening to a short podcast and discussing or summarizing it in writing, to promote well-rounded language proficiency. 3. Personalized Feedback: Provide individualized feedback on assignments and class participation, focusing on areas where each student needs improvement, to help them recognize and correct their mistakes. 4. Use of Authentic Materials: Include authentic texts and media, such as news articles, videos, and podcasts, to expose students to real-life language usage and encourage familiarity with different accents and contexts. 5. Interactive Technology: Utilize digital tools and platforms like language learning apps, online quizzes, and interactive grammar games to make learning engaging and accessible, while promoting self-paced practice outside the classroom.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعاً			
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	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative Assessment	**Assignments (Homework)**	1	25% (5)	2, 4, 6, 10, 12, 14	LO # 1, 2, 3, ……., 14.
	Daily Activity	3	5% (5)	continuous	LO # 1, 2, 3, …….. 14.
Summative assessment	**Midterm Exam**	2 hr	10% (10)	15	LO # 1-6
	Report	1	10%(10)	13	LO # 5, 8 and 10
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction – Getting to Know you - Tenses – Questions – Questions Words
Week 2	The Way We live – Present Tense – Simple Present – Present Continuous – Have, have got
Week 3	It all went wrong – Past Tense – Past Simple – Past Continuous
Week 4	Let's go shopping – Quantity – Much and Many – Some and Any - Articles
Week 5	What do you want to do? Verb Patterns – Future Intentions
Week 6	Tell me what's it like? Comparative and Superlative Adjectives
Week 7	Famous Couples – Present Perfect and Past Simple – For and Since – Tense Revision
Week 8	Do's and Don'ts – have (got) to – should – must
Week 9	Going Places – Time and Conditional Clauses – What if …. ?
Week 10	Scared to Death – Verb Patterns 2 – Infinitives
Week 11	Things that Changed the World – Passives

Week 12	Dreams and Reality – Second Conditional – Might
Week 13	Earning and Living – Present Perfect Continuous – Present Perfect Simple vs Continuous
Week 14	Love you and Leave you – Past Perfect – Reported Statements
Week 15	Monthly exam
Week 16	Preparatory week before the final exam.

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الأسبوعي للمختبر: لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Pre-Intermediate New Headway (2002) by John and Liz Soars.	Yes

Recommended Texts	Any helping test on Internet.	No
Websites	https://test-english.com/grammar-points/	

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

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

MODULE DESCRIPTOR

وصف مادة حرية و ديمقراطية

Module Information معلومات المادة الدراسية					
Module Title	**ba'ath party crimes**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**005UOT**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	UGII		**Semester (s) offered**	3	
Min number of students	15		**Max number of students**	100	
Administering Department	Math		**College**	CCSM	
Module Leader	Saad Hussein Ali		**e-mail**	Saad.h.ali@tu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name	Ahmad. M. Salh		**e-mail**		
Review Committee Approval	4/09/2025		**Version Number**	1.1	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	لايوجد	**Semester**	-
Co-requisites module	لايوجد	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	**1-To identify the crimes committed by the baath party** **2- To study how the nobie Islamic religion addresses human rights in both religious and worldly aspects** **3- The course examines the methods used by the baath regime to starve the people**		

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	
Indicative Contents المحتويات الإرشادية	
Course Description	
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The teaching and learning strategy was designed to ensure that the student acquires comprehensive information covering the curriculum prepared for the subject in order to achieve the main objective course which focuses on enabling the student to grasp

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **30** **In class tests** **3**	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 تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	3, 5, ,7, 9,11,13,	LO #1, 2,3,....., 11
	Assignments (Homeworks)	6	10% (10)	2, 4, 6, 10,12,14	LO # 1, 2, 3, ...,11
	Discussions	7	5% (5)	Continuous	
Summative assessment	**Midterm Exam**	2	10% (10)	8	LO # 1-7
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**وزارة التعليم العالي والبحث العلمي**	Yes
Recommended Texts	.	No
Websites	N/A	

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria

Fail Group (0 – 49)	**FX –** Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information					
Module Title	**Partial Differential Equation**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 205**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level		UGII	**Semester of Delivery**		4
Administering Department		Math	**College**	CCSM	
Module Leader	Esraa Habeeb Khaleel		**e-mail**	Esraa.h.khaleel@tu.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Hind Khaled Kolaib		**e-mail**	Hind.Khaled@tu.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		2026\1\10	**Version Number**	1.1	

Relation with other Modules			
Prerequisite module	**MS 202** Ordinary Differential Equation	**Semester**	3
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	

	1. To familiarize the student with the definition and concept of partial differential equations and their formation. 2. That the student recognizes the classification of the partial differential in terms of degree and rank. 3. Identify the applications of partial differential equations in various fields. 4. Knowledge and understanding. 5. Learn the methods and rules for finding solutions to different partial differential equations with initial and limit values. 6. The student is acquainted with the legal formulas for partial equations (hyperbolic, ellipse, parabola). 7. The student was introduced to the integral transformation: Laplace transform, Fourier transform, and some of its applications.
Module Learning Outcomes	1. 1Identify and classify partial differential equations based on order, linearity, and type (elliptic, parabolic, hyperbolic), and understand their fundamental properties. 2. Formulate mathematical models that lead to partial differential equations arising in physical, engineering, and scientific contexts such as heat flow, wave motion, and potential theory. 3. Apply analytical methods (including separation of variables, Fourier series, and eigenfunction expansions) to obtain solutions of classical PDEs with appropriate boundary and initial conditions. 4. Solve standard linear PDEs such as the heat equation, wave equation, and Laplace equation using established analytical techniques. 5. Use basic transform methods, including Fourier and Laplace transforms, to solve PDEs in one and multiple dimensions when applicable. 6. Analyze the behavior of solutions and interpret the physical and mathematical meaning of PDE models, including stability, uniqueness, and qualitative properties.
Indicative Contents	1. Introduction to Partial Differential Equations: Definitions, basic concepts, classification of PDEs (elliptic, parabolic, hyperbolic), and physical interpretation. 2. First-Order Partial Differential Equations: Linear and nonlinear first-order PDEs, method of characteristics, geometric interpretation, and applications. 3. Second-Order Linear Partial Differential Equations: Canonical forms of PDEs, classification criteria, transformation to standard forms, and solution techniques for each type. 4. The Heat Equation: Derivation from physical principles, initial and boundary value problems, solution by separation of variables, Fourier series solutions, stability and uniqueness. 5. The Wave Equation: Vibrating string and membrane models, d'Alembert's formula, separation of variables, eigenfunction expansions, and energy interpretation. 6. Laplace Equation and Elliptic PDEs: Properties of harmonic functions, boundary value problems, separation of variables in rectangular and cylindrical coordinates. 7. Fourier Series and Orthogonal Expansions: Convergence, orthogonality of eigenfunctions, Sturm–Liouville problems, and application to PDE solutions.

	8. Integral Transform Methods: Fourier transforms and Laplace transforms for PDEs, solution of problems on infinite and semi-infinite domains. 9. Applications of PDEs: Physical and scientific models demonstrating the role of PDEs in heat conduction, fluid flow, electromagnetism, and potential theory.

Learning and Teaching Strategies

Strategies	The primary strategy for this unit is to encourage students to participate in the exercises while simultaneously improving and expanding their thinking skills. This will be achieved through assignments and the methods used to solve them.

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem)	93	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	107	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	200		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	4, 7, 10	
	Assignments	3	5% (5)	5, 9,12	
	Projects / Lab.				
	Report	1	10% (10)	13	
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	
	Final Exam	3 hr	50% (50)	16	
Total assessment			100% (100)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Classification of equations: second-order partial differential equations.
Week 2	Partial differential equations of order n.
Week 3	Fourier series.
Week 4	Study different types of equations with variable coefficients.
Week 5	Different types of equations with variable coefficients and different ways to solve them.
Week 6	Laplace transform to solve this type of partial differential equation.
Week 7	Heat diffusion equation in an isolated metal arm and homogeneous boundary conditions.
Week 8	Heat diffusion equation in an isolated metal arm and homogeneous boundary conditions.
Week 9	Heat diffusion equation in a metal arm with insulated ends.
Week 10	Construct the wave equation.
Week 11	The wave equation and methods for solving it in one or two dimensions.
Week 12	Applied problems on the wave equation.
Week 13	Solve Laplace's equation in two dimensions.
Week 14	Solve the Laplace equation in two dimensions by separating variables.
Week 15	Laplace's equation with polar coordinates and its solution.

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	**1. Dennis G. Zill — "A First Course in Differential Equations with Modeling Applications"** **2. George F. Simmons — "Differential Equations with Applications and Historical Notes"**	yes
Recommended Texts	**1. Dennis G. Zill — "A First Course in Differential Equations with Modeling Applications"** **2. George F. Simmons — "Differential Equations with Applications and Historical Notes"**	yes
Websites		

Grading Scheme
مخطط الدرجات

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

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Numerical Analysis I**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 206**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level		UGII	**Semester of Delivery**		4
Administering Department		Math	**College**	CCSM	
Module Leader	Firas Adel Fawzi		**e-mail**	Firasadil01@tu.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Shaimaa Shehab Ahmed		**e-mail**	Shaymaa.sh.ahmed@st.tu.edu.iq	
Peer Reviewer Name		Nazar K. Hussein	**e-mail**	nazar.dikhil@tu.edu.iq	
Scientific Committee Approval Date		2026\1\10	**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	**MS 305** Numerical Analysis II	**Semester**	5

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To introduce numerical approximation techniques for solving standard problems in Mathematics. 2. To derive some of these techniques from mathematics principles. 3. To explain how computer software is able to produce numerical solutions, and to enable a judgment of whether the results are reliable. 4. To provide opportunities for implementing numerical techniques on a computer. 5. To develop problem solving skills via numerical methods.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Summarize what is meant by a basic numerical methods. 2. Recognize how used numerical methods . 3. Compute error estimates for simple numerical methods. 4. Derive elementary numerical methods from first principles. 5. The student learns how to find the approximate value of nonlinear equations using numerical methods. 6. Apply the numerical methods which discussed to simple examples. 7. The student learns how to find the approximate solutions of linear and nonlinear systems using numerical methods. 8. Implement numerical methods using computer software, and apply them in examples. 9. Understand some elements of computer programming.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Numerical errors Error sources, Define the absolute error and relative error with solving an examples, Error sources and errors in calculations(addition, subtraction, multiplication and division) and solve examples.[1 2hrs] Define the root of the equation and determination of roots positions with solving examples.[1 0hrs]. A review of the language MatLab, A review of the language MatLab, A review of the language MatLab, Write program of errors in calculations, Write program of Bisection method, Write program of False position method, Write program of Secant method, Write program of Newton -Raphson method and daily examination. [9 hrs] Part B - Numerical methods to solve nonlinear equations Numerical methods to solve nonlinear equation , Bisection method and False position method and solving an example and write algorithm, Derivative of the approximation root of Secant method with solving an example and write algorithm, Derivative of the approximation root of Newton-Raphson method and solve examples and write

	algorithm , Special cases of Newton-Raphson method and solve examples.[14hrs] Fixed point method with solving several examples and write algorithm , Aitken method with solving examples and write properities.[10 hrs] Write program of Fixed point, Write program of Aitken method, Write program of Gauss elimination method, Write program of Gauss Jordan method, Write program of Jacobi method, Write program of Gauss-seidel method.[10hrs] Part C - Numerical solutions of linear systems(direct methods and iterative methods): Gauss elimination metod and Gauss Jordan method to solve linear system of equations, LU-Decomposition method and solve examples, Iterative methods : Jacobi and Gauss-seidel methods.[12 hrs] Write program of exponential approximation, Solving examples by programs.[10 hrs]

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

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	107	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	25% (25)	5,7, 12	LO #1, 2, 3 and 8
	Assignments	3	5% (5)	3,10,13	LO # 1, 2, 6 and 9
	Projects / Lab.				
	Report	1	10% (10)	15	LO # 4, 5 and 7
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)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction in numerical analysis and define rounding and chopped.
Week 2	Define the absolute error and relative error with solving an examples.
Week 3	Error sources and errors in calculations(addition, subtraction, multiplication and division) and solve examples , write a duty.
Week 4	Define the root of the equation and determination of roots positions with solving examples.
Week 5	daily exam + Numerical methods to solve nonlinear equation , Bisection method with write algorithm.
Week 6	False position method and solving an example and write algorithm.
Week 7	Derivative of the approximation root of Secant method with solving an example and write algorithm.
Week 8	**Mid-term Exam**
Week 9	Derivative of the approximation root of Newton-Raphson method and solve examples and write algorithm.
Week 10	Special cases of Newton-Raphson method and solve examples , write a duty.
Week 11	Fixed point method with solving several examples and write algorithm.
Week 12	daily exam + Aitken method with solving examples and write properties.
Week 13	Gauss elimination metod and Gauss Jordan method to solve linear system of equations.
Week 14	LU-Decomposition method and solve examples.
Week 15	Iterative methods : Jacobi and Gauss-seidel methods , Report.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Principles of Numerical Analysis, Dr. Ali Muhammad Siddiq and Ibtisam Kamal Al-Din: 1986	Yes
Recommended Texts	Numerical Methods Using MatLab, fourth edition, John H.M. and Kurtis D.F.(2004).	No
Websites		

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Rings Algebra**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 207**				
ECTS Credits	**7**				
SWL (hr/sem)	**175**				
Module Level		UGII	**Semester of Delivery**		4
Administering Department		Math	**College**	CCSM	
Module Leader	Omer Abdulrazzaq Abdullah		**e-mail**	omerabdulrazzaqa@tu.edu.iq	
Module Leader's Acad. Title		Lect.	Instructor		Dr.
Module Tutor	Abdelwahhab Mohammed Abdelwahhab		**e-mail**	abdulwahhab.elnajjar@tu.edu.iq	
Peer Reviewer Name		Akram Salim Mohammed	**e-mail**	Ak_tel@tu.edu.iq	
Scientific Committee Approval Date		2026\1\10	**Version Number**		1.1

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MS 204 Group Algebra	**Semester**	3
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Giving the student definitions of rings, examples and related theorems 2. Make the student distinguish between rings and subrings. 3. The ability to employ different theorems to study the types and properties of rings.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Identify the concept of algebraic structure, especially rings 2. Identify examples of non-commutative rings 3. How to find sub rings 4. How to find the division ring 5. Study the concept of ring homomorphism .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Chapter 1</u> Definition of ring and some example , Definition of Zero divisor and integral domain , Integral domain and commutative ring with identity with examples , [15 hrs] <u>Chapter 2</u> Definitions of Sub-ring and center of rings , Some theorems of rings and sub-rings , definitions of Ideals with examples and theorems , [15 hrs] <u>Chapter 3</u> Prime ideals, maximal ideal and principal ideal , Idempotent elements and nilpotent elements , Jacobson radical of rings and unite elements ,[12 hrs] <u>Chapter 4</u> Definition Quotient Rings with examples and theorems , Polynomial Rings and Boolean Rings ,[15 hrs] <u>Chapter 5</u> Definition of Homomorphisms and isomorphisms, examples and theorems , Definition of fields and sub-fields , [15 hrs]

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

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	97	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5 ,8, 10	LO #1, 2, 3
	Assignments	3	5% (5)	2,7, 12	LO # 1-4
	Projects / Lab.				
	Report	1	10% (10)	10	LO # 4

Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Definition and Elementary Properties of Rings
Week 2	Definition of ring and some example
Week 3	Definition of Zero divisor and integral domain
Week 4	Integral domain and commutative ring with identity with examples
Week 5	Definitions of Sub-ring and center of rings
Week 6	Some theorems of rings and sub-rings
Week 7	definitions of Ideals with examples and theorems
Week 8	Special ideals and elements such as : Prime ideals, maximal ideal and principal ideal
Week 9	Idempotent elements and nilpotent elements
Week 10	Jacobson radical of rings and unite elements
Week 11	Definition Quotient Rings with examples and theorems
Week 12	Polynomial Rings and Boolean Rings
Week 13	Definition of Homomorphisms and isomorphisms, examples and theorems
Week 14	Definition of fields and sub-fields
Week 15	Some important theorems of fields
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Abstract Algebra, David, M. Burton, 1988	Yes
Recommended Texts	The Theory of Rings Algebra	No
Websites		

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

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Arabic Language II**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**UOT011**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	UGII		**Semester of Delivery**	4	
Administering Department	Math		**College**	CCSM	
Module Leader	Bushra Adel Saleh		**e-mail**	Bushra.a.salih@st.tu.edu.iq	
Module Leader's Acad. Title	**Assistant Lecturer**		**Module Leader's Qualification**	Master	
Module Tutor	None		**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	2026\1\10		**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**UOT001** Arabic Language I	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Developing students' ability to interpret and analyze Qur'anic verses correctly by identifying the lexical meanings of words, and instilling Islamic principles through the Noble Prophetic Hadiths and clarifying their meanings. 2. Strengthening students' linguistic competence. 3. Introducing students to the heritage of Arabic literature through selected poems and highlighting their values and meanings. 4. Providing students with full knowledge of the fundamentals of the Arabic language and enabling them to express themselves correctly. 5. Clarifying the importance of Arabic grammar. 6. Enhancing students' linguistic proficiency and identifying common language errors. 7. Learning the basic grammatical rules and applying them. **.**
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the module, students will be able to: 1. Recognize the terminology related to orthographic and grammatical rules. 2. Understand grammatical rules and use them correctly. 3. Appreciate the importance of accuracy in observation and the ability to distinguish between correct and incorrect forms in what they hear and read, which helps them understand sentence meanings and styles.
Indicative Contents المحتويات الإرشادية	• Developing students' ability to interpret and analyze Qur'anic verses correctly by identifying the lexical meanings of words, and instilling Islamic principles through the Noble Prophetic Hadiths and explaining their meanings. **(2 hours)** • Strengthening students' linguistic ability. • Strengthening students' linguistic ability. **(2 hours)** • Introducing students to the heritage of Arabic literature through selected Arabic poems and highlighting the values and meanings they contain. **(2 hours)** • Providing students with full knowledge of the fundamentals of the Arabic language and enabling them to express themselves correctly. **(2 hours)** • Clarifying the importance of Arabic grammatical rules. **(2 hours)** • Enhancing students' linguistic competence and identifying common language errors. **(2 hours)** • Learning the basic grammatical rules and the ability to use and apply them. **(2 hours)** • Familiarizing students with the Arabic verb in terms of soundness and weakness (regular and weak forms). **(2 hours)** • Learning punctuation marks in writing. **(2 hours)** • Learning the rules for writing the hamza. **(2 hours)** • "Say and do not say": common mistakes among speakers and writers. **(2 hours)** • Developing language skills: refining linguistic taste and improving students' style. **(2 hours)**

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategy is designed to provide the student with comprehensive knowledge covering the prescribed syllabus and to achieve the main goal of enabling the student to grasp the fundamental concepts of the Arabic language. This course requires a special approach that mainly depends on developing the student's ability to understand grammatical and orthographic rules and apply them to Qur'anic and poetic texts, while avoiding grammatical errors.

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	32	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	18	**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

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	5, 10,12	LO #1-3 , LO# 9 - 11
	Assignments	3	5% (5)	2, 12	LO # 3, 4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 and 11
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-8
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Surah Al-Isra (29–32)
Week 2	Surah Yusuf (1–7)
Week 3	From the Noble Prophetic Hadiths: the Hadith on the perfection of work and the Hadith *"Every Muslim is inviolable to another Muslim."*
Week 4	Verses from Al-Sharif Al-Radi's elegy for his mother
Week 5	Dāliyya of Abu Al-Ala' Al-Ma'arri
Week 6	Exam
Week 7	Poems by Al-Jawahiri and Al-Sayyab (Rain Song / A Stranger on the Shore)
Week 8	Subjunctive and jussive forms of the present verb
Week 9	Midterm exam
Week 10	Genitives – by prepositions
Week 11	Genitive by annexation (iḍāfa)
Week 12	Genitive by dependency
Week 13	Rules of writing tā' (open and tied)
Week 14	Exam
Week 15	Common errors in Arabic
Week 16	Final exam

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر:	
	Material Covered

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

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	**General Arabic for Non-Specialist Departments** Compiled by: Asst. Lect. Bushra Adel Saleh Tikrit University – Computer Science & Mathematics	No
Recommended Texts	• The Holy Qur'an and its exegesis • Books of Prophetic Hadith • Sharḥ Ibn ʿAqīl • Qaṭr al-Nadā	No
Websites		

Grading Scheme

مخطط الدرجات

Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors

	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
(0 – 49)	**F** – Fail	راسب	(0-44)	Considerable amount of work required

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Computer Applications II**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOT031**				
ECTS Credits	**3**				
SWL (hr/sem)	**75**				
Module Level	UGII		**Semester of Delivery**	4	
Administering Department	Math		**College**	CCSM	
Module Leader	Noor Walid Khalid		e-mail	noor.w.khalid22ms@tu.edu.iq	
Module Leader's Acad. Title	Asst. Lecturer		**Module Leader's Qualification**	master	
Module Tutor	Ahmed Maher Salih		**e-mail**	Ahmed.m.salih@tu.edu.iq	
Peer Reviewer Name	Ahmed Maher		**e-mail**		
Scientific Committee Approval Date	10/1/2026		**Version Number**	1.1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	UOT003	**Semester**	2
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	This course aims to introduce students to the fundamentals of computers and their components, as well as concepts of data, information, and multimedia systems. It seeks to develop students' skills in using essential computer applications such as word processing (Word), spreadsheets (Excel), and presentation software (PowerPoint). The course also aims to familiarize students with the basics of the Internet, computer networks, Internet of Things (IoT), and virtual reality technologies. Additionally, it provides an introduction to computer programming using Python, enabling students to develop basic programming skills.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. **Understand Computer Fundamentals and Components** o Students will define what a computer is, identify its main components, and explain their functions. 2. **Understand Data, Information, and Multimedia Systems** o Students will distinguish between data and information, and explain the role of multimedia systems including images, audio, and video. 3. **Demonstrate Proficiency in Core Applications (Word, Excel, PowerPoint)** o Students will create, format, and manage documents, spreadsheets, and presentations professionally. 4. **Understand Internet, Networks, and IoT** o Students will describe basic Internet and networking concepts, explore IoT applications, and understand how networks and connected devices communicate. 5. **Understand Virtual Reality Technologies** o Students will be introduced to VR, its components, and applications in education, entertainment, and industry. 6. **Apply Basic Python Programming Skills** o Students will write simple Python programs and solve basic computational problems. 7. **Apply Practical Skills in Network Simulation and Tools** o Students will conduct hands-on exercises using Cisco Packet Tracer and other networking tools. 8. **Create Barcodes and QR Codes and Use Online Tools** o Students will learn how to generate barcodes and QR codes, and use websites and tools that support mathematics and educational applications.

	9. **Work with Windows Programs and Operating Systems** o Students will explore and apply practical skills in using Windows programs and managing operating systems.
Indicative Contents المحتويات الإرشادية	**Introduction to Computers and Data** • Overview of computer systems • Types of computers (desktops, laptops, tablets, etc.) • Basic computer terminology • Concepts of data and information **Hardware and Software** • Identification and functions of hardware components (CPU, RAM, storage, input/output devices) • Introduction to software: system software vs. application software • Working with Windows programs and operating systems **Word Processing, Spreadsheets, and Presentations** • Creating, formatting, and editing documents using Word • Designing spreadsheets and performing calculations using Excel • Creating professional presentations using PowerPoint with multimedia elements **Internet, Networks, and IoT** • Introduction to web browsers and search engines • Conducting research and evaluating online information • Basic networking concepts and Internet structure • Internet of Things (IoT) concepts and applications • Hands-on networking exercises using Cisco Packet Tracer **Virtual Reality** • Definition and concepts of Virtual Reality (VR)

	• Difference between VR and AR • Applications of VR in education, industry, and entertainment **Python Programming** • Introduction to Python programming • Variables, data types, and basic operations • Writing simple programs and solving problems **Practical Applications and Tools** • Creating barcodes and QR codes • Using online tools and websites useful for mathematics and educational purposes • Practical exercises with multimedia, images, and videos **Introduction to Artificial Intelligence** • Definition and history of AI • Machine Learning and Deep Learning concepts • Real-world applications of AI (virtual assistants, robotics, predictive analytics) • Ethical considerations in AI development and usage

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• **Board:** To explain basic concepts and key ideas. • **Smart Board:** To display practical applications, multimedia content, and enable interactive learning. • **Computer:** To use practical software such as Word, Excel, PowerPoint,

	Python, and networking tools. • **Presentation Software:** To present theoretical concepts and practical applications effectively. • **Collaborative Learning:** Sharing experiences and working in groups on projects and exercises. • **Brainstorming:** Generating ideas and solving problems interactively. • **Ice-breaking Activities:** Short activities to engage students and increase participation. • **Barcode / QR Code Activities:** Each barcode or QR code links to an activity or question, allowing students to complete it interactively, increasing engagement and participation during the lesson.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation

تقييم المادة الدراسية

	Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome

Formative assessment	**Quizzes**	3	25% (25)	5,7, 11	#LO 1-3, #LO 3-5
	Assignments	3	5% (5)	3,7, 12	#LO 3-5, #LO 1-4
	Project	1	10% (10)	14	#LO 1-5
Summative assessment	**Midterm Exam**	2 hr	10% (10)	11	#LO 1-3
	Final Exam	2 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

Week No.	Material Covered
Week 1	Introduction to Computers: Concepts of computers, hardware and software, data and information, connecting I/O devices and peripherals to CPU.
Week 2	Computer Components: CPU, RAM, storage devices, input/output units, types of memory.
Week 3	Advanced Computer Components: Computer ports, personal computer features and types, overview of systems.
Week 4	Operating System & GUI: Introduction to common operating systems, user interface basics, mouse and keyboard techniques.
Week 5	GUI Advanced: Using icons, status bar, menus, folders and directories, opening/closing windows, creating shortcuts.
Week 6	Word Processing Basics: Creating, formatting, editing documents, using templates, text and paragraph formatting.
Week 7	Word Processing Advanced: Tables, styles, themes, spell check, grammar tools, headers and footers.
Week 8	Spreadsheets Basics: Introduction to Excel, creating and formatting worksheets, sorting and filtering data, basic formulas and functions.
Week 9	Spreadsheets Advanced: Advanced formulas, Pivot Tables, data validation, error checking, creating charts and graphs.

Week 10	Presentation Software Basics: Creating presentations, using templates and themes, inserting text and images, transition and animation effects.
Week 11	Presentation Software Advanced: Speaker notes, timers, hyperlinks, action buttons, troubleshooting, future trends.
Week 12	Internet & Web Browsers: Introduction to WWW, web browsers, search engines, URLs, domain names, IP addresses.
Week 13	Networks & IoT: Basics of computer networks, Internet of Things (IoT) concepts and applications, practical examples.
Week 14	Virtual Reality & Multimedia: Introduction to VR, difference between VR and AR, multimedia (images, audio, video), practical applications.
Week 15	Python Programming: Introduction to Python, variables, data types, basic operations, writing simple programs, problem-solving exercises.

Delivery Plan (Weekly Lab. Syllabus): المنهاج الاسبوعي للمختبر:	
Week 1	• Identifying computer hardware components (CPU, RAM, storage, input/output devices) – Computer Components
Week 2	• Exploring memory types and understanding I/O units – Computer Components & Data
Week 3	• Identifying and classifying personal computer types and features – Computer Components
Week 4	• Using operating systems and practicing GUI techniques (windows, icons, shortcuts) – Operating System & GUI
Week 5	• Word Processing: Formatting text, using templates, tables, styles, headers, and footers – Word
Week 6	• Excel: Creating worksheets, formatting cells, basic and advanced formulas, Pivot Tables, charts and graphs – Excel
Week 7	• PowerPoint: Creating presentations, inserting multimedia (images, audio, video), transitions, animations, speaker notes, timers – PowerPoint & Multimedia
Week 8	• Navigating the Internet, using search engines, evaluating online information – Internet &

	Research Skills
Week 9	• Exploring networks and IoT: practical exercises using Cisco Packet Tracer – Networks & IoT
Week 10	• Introduction to Virtual Reality (VR) and interactive multimedia applications – VR & Multimedia
Week 11	• Python Programming: Writing simple programs, using variables, loops, and basic operations – Python
Week 12	• Creating Barcodes / QR Codes for interactive activities – Interactive Activities
Week 13	• Using educational websites and tools for mathematics and learning activities – Educational Resources
Week 14	• Applying multimedia, images, and videos in practical exercises – Multimedia Applications
Week 15	• Advanced practice with computer applications and tools – Consolidation / Project Work

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	1. **Essentials of Computer – Al-Khadr Ali Al-Khadr (Not available in library)** 2. **Computer Fundamentals – P. K. Sinha** 3. **Fundamentals of Information Technology – Alexis Leon & Mathews Leon**	No Yes Yes
Recommended Texts	1. **Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig** 2. **Introduction to Artificial Intelligence – Wolfgang Ertel**	Yes Yes
Websites	1. **Cisco Networking Academy** – For learning computer networks, Packet Tracer simulations, and IoT applications https://www.cisco.com/c/en/us/training-events/training-certifications/netacad.html 2. **Microsoft Learn** – Tutorials for Word, Excel, PowerPoint, and Office 365 https://learn.microsoft.com/en-us/training/ 3. **GCFGlobal.org** – Tutorials for computer basics, internet, multimedia, and digital skills	

	https://edu.gcfglobal.org/en/ 4. **Python Official Documentation / Tutorial** – Learn Python programming from beginner to advanced https://docs.python.org/3/tutorial/index.html 5. **QR Code Generator** – Create interactive barcodes and QR code activities https://www.qr-code-generator.com/

Grading Scheme

مخطط الدرجات

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

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

MODULE DESCRIPTION FORM

Module Information					
Module Title	**Research Methodology**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 208**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	UGII		**Semester of Delivery**	4	
Administering Department	Math		**College**	CCSM	
Module Leader	Hanan Nazar Sabbar		**e-mail**	Hanan.sabbar@tu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master	
Module Tutor	None		**e-mail**	---	
Scientific Committee Approval Date	2026\1\10		**Version Number**	1.1	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Understanding the nature and importance of scientific knowledge. 2. Identifying the different types of scientific research. 3. Learning how to define and formulate a research problem. 4. Developing skills in evaluating research problems. 5. Learning how to select an appropriate research methodology for a specific study. 6. Developing skills in collecting and organizing research data.
Module Learning	1- Understanding the importance of science and knowledge and their role in societal

Outcomes	development and scientific progress. 2- Identifying the different types of scientific research and understanding the differences between them and their various objectives. 3- Acquiring skills in defining a research problem and designing a research study related to it. 4- Developing the ability to evaluate a research problem and formulate a testable hypothesis. 5- Understanding the importance of selecting an appropriate research methodology to achieve the objectives of a study. 6- Acquiring skills in collecting and classifying data related to scientific research. 7- Learning how to organize and manage collected data to ensure easy access and effective analysis. 8- Understanding the differences between primary and secondary data sources and using them effectively in scientific research. 9- Developing skills in data analysis and presenting results accurately and appropriately. 10- Enhancing the ability to read research sources critically and extract essential information from them.
Indicative Contents	The indicative content includes the following: **Scientific knowledge and research fundamentals:** Science and knowledge; scientific research and its types; characteristics of scientific research and defining the research problem; evaluating the research problem and formulating a hypothesis; selecting the appropriate research methodology. **[6 hrs.]** **Data collection and analysis:** Collecting and classifying data; tabulating and managing data; types of data sources (primary and secondary); data analysis and presentation of results. **[6 hrs.]** **Research writing skills:** Reading research sources; scientific methods and rules of academic writing; citation and referencing styles; the concept of footnotes; preparing the list of references; appendices and formatting; research abstract preparation. **[5 hrs.]**

Learning and Teaching Strategies	
Strategies	The primary strategy adopted in delivering this module is to encourage students to actively participate in exercises while simultaneously enhancing and expanding their critical thinking skills. This will be achieved through interactive classes and instructional programs, as well

	as by incorporating simple experimental activities that involve sampling tasks relevant to students' interests.

Student Workload (SWL) The student workload is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student workload during the semester**	33	**Structured SWL (h/w)** **Regular student workload per week**	2
Unstructured SWL (h/sem) **Independent (unstructured) student workload during the semester**	17	**Unstructured SWL (h/w)** **Independent (unstructured) student workload per week**	2
Total SWL (h/sem) **Total student workload during the semester**	**50**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	5, 11 , 13	LO #1, #2 and #9, #10
	Assignments	3	5% (5)	3,7 , 12	LO #3, #4 and #6, #7
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO #1 - #7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Science and Knowledge
Week 2	Scientific Research and its Types
Week 3	Characteristics of Scientific Research and Identifying the Research Problem
Week 4	Evaluating the Research Problem and Formulating Hypotheses
Week 5	Determining the Research Methodology
Week 6	Data Collection and Classification
Week 7	Data Tabulation and Management
Week 8	Midterm Exam + Types of Data Sources (Primary & Secondary)
Week 9	Data Analysis and Presentation of Results
Week 10	Reading Research Sources
Week 11	Scientific Methods and Rules for Research Writing
Week 12	Methods of Citation and Footnote Writing
Week 13	The Meaning of Annotations and Preparing the Bibliography
Week 14	Appendices and Final Layout
Week 15	Research Abstract
Week 16	Preparatory Week Before the Final Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	There are no laboratories
Week 2	There are no laboratories
Week 3	There are no laboratories
Week 4	There are no laboratories
Week 5	There are no laboratories

Week 6	There are no laboratories
Week 7	There are no laboratories

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Abd Al-Karim, A. M., & Kidawi, T. M. (2006). Fundamentals of Scientific Research in the Humanities. Ibn Al-Atheer House for Printing and Publishing, University of Mosul, Iraq.	Yes
Recommended Texts	none	No
Websites	https://www.coursera.org/learn/research-methodologies	

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Mathematical Analysis (1)**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 301**				
ECTS Credits	**8.00**				
SWL (hr/sem)	**200**				
Module Level	UGIII		**Semester of Delivery**	5	
Administering Department	Math.		**College**	CCSM	
Module Leader	Ahmed Maher Salih		**e-mail**	Ahmed.m.salih@tu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Dr.	
Module Tutor	Hanan Nazar Sabbar		**e-mail**	Hanan.sabbar@tu.edu.iq	
Peer Reviewer Name	**Laith K. Shakair**		**e-mail**	Dr.laithkhaleel@tu.edu.iq	
Scientific Committee Approval Date	**4/9/2025**		**Version Number**	**1**	

Relation with Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	MS 306	**Semester**	6

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. This module aims mathematical analysis aims to introduce the student to the basic concepts and techniques of real analysis. 2. Exploration of the properties of mathematical numbers: mathematical analysis investigates the properties of real numbers, such as their order, completeness, and algebraic and topological properties. It delves into the structure of the real number system and its various subsets. 3. Rigorous understanding of calculus: mathematical analysis provides a rigorous foundation for calculus. It aims to give a precise definition of limits, continuity, which are fundamental concepts in calculus. 4. Study of mathematical functions: mathematical analysis focuses on the behavior and properties of functions defined on the real numbers. 5. Development of mathematical reasoning and proof-writing skills: mathematical analysis is a discipline that emphasizes rigorous proofs and logical reasoning. It aims to develop students' ability to construct and present mathematical arguments in a precise and coherent manner.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	10. Understanding of the properties of real numbers: Students will learn about the order and completeness properties of real numbers, the algebraic structure of real numbers, and the topological properties of real line; 11. Understanding of fundamental concepts, such as sequences, series, limits, convergence, and continuity; 12. Ability to construct and present rigorous mathematical proofs; 13. Learn to apply real analysis techniques to solve mathematical problems. This includes finding limits, studying the convergence of sequences and series, determining the continuity of functions, and analyzing the behavior of functions; 14. Preparation for advanced mathematics: Mathematical analysis serves as a foundation for many advanced mathematical subjects. Students will be prepared to pursue further studies in areas such as complex analysis, functional analysis, measure theory, and differential equations, where the concepts and techniques of real analysis are extended and applied in more advanced contexts.
Indicative Contents المحتويات الإرشادية	Chapter One Definition of mathematical analysis, its most important applications, The real numbers, the relationship between the field of rational numbers and the field of real numbers, Archimedes property, the set of real numbers, the concept of order, upper and lower bounds, The concept of completeness, the complete ordered field, the density of relative numbers, the density of irrational numbers. [15 hrs] Chapter Two Real number sequences, convergent sequences, bound sequences, monotonic sequences, alternating sequences, Real number series, types of series, convergence of series, tests for convergence of infinite series. [15 hrs] Chapter Three Metric spaces, topological concepts, convergence in metric spaces, Some tests of convergence, absolute convergence and conditional test, multiplication of series. [12 hrs]

	Chapter Four Compactness, limits of functions and some important theorems in limits. [12 hrs] Chapter Five Continuity, Continuous maps, Real Continuous maps space, Real maps defined on compact spaces, uniform continuity, Mean value property (examples with top applications). [12 hrs] Chapter Six Function sequences and series, point convergence and regular convergence, Infinite series of functions, power series. [12 hrs]

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

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative	**Quizzes**	3	25% (25)	4, 7, 10	LO #1, 2, 3, 4 and 5

assessment	**Assignments**	3	5% (5)	2, 12,5	LO # 1, 2, 3, 4 and 5
	Seminar / Lab.	1	10% (10)	6	
	Report				
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	LO # 1-3
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Real numbers: $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$, $\mathbb{R}$; properties of an ordered field
Week 2	Ordered sets; upper and lower bounds; supremum and infimum
Week 3	Completeness property; Archimedean property
Week 4	Irrational numbers; density of $\mathbb{Q}$ in $\mathbb{R}$
Week 5	Sequences; boundedness; monotonicity
Week 6	ε–N definition of convergence; uniqueness of limits; examples
Week 7	Cauchy sequences; completeness of $\mathbb{R}$; important consequences and applications
Week 8	Mid-term Exam + Tests for convergence of infinite series
Week 9	Nested interval theorem; related results
Week 10	Sum, product, and quotient of convergent sequences
Week 11	Infinite series; partial sums; concept of convergence
Week 12	Geometric series; divergence test; harmonic series (with examples)
Week 13	Absolute convergence; conditional convergence
Week 14	Metric spaces; open balls; convergence in metric spaces
Week 15	Open and closed sets; compactness; contraction mapping and fixed-point theorem (briefly)
Week 16	**Preparatory week before the final Exam**
Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	

Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Adel Ghassan Naoum, Introduction to Mathematical Analysis, Mosul University Press, 1986	Yes
Recommended Texts	Rudin, W., Principles of Mathematical Analysis, 3rd ed., 1976, McGraw-Hill, Inc., New York, USA.	Yes
Websites	https://en.wikipedia.org/wiki/Mathematical_analysis	

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Operations Research**			**Module Delivery**	
Module Type	**E**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 302**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		UGIII	**Semester of Delivery**		5
Administering Department		Math	**College**	CCSM	
Module Leader	Dr. Thekra Ibraheem Latif		**e-mail**	Thekra.i.latif@tu.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Hind Khaled Kolaib		**e-mail**	Hind.Khaled@tu.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		2025\9\4	**Version Number**		**1**

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	8. Building a mathematical model. 9. Solve problems with two variables. 10. He touched on the types of solution of the mathematical model. 11. Solve a problem with more than two variables. 12. Description of inert and artificial variables. 13. Solve a problem using the simplex method. 14. Solve problems using M-Big method.

	15. Sensitive analysis of the mathematical model. 16. **Mid Examination.** 17. corresponding form. 18. Solve models using inverses. 19. Solve problems using the sensitive analysis method. 20. Linear programming applications. 21. **Final Examination.**
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding of the fundamental principles and methodologies underlying Operations Research. 2. Ability to apply mathematical models and analytical techniques to solve complex decision-making problems. 3. Familiarity with tools and software commonly used in Operations Research, such as linear programming, network analysis, and simulation. 4. Ability to formulate and solve optimization problems, including linear and nonlinear programming, integer programming, and dynamic programming. 5. Knowledge of stochastic models and their application in decision-making under uncertainty. 6. Understanding of queueing theory and its application in service operations. 7. Ability to analyze and optimize supply chain systems, including inventory management, transportation, and facility location. 8. Familiarity with game theory and its application in strategic decision-making. 9. Ability to communicate effectively and present technical findings to both technical and non-technical audiences. 10. Overall, the learning outcomes of an Operations Research module aim to equip students with the skills and knowledge necessary to model, analyze, and optimize complex systems in a variety of industries and domains.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part [I] Introduction, Theoretical models for linear programming problems, Numerical procedures for soling linear programming problems, Graphical method, Basic and Basic feasible solution, Simplex method (slack variables), Simplex method (artificial variables), Simplex multipliers method, Introduction, Dual method and Dual theorem, The relationship between the two models solution and what results from them, The inverse basis method**.** [17 hrs] Part [II] Sensitivity analysis method, Changes in the right side of the constraints, Changes in objective function coefficients, Introduction, find a primary solution, West corner method, least cost method, Vogle's method, Unbalanced transport problems, The total of the sources contains the greatest goals you need, the total of the sources is less than what the ends need, Find the optimal solution to the transport problem, Examples of the optimal solution. [20 hrs]

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

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	2, 6, 10	LO #1, 5,7
	Assignments	3	5% (5)	4,8, 9	LO #1-10
	Projects / Lab.				
	Report	1	10% (10)	12	LO #11 , 12
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-8
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Introduction, Theoretical models for linear programming problems.**
Week 2	**Numerical procedures for solving linear programming problems, Graphical method.**

Week 3	**Basic and Basic feasible solution.**
Week 4	**Simplex method (slack variables).**
Week 5	**Simplex method (artificial variables).**
Week 6	**Simplex multipliers method.**
Week 7	**Introduction , Dual method and Dual theorem.**
Week 8	**The relationship between the two models solution and what results from them, The inverse basis method.**
Week 9	**Mid Examination.**
Week 10	**Sensitivity analysis method , Changes in the right side of the constraints , Changes in objective function coefficients.**
Week 11	**Introduction, Find a primary solution , West corner method , Least cost method.**
Week 12	**Vogle's method, Unbalanced transport problems.**
Week 13	**The total of the sources contains the greatest goals you need, The total of the sources is less than what the ends need.**
Week 14	**Find the optimal solution to the transport problem.**
Week 15	**Examples of the optimal solution**
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**Linear and Nonlinear Programming, Fourth Edition** **David G. Luenberger, Yinyu Ye, (2008)**	Yes
Recommended Texts	**Engineering Optimization Theory and Practice, Fourth Edition ,** **Singiresu S. Rao, (2009)**	No
Websites		

Grading Scheme
مخطط الدرجات

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Mathematical Statistics 1**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 303**				
ECTS Credits	**6.00**				
SWL (hr/sem)	**150**				
Module Level	UGIII		**Semester of Delivery**	5	
Administering Department	Math		**College**	CCSM	
Module Leader	Mundher A. Khaleel		**e-mail**	mun880088@tu.edu.iq	
Module Leader's Acad. Title	Prof.		**Module Leader's Qualification**	PhD	
Module Tutor			**e-mail**		
Peer Reviewer Name	Ahmed Maher Salih		**e-mail**	ahmed.m.salih@tu.edu.iq	
Scientific Committee Approval Date	4/9/2025		**Version Number**	1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Probability	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	• Recognize the basic concepts of mathematical statistics. • Recognize distributions and their importance. • Recognize random sampling distributions. • Know the applications of distributions in various sciences.

	• Recognize the principle of Order Statistics and their distributions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Distributions of functions of random variables and the methods used to obtain them, sampling distributions, and the distributions of order statistics. The topic also includes limit distributions, particularly the Central Limit Theorem. In addition, it covers point estimation and the main methods for deriving estimators, such as the Method of Moments, the Least Squares Method, and the Maximum Likelihood Method. Finally, it discusses the key properties of point estimators, including unbiasedness, consistency, sufficiency, completeness, uniqueness, and efficiency.**
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• **Pre-class preparation:** The instructor should prepare lessons thoroughly and ensure a solid understanding of the material before teaching it. • **Use of computer applications:** Statistical software and computational tools can be used to facilitate understanding and learning, and to help students work with practical examples and real applications. • **Use of examples and exercises:** Various examples and exercises can be used to clarify concepts, enhance understanding, and train students to solve statistical problems. • **Interaction with students:** The instructor should interact with students, listen to them, guide them, and answer their questions and inquiries. • **Use of graphical representations:** Graphs and different statistical plots can be used to illustrate concepts and show relationships within the data. • **Project implementation:** Statistical projects can be assigned at the end of the semester to apply learned concepts and skills to real-world problems. • **Exam preparation:** Students should prepare well for exams by solving exercises, practicing examples, and reviewing the material before tests.

Student Workload (SWL) الحمل الدراسي للطالب			
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 تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**3**	**25% (25)**	5,7 and 10	LO #1, 2, 10 and 11
	Assignments	**3**	**5% (5)**	2,6 and 12	LO # 3, 4, 6 and 7
	Projects / Lab.				
	Report	**1**	**10% (10)**		
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) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	• **Distributions of functions of random variables: Distribution function technique**
Week 2	• **Distributions of functions of random variables: Single-variable transformation technique**
Week 3	• **Distributions of functions of random variables: Multivariable transformation technique**
Week 4	• **Distributions of functions of random variables: Moment-generating function technique**
Week 5	• **Sampling distributions of the mean**
Week 6	• **Sampling distributions of the mean: Finite populations**
Week 7	• **Sampling distributions: Chi-square distribution**
Week 8	• **Sampling distributions: t-distribution**
Week 9	• **Sampling distributions: F-distribution**
Week 10	• **Sampling distributions: Order statistics**
Week 11	• **Limit distributions: Central Limit Theorem**
Week 12	• **Methods for finding estimators: Method of Moments**
Week 13	• **Methods for finding estimators: Least Squares Method**
Week 14	• **Methods for finding estimators: Maximum Likelihood Method**
Week 15	• **Properties of point estimators (Unbiasedness, Consistency, Sufficiency, Completeness, Efficiency, Uniqueness)**

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

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**John E. Freund's Mathematical Statistics with Applications** by Irwin Miller Marylees Miller, Pearson Education 2014	
Recommended Texts	**Mathematical Statistics with Applications**, Seventh Edition By Dennis D. Wackerly, Thomson Higher Education 2008	
Websites		

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Numerical Optimization**	**Module Delivery**	
Module Type	**C**	☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**MS 304**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		

Module Level	UGIII	**Semester of Delivery**	5
Administering Department	Math	**College**	CCSM
Module Leader	Nazar Khalaf Hussein	**e-mail**	nazar.dikhil@tu.edu.iq
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	Ph.D
Module Tutor	Rana hazim jasem	**e-mail**	Rana.hazim@tu.edu.iq
Peer Reviewer Name	Laith Khaleel	**e-mail**	Dr.laithkhaleel@tu.edu.iq
Scientific Committee Approval Date	2025\9\4	**Version Number**	1

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

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

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1- This course deals with the basic concepts of unrestricted one-variable optimization problems. 2- Providing the student with skills in solving unrestricted optimization problems with one variable using different methods and finding the optimal solution to the problem. 3- Finding convexity, concavity, and maximum and minimum points for unrestricted problems with one variable. 4- Understanding and solving Taylor series with one variable
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 learning outcomes, ideally equal to the number of weeks of study. 1- The student writes some terms 2- The student describes the model 3- To distinguish between the models 4- To explain the mathematical formula to the student 5- The student summarizes the steps for solving the mathematical formula 6- The student presents a problem from reality 7- That the student compare the methods of solution 8- To rearrange the solution method 9- To plan how to use the appropriate method in the solution 10- The student applies the model to a realistic situation 11- The student reveals the error in the form. 12- The student should schedule the results
Indicative Contents المحتويات الإرشادية	Basic concepts: Optimization, Statement of an optimization problem, One variable unconstrained optimization problem, Definition: local minimum value, local maximum value , global minimum value , global maximum value, Concave and convex functions of a one variable, Necessary and sufficient conditions of a one variable functions , Taylor' s series expansions [10 h] Methods of One variable unconstrained optimization problem Dichotomous method, introduction, Algorithm, examples. [10] Interval halving method , introduction , Algorithm, examples. [10] Fibonacci method, introduction , Algorithm, examples. [10] Golden section method , introduction , Algorithm, examples. [10] Quadratic interpolation method , introduction , Algorithm, examples. [10] Cubic interpolation method , introduction , Algorithm, examples. [10] Newton method , introduction , Algorithm, examples. [5] Quasi newton method , introduction , Algorithm, examples. [6]

	Secant method , introduction , Algorithm, examples. [6]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Stimulating and encouraging students to understand the role of the game theory in the developed knowledge society and to become aware of the scientific applications of the competitive game theory using the computer through 1- Determine the scientific concepts and principles that will be learned and put forward in the form of a question or problem. 2- Preparing the educational materials needed to implement the lesson. 3- Formulating the problem in the form of sub-questions so as to develop the skill of imposing assumptions among the learners 4- Determine the discovery activities or experiments that the learners will carry out. 5- Evaluate learners and help them apply what they have learned in situations

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment التقييم التكويني	**Quizzes**	3	25% (25)	4-6-10	LO #1, #2 and #7, #8
	Assignments	3	5% (5)	3-5-12	LO #3, #4 and #5, #6, #8
	Projects / Lab.				
	Report	1	10% (10)	13	LO #5, #7 and #8
Summative assessment التقييم التلخيصي	**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)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Basic concepts: Optimization, Statement of an optimization problem, One variable unconstrained optimization problem, Definition: local minimum value, local maximum value , global minimum value , global maximum value
Week 2	Concave and convex functions of a one variable, Necessary and sufficient conditions of a one variable functions ,
Week 3	Methods of One variable unconstrained optimization problem Dichotomous method, introduction , Algorithm, examples
Week 4	Interval halving method , introduction , Algorithm, examples.
Week 5	Fibonacci method, introduction , Algorithm, examples.
Week 6	Mid-term Exam
Week 7	Golden section method , introduction , Algorithm, examples.
Week 8	Direct Roots methods, Newton method

Week 9	Quasi-Newton method, examples
Week 10	Secant method, examples
Week 11	Convex set and some theorem
Week 12	Determine the function for many examples is convex or concave or stritly convex or stritly concave.
Week 13	Define Hessian matrix and test the matrix (positive ,negative or indefinite)
Week 14	Example of Positive definite
Week 15	Preparatory week before the final Exam
Week 16	Preparatory week before the final Exam

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Operations research , Gupta & Hira, 2008	Yes

النصوص المطلوبة		
Recommended Texts	Engineering optimization, Rao, 2009	No
Websites		

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performanceأداء مذهل
	B - Very Good	جيد جدا	80 - 89	Above average with some errors فوق المتوسط مع بعض الأخطاء
	C - Good	جيد	70 - 79	Sound work with notable errors العمل السليم مع أخطاء ملحوظة
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings عادل ولكن مع نواقص كبيرة
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria العمل يلبي الحد الأدنى من المعايير
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded مطلوب المزيد من العمل ولكن الائتمان الممنوح
	F – Fail	راسب	(0-44)	Considerable amount of work required قدر كبير من العمل المطلوب

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Numerical Analysis II**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 305**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	UGIII		**Semester of Delivery**	5	
Administering Department	Math		**College**	CCSM	
Module Leader	Firas Adel Fawzi		**e-mail**	Firasadil01@tu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Sarah Majeed Talab		**e-mail**	sara.m.taleb@tu.edu.iq	
Peer Reviewer Name	Nazar K. Hussein		**e-mail**	nazar.dikhil@tu.edu.iq	
Scientific Committee Approval Date	2025\9\4		**Version Number**	1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**MS 206** Numerical Analysis I	**Semester**	4
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	22. The student's teaching of Numerical Analysis 2 aims at his knowledge of the numerical methods for solving a problem that may be difficult to find an analytical solution.

	23. Study numerical methods to find the numerical integral with their application in solving examples. 24. Study the error analysis of the approximate solutions of these numerical methods to make it easier for us to know which numerical methods are better in finding the value of numerical integration. 25. To understand the methods of solving ordinary differential equations numerically with different examples. 26. To understand the least square approximation ,linear, nonlinear approximation for x and for constants. 27. Writing algorithms for those numerical methods and programming them using MatLab language practically.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	15. The student learns to derive the iterative form of numerical methods with the error form. 16. The student learns how to find the approximate value of the integral using numerical methods and compares it with the real value of the integral. 17. Find the numerical solution to the ordinary differential equations by the numerical methods. 18. Learn to solve initial value problems and compare it with the real solution 19. Learns to find the best fit function for a given data using least squares approximation for both linear and nonlinear form. 20. Teach the student how to write algorithms for these numerical methods. 21. Understand some elements of computer programming. 22. How to write a program of the numerical methods using MatLab language practically.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Numerical Integration Introduction to Numerical integration, derivative of Trapezoidal rule with an error form, solve an example, write algorithm, derivative of 1/3and 3/8 Simpson's rule with a study of error analysis and solving an example and write algorithm, Midpoint Method with solving an example. [12 hrs] Romberg method and solving an example and write algorithm, Gauss-Legendre with solving different examples Closed Newton-Cotes methods.[10 hrs] A review of the language Matlab, Write program of Trapezoidal rule , Write program of 1/3 Simpson's rule , Write program of 3/8 Simpson's rule , Write program of Midpoint method, Write program of Romberg method, Solving examples by programs.[9 hrs] Part B - Numerical Solution of Ordinary Differential Equations Existence and uniqueness theorem , Numerical Methods: Derivative of explicit Euler's method with order of error solving the examples and write an algorithm of explicit Euler's method, Derivative of implicit Euler's method and solving an example and

	write algorithm.[10 hrs] Taylor series method and solving examples and write algorithm, twice and fourth order Runge-Kutta methods and solving examples and write algorithm.[12 hrs] Write algorithm and program of explicit Euler's method, Write program of implicit Euler's method, Write program of Fourth order Runge-Kutta method.[8 hrs] Part C - Least Square Method Approximation Introduction to least square approximation ,linear, solve examples, nonlinear approximation for x and for constants, exponential approximation with solving several examples , write algorithm.[8 hrs] Write program of exponential approximation, Solving examples by programs.[3 hrs]

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

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

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	5,8, 11	LO #1, 2, 3,4 and 6
	Assignments	3	5% (5)	4,7, 10	LO # 2, 3, 4 and 6
	Projects / Lab.				

	Report	1	10% (10)	14	LO # 3, 5 and 8
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1, 2 and 3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Numerical integration, derivative of Trapezoidal rule ,solve an example , write algorithm
Week 2	Derivative of 1/3 Simpson's rule with a study of error analysis , solve an example , write an algorithm
Week 3	Derivative of 3/8 Simpson's rule with a study of error analysis, solve an example, write algorithm
Week 4	Midpoint Method with solving an example , write a duty
Week 5	daily exam + Romberg method , solve an example , write algorithm
Week 6	Gauss-Legendre , solve different examples
Week 7	Closed Newton-Cotes methods , solve several examples
Week 8	**Mid-term Exam**
Week 9	Derivative of explicit Euler's method with order of error, solve the examples, write an algorithm of explicit Euler's method.
Week 10	Derivative of implicit Euler's method, solve an example , write algorithm, write a duty
Week 11	daily exam + Taylor series method , solve examples , write algorithm
Week 12	Fourth order Runge-Kutta method , solve examples , write algorithm
Week 13	Introduction to least square approximation ,linear, solve examples.
Week 14	Nonlinear approximation for x and for constants + Report
Week 15	exponential approximation , solve several examples
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	Principles of Numerical Analysis, Dr. Ali Muhammad Siddiq and Ibtisam Kamal Al-Din: 1986	Yes

Recommended Texts	Numerical Methods Using MatLab, fourth edition, John H.M. and Kurtis D.F. :2004	No
Websites		

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Mathematical Analysis II**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 306**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level		UGIII	**Semester of Delivery**		6
Administering Department			**College**		
Module Leader	Ahmed Maher Salih		**e-mail**	Ahmed.m.salih@tu.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		D.
Module Tutor	Hanan Nazar Sabbar		**e-mail**	Hanan.sabbar@tu.edu.iq	
Peer Reviewer Name		**Laith K.Shakair**	**e-mail**	Dr.laithkhaleel@tu.edu.iq	
Scientific Committee Approval Date		**10/01/2026**	**Version Number**	**1**	

Relation with Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MS 301	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	23. Mathematical analysis aims to introduce the student to the basic concepts and techniques of real analysis. 24. Understanding Differentiation helps students develop an understanding of how a function's output changes in response to small changes in its input. 25. Analyzing Extrema: Differentiation enables the identification and analysis of critical points, which include local maxima and minima of a function. 26. Analyzing Graphs and Behavior: Differentiation provides valuable insights into the behavior of a function's graph. 27. Approximating Areas: Riemann integration allows us to approximate the area under a curve by dividing the region into smaller rectangles and summing their individual areas. The aim is to obtain a close approximation to the exact area. 28. Understanding Measurable Sets: Measure theory aims to study measurable sets and their properties. Measurable sets are subsets of a measure space. The aim is to define and characterize measurable sets and explore their properties. 29. Generalizing Integration: The Lebesgue integral aims to provide a more general and flexible framework for integration compared to the Riemann integral. 30. Overcoming Riemann's Limitations: The Lebesgue integral aims to overcome the limitations of the Riemann integral, such as the inability to integrate functions with unbounded or discontinuous points.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding of Rates of Change: Differentiation helps students develop a deep understanding of rates of change by examining how a function's output changes in response to small changes in its input. 2. Ability to Calculate Derivatives: Students learn how calculate derivatives by definition. 3. Student can analyze the behavior of functions. They learn to identify critical points, such as local maxima, local minima, and points of inflection, by examining the derivative and its properties. 4. Graphical Understanding: Students develop a graphical understanding of functions and their derivatives. 5. Students learn the definition of the Riemann integral. 6. Understanding of Area Approximation: Students learn how to approximate the area under a curve by dividing the region into smaller rectangles and summing their individual areas. 7. Calculation of Definite Integrals: Students learn how to calculate definite integrals using Riemann sums. 8. Comprehension of Measurable Sets: Students learn about measurable sets and the concept of measurability. 9. Students gain a deep understanding of the Lebesgue integral as a generalization of the Riemann integral. They learn the definition of the Lebesgue integral and the conditions under which it exists. 10. Students learn techniques to evaluate improper integrals using the Lebesgue integral, such as handling integrals over unbounded intervals or functions with infinite or discontinuous points. 11. Evaluation of Improper Integrals: Lebesgue integration allows for the evaluation

	of improper integrals, which may be divergent or undefined under Riemann integration.
Indicative Contents المحتويات الإرشادية	Chapter one The differentiation, the derivative, the space of differentiable functions, Fermat's principle, Rolle's theorem, mean value theorem, L'Hôpital's law, blancmange function, Taylor series, Taylor's theorem. [18hrs] Chapter Two Riemann integration, definition, Relation between continuous, monotonic functions and Riemann integration, Riemann integral as a positive non-variance monotonic linear transformation, space of Riemann integrable functions. [1 8hrs] Chapter Three Measure Theory, lengths of bounded open intervals, lengths of bounded open sets, Inner and outer measure of bounded sets, measurable bounded sets, example of an unmeasurable set, measure of unbounded sets, measurable functions, negligible sets, some important characteristics and theories about negligible sets. [18hrs] Chapter Four Lebesgue integration, some weaknesses points of Riemann integration, Lebesgue's theorem of Riemann integration, some properties of Lebesgue integration, the space of Lebesgue integrable functions. [1 8hrs]

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

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	4, 7, 10	LO #1, 2, 3, 7, 8, and 9
	Assignments	2	5% (5)	2, 12	LO # 1, 2, 3, 7, 8, and 9
	Projects / Lab.	1	10% (10)	6	
	Seminar				
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	LO # 1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Partitions of [a,b], subintervals, refinement of partitions
Week 2	Upper sums, lower sums, Darboux sums
Week 3	Refinement theorem, inequalities between sums
Week 4	Upper and lower integrals, ε-criterion for integrability
Week 5	Constant functions, step functions, bounded functions
Week 6	Continuous and monotone functions are Riemann integrable
Week 7	Definition, finite and countable sets, basic properties
Week 8	Mid-term Exam + Examples of an unmeasurable set
Week 9	Discontinuities and negligible sets
Week 10	Linearity, monotonicity, inequalities, absolute value
Week 11	Definition of derivative, differentiability and continuity
Week 12	Chain rule, increasing/decreasing functions, extrema
Week 13	Rolle's theorem, Mean Value Theorem, applications
Week 14	Antiderivatives, FTC Part I & II, evaluation of integrals
Week 15	Measure, measurable sets, Lebesgue measure, basic Lebesgue integral
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Adel Ghassan Naoum, Introduction to Mathematical Analysis, Mosul University Press, 1986	Yes
Recommended Texts	Rudin, W., Principles of Mathematical Analysis, 3rd ed., 1976, McGraw-Hill, Inc., New York, USA.	Yes
Websites	https://en.wikipedia.org/wiki/Mathematical_analysis	

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Mathematical Statistics II**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 307**				
ECTS Credits	**6.00**				
SWL (hr/sem)	**150**				
Module Level		UGIII	**Semester of Delivery**		6
Administering Department		Math	**College**	CCSM	
Module Leader	Mundher Abdullah Khaleel		**e-mail**	mun880088@tu.edu.iq	
Module Leader's Acad. Title		Prof.	**Module Leader's Qualification**		Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Ahmed Maher Salih	**e-mail**		
Scientific Committee Approval Date		10/1/2026	**Version Number**	1	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MS 303 Mathematical Statistics I	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	• **Understanding the fundamental concepts of bivariate random variables.** • **Analyzing the statistical relationships between bivariate variables.** • **Applying transformation methods to obtain the distributions of functions of random variables.** • **Identifying special bivariate distributions and their practical applications.**
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	• **Understanding bivariate distributions (joint, conditional, and independence) and distinguishing between discrete and continuous random variables.** • **Computing and analyzing product moments, covariance, and correlation, and interpreting the statistical relationships between two variables.** • **Applying transformation, convolution, and moment methods to obtain the distributions of functions and sums of random variables.** • **Using special bivariate distributions in statistical modeling, data analysis, and decision-making based on analytical results.**
Indicative Contents المحتويات الإرشادية	• **Introduction to Bivariate Random Variables:** Definitions, joint distributions, marginal distributions, and types of bivariate data (discrete and continuous). • **Bivariate Discrete and Continuous Distributions:** Joint probability mass functions (pmf), joint probability density functions (pdf), and their properties. • **Conditional Distributions and Independence:** Conditional pmf/pdf, conditional probabilities, conditional expectations, and criteria for independence of random variables. • **Product Moments and Covariance:** Moments of bivariate random variables, covariance and correlation, and interpretation of linear relationships. • **Variance of Linear Combinations:** Analysis of variance for linear combinations of two random variables and applications in statistical modeling. • **Moment Generating Functions (MGFs):** MGFs for joint distributions, properties, and use in finding distributions of sums. • **Functions of Random Variables:** Distribution of functions of one variable and two variables using transformation methods (univariate and bivariate cases). • **Convolution Method:** Deriving the distribution of the sum of independent random variables (discrete and continuous cases). • **Moment Method for Sums:** Using moments to derive distributions for

	sums of random variables. • **Special Bivariate Distributions:** Selected discrete distributions (e.g., bivariate Bernoulli, bivariate Poisson) and continuous distributions (e.g., bivariate normal, bivariate exponential). • **Applications in Statistical Modeling:** Practical implementation of bivariate distributions in real data analysis and decision-making contexts.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• **Interactive lectures to explain the fundamental concepts and bivariate distributions.** • **Problem-solving activities to enhance analytical thinking in joint and conditional distributions.** • **Collaborative group work to solve complex problems and applications involving bivariate variables.** • **Short projects and assignments to apply transformation and convolution methods to real data.**

Student Workload (SWL) الحمل الدراسي للطالب			
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 تقييم المادة الدراسية				
	Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**

Formative assessment	**Quizzes**	3	25% (25)	5, 7,10	LO #1, 2, 10 and 11
	Assignments	3	5% (5)	2, 12,3	LO # 3, 4, 6 and 7
	Projects / Lab.				
	Report	1	10% (10)		
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) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Two Random Variables
Week 2	Bivariate Discrete Random Variables, Bivariate Discrete Random Variables
Week 3	Conditional Distributions, Independence of Random Variables
Week 4	Product Moments of Bivariate Random Variables
Week 5	Covariance of Bivariate Random Variables
Week 6	Independence of Random Variables
Week 7	Variance of the Linear Combination of Random Variables + Mid Term
Week 8	Moment Generating Functions
Week 9	Conditional Expectations of Bivariate Random Variables
Week 10	Functions of Random Variables and Their Distribution
Week 11	Transformation Method for Univariate Case, Transformation Method for Bivariate Case
Week 12	Convolution Method for Sums of Random Variables
Week 13	Moment Method for Sums of Random Variables
Week 14	Some Special Discrete Bivariate Distributions
Week 15	Some Special Continuous Bivariate Distributions
Week 16	**Preparing for the Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered

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

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**John E. Freund's Mathematical Statistics with Applications** by Irwin Miller Marylees Miller, Pearson Education 2014	
Recommended Texts	**Mathematical Statistics with Applications**, Seventh Edition By Dennis D. Wackerly, Thomson Higher Education 2008	
Websites		

Grading Scheme
مخطط الدرجات

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Number Theory**			**Module Delivery**	
Module Type	**E**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**MS 308**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		UGIII	**Semester of Delivery**		6
Administering Department		Math	**College**	CCSM	
Module Leader	Rana Hazim Jasim		**e-mail**	rana.hazim@tu.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
Peer Reviewer Name		Thekra I. Latif	**e-mail**	Thekra.i.latif@tu.edu.iq	
Scientific Committee Approval Date		2026\1\10	**Version Number**	1	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	Number theory aims to introduce the student to the concepts of: 1. Divisibility 2. Linear congruence 3. Inverse square law 4. Introduce the student to Ferman's theorem and Wilson's theorem 5. Power sediments 6. Arithmetic functions 7. Dieuw-Watt equations.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding of the fundamental principles and methodologies underlying number theory. 2. Properties of Integers 3. The Rule of Good Order and Mathematical Induction 4. The Division Algorithm and the Greatest Common Divisor 5. Prime Numbers 6. The Fundamental Theorem of Arithmetic and Some of its Applications 7. The Concept of Congruence and its Basic Properties 8. Linear Congruences 9. Euler's and Ferma's Theorems
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part [I] Algorithmic division and greatest common divisor, examples and definitions Definitions and Examples Examples of Applications of the Theorem The Concept of Congruence and Its Basic Properties Examples of Applications of the Theorem Examples of Applications of the Theorem Examples of Applications of the Theorem Definitions and Examples. [hrs] Part [II] Quadratic Remainders and the Law of Binary Inverse Definitions and Examples Definitions and Examples Linear Diophantine Equations and Special Cases Definitions and Examples Definitions and Examples Definitions and Examples. [hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and

	expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	2, 6, 10	LO #1, 5,7
	Assignments	3	5% (5)	4 ,8, 9	LO #1-10
	Projects / Lab.				
	Report	1	10% (10)	12	LO #11 , 12
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-8
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Algorithmic division and greatest common divisor, examples and definitions
Week 2	Definitions and Examples
Week 3	Examples of Applications of the Theorem
Week 4	The Concept of Congruence and Its Basic Properties
Week 5	Examples of Applications of the Theorem
Week 6	Examples of Applications of the Theorem

Week 7	Examples of Applications of the Theorem
Week 8	Definitions and Examples
Week 9	Quadratic Remainders and the Law of Binary Inverse
Week 10	Definitions and Examples
Week 11	Definitions and Examples
Week 12	Linear Diophantine Equations and Special Cases
Week 13	Definitions and Examples
Week 14	Definitions and Examples
Week 15	Definitions and Examples

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

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

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	**Prof. Dr. Faleh bin Imran Al-Dosari, "Introduction to Number Theory", Umm Al-Qura University - Makkah Al-Mukarramah, 2007**	Yes
Recommended Texts	**William Stein," Elementary Number Theory: Primes, Congruences, and Secrets" ,November 16, 2011.** **Victor Shoup , "A Computational Introduction to Number Theory and Algebra", (Version 2), 2008.**	No
Websites		

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Chaos Theory**			**Module Delivery**	
Module Type	**E**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**MS 309**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		UGIII	**Semester of Delivery**		6
Administering Department		Math	**College**	CCSM	
Module Leader	Mizal Hamad Thawi		**e-mail**	mizalobaidi@tu.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Ph. D.
Module Tutor	Ali Shebl Ajeel		**e-mail**	Ali.shebl@tu.edu.iq	
Peer Reviewer Name		Omer Abdulrazzaq Abdullah	**e-mail**	omerabdulrazzaqa@tu.edu.iq	
Scientific Committee Approval Date		2026\1\10	**Version Number**	1	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims	1. Identify the basic concepts of chaos theory.

أهداف المادة الدراسية	2. Identify fixed points and their importance. 3. Identify fixed points and their stability. 4. Knowledge of the chaoticity in various sciences. 5. Identify the one dimensional chaos and its basis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Understand foundations of chaos theory 2- Define fixed points and stability 3- Analyze iterates graphically 4- Identify chaotic functions 5- Understand SDIC 6- Calculate Lyapunov exponent 7- Distinguish transitivity and strong chaos 8- Understand conjugacy 9- Study Cantor sets
Indicative Contents المحتويات الإرشادية	Indicative content includes the following:. Part A – Basic Concepts Iterates, fixed points, stability criteria, families of functions Part B – One Dimensional Chaos SDIC, Lyapunov exponent, transitivity, conjugacy Part C – Cantor Sets Cantor set, ternary set Part D – Advanced Topics Q–chaos, strong chaos

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

Learning Strategy for Chaos: Fixed points and their stability, families of Functions and their characteristics.

General Objective:

Enable students to understand various concepts of chaos, the importance of chaoticity in different fields of science

Educational Steps:

Phase 1: Basic Concepts

1. **Iterates of Functions.:**
   - Graphical Analysis of Iterates.
   - Fixed points.
   - Criteria for stability of fixed points.
2. **Families of functions:**
   - The family g .
   - The tent family.
   - Quadratic family.

Phase 2: One Dimensional Chaos.

1. **Sensitive dependence on initial conditions**
   - Define SDIC.
   - Example of SDIC.
2. **Lyapunov exponent.**
   - Define Lyapunov exponent.
   - Example of Lyapunov exp.
3. **Transitivity and strong chaos**
   - Define and theorems
   - example.
4. **Conjugacy**
   Theorems and examples

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	25% (25)	5, 10,12	LO #3 , LO# 6 , LO# 8
	Assignments	3	5% (5)	5, 7,12	LO # 3-4, LO#5 -8
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 1-9
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Fixed points

Week 2	Criteria for stability
Week 3	Periodic points
Week 4	Families of functions
Week 5	The tent family
Week 6	Quadratic family
Week 7	One dimensional Chaos
Week 8	Sensitive dependence on initial conditions + Mid Exam
Week 9	Lyapunov exponent
Week 10	Transitivity and strong chaos
Week 11	Conjugacy
Week 12	Cantor sets
Week 13	The cantor ternary set
Week 14	Strong chaos of functions
Week 15	Q – chaos
Week 16	**Preparatory week before the final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر: لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	

Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	○ Encounters with Chaos, and fractals, 3d ed. Denny Gulick ○ Discrete Chaos with applications in science and engineering, 2nd ed. ○ Saber N Elaydi	No
Recommended Texts		
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Subjects in Geometry**			**Module Delivery**	
Module Type	**E**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**MS 310**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	UGIII		**Semester of Delivery**	6	
Administering Department	Math		**College**	CCSM	
Module Leader	Azher Abbas Mohammad		**e-mail**	drazh64@tu.edu.iq	
Module Leader's Acad. Title	Ass .Prof.		**Module Leader's Qualification**	Ph. D.	
Module Tutor	Azher Abbas Mohammad		**e-mail**	drazh64@tu.edu.iq	
Peer Reviewer Name	Omer Abdulrazzaq Abdullah		**e-mail**	omerabdulrazzaqa@tu.edu.iq	
Scientific Committee Approval Date	2026\1\10		**Version Number**	1	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	6. Students must realize basic concepts in Euclidean geometry. 7. Learning a student's haw the Axiomatic system work with its contents, postulates, theorems, exercises. 8. Students must know a philosophy of Euclidean and non- Euclidean geometry. 9. Developing the ability of students in treat with a non-Euclidean geometry such as points, lines, surfaces, spaces which takes its meaning from the axiomatic system. 10. Providing students with experience and skills in treatment with the concepts in hyperbolic and Elliptic geometry 11. Providing students with experience and skills in treatment with the concepts in hyperbolic and Elliptic triangles and the triangular relations for them.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Learn about the history of geometry and its origins 2. Concepts of axiom, postulate and axiomatic systems 3. Dealing with the most important concepts of circles 4. Inversion concept with respect to a circle 5. Cross ratio concept 6. Developing of non-Euclidean concepts in geometry 7. Haw to measure a hyperbolic distance in Poincare space 8. Learning a parallelism concept in Poincare space 9. Haw to measure a vertical hyperbolic distance 10. Recognition the relation between the elements of hyperbolic right triangle 11. Recognition the relation between the elements of hyperbolic oblique triangle 12. Identifying the axiomatic system of elliptic geometry 13. Haw to calculate a elliptic distance on Riemann Sphere 14. Recognition the relation between the elements of elliptic right triangle 15. Recognition the relation between the elements of elliptic oblique triangle
Indicative Contents المحتويات الإرشادية	Indicative content includes the following:. <u>Part A – Euclidean axiomatic system</u> Euclidian geometry , Euclidean axiomatic system, some Euclidean theorems , Hilbert Axiomatic system , Some geometrical exercises. [12 hours] <u>Part B- geometry of pencil cycles and cross ratio</u> The power of point to the circle , the main axes of two cycles , Inversion of circles , some theorems and exercises , hyperbolic and elliptic pencil of circles, cross ratio with its properties and some examples. [12 hours]

	Part C- hyperbolic geometry The axiomatic system of hyperbolic geometry , points lines in Poincare plan , the hyperbolic distance between two points , parallel and orthogonal hyperbolic lines, the angel of parallelism , Right and oblique hyperbolic triangles relations and area [24 hours] Part D- Elliptic geometry The axiomatic system of elliptic geometry , points lines in Riemann Sphere , the elliptic distance between two points and stereographic projection, some theorems and exercises , Right and oblique elliptic triangles relations and area . [12 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course is characterized by developing the student's geometric concepts. This requires expanding his awareness and vision so that the student can accept and understand non-Euclidean geometries, which are based on a philosophy different from the Euclidean geometry that the student studied in previous educational stages. Some geometric facts take other forms of understanding and in non-Euclidean spaces, such as the Poincaré space or the Riemann sphere.. Teaching is mainly based on the home works that are given at the end of each week, and the student notes the interdependence between the serial topics of this course, in addition to assigning the student (or a group of students) to write one report and represent it as a seminar for the purpose of training in the use of scientific resources and the method of writing a subject in mathematics.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	25% (25)	5, 10,12	LO #3 , LO# 9 , LO# 11
	Assignments	3	5% (5)	3, 12,3	LO # 3-4, LO#8 -10
	Projects / Lab.				
	Report	1	10% (10)	12	LO # 5, 9 and 11
Summative assessment	**Midterm Exam**	2 hr	10% (10)	9	LO # 1-10
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Brief history of geometry and Euclidean Axiomatic system
Week 2	Hilbert Axiomatic system
Week 3	The power of a point with respect to a circle , pencil of hyperbolic and elliptic circles

Week 4	Inversion , inversion relations and some theorems and exercises
Week 5	Cross ratio of collinear four points on a line definitions and properties
Week 6	Fifth Euclidean postulate reward and axiomatic system of hyperbolic geometry in Poincare space
Week 7	Hyperbolic distance between two points in Poincare space
Week 8	Hyperbolic lines , parallel and meeting lines
Week 9	**Midterm Exam** , Hyperbolic vertical distance and angle of parallelism
Week 10	Hyperbolic right triangle ,relation between its elements with examples
Week 11	Hyperbolic oblique triangle ,relation between its elements with examples
Week 12	Introduction in elliptic geometry and Riemann unite sphere and stereographic projection
Week 13	The elliptic distance between two points on Riemann sphere and its projection in a plane
Week 14	Elliptic right triangle ,relation between its elements with examples
Week 15	Elliptic oblique triangle ,relation between its elements with examples
Week 16	**Preparatory week before the final exam.**

Delivery Plan (Weekly Lab. Syllabus): There is no Lab activities المنهاج الاسبوعي للمختبر:لا توجد فعاليات مختبرية	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	

Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. مال شهاب العطار , " مفاهيم اساسية في الهندسة", دار الحكمة للطباعة والنشر – بغداد 1992 2. خالد احمد السامرائي , " الهندسة الحديثة" , مطابع التعليم العالي – بغداد – 1988 3. محاضرات خاصة مأخوذة من عدد كبير من المصادر وحلول التمارين وملفتها موجودة ضمن الكلاسروم الخاص بالمرحلة	yes
Recommended Texts	عبد الوهاب احمد السراج ,"نظم البديهيات والهندسة " , مطابع جامعة الموصل 1985	yes
Websites	كتاب الهندسة اللااقليدية ومصادرة اقليدس الخامسة https://www.alfreed-ph.com/2018/03/No-Euclid-Engineering-pdf.html#google_vignette	

Grading Scheme

مخطط الدرجات

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

(0 – 49)	**F –** Fail	راسب	(0-44)	Considerable amount of work required

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

Course Description Form

1. Course Name:
Complex Analysis I
2. Course Code:
MS 401
3. Semester / Year: Semester 1
Semester 1/ 4 year
4. Description Preparation Date:
4-9-2025
5. Available Attendance Forms:
presence
6. Number of Credit Hours (Total) / Number of Units (Total):
60 hours/ 3 units
7. Course administrator's name (mention all, if more than one name)
Name: Akram S. Mohammed Email: akr_tel@tu.edu.iq
8. Course Objectives

Course Objectives	• For the student to become familiar with analytical functions and what is related to them in limits, continuity, and derivation. • To become familiar with the Cauchy-Riemann equations, their sufficient conditions, and harmonic functions • For the student to become familiar with prime, exponential, logarithmic, trigonometric, hyperbolic trigonometric functions, inverse trigonometric functions, and inverse hyperbolic trigonometric functions. • For the student to become familiar with definite integration and linear integration, in addition to the theorems related to integration.

9. Teaching and Learning Strategies

Strategy	

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	The complex analysis and complex plane	Definition of complex analysis with a historical overview, the most important	Lecture	Discussion and tests
2	4	The complex analysis and complex plane	applications of the topic, and the emergence of complex numbers with algebraic properties.		
3	4	The complex analysis and complex plane	Cartesian and polar representation of complex numbers,	Lecture	Discussion and tests
4	4	Topology in ℂ, functions, limit, and continuity	powers and roots	Lecture	Discussion and tests
5	4	Cauchy-Riemann theorem	Definition of topology at the complex plane with some examples,	Lecture	Discussion and tests
6	4	Analytical functions, harmonic functions	definition of functions with some examples, and theorems	Lecture	Discussion and tests
7	4	Mandelbrot and Julia sets	Cauchy-Riemann theorem with some examples	Lecture	Discussion and tests

8	4	Elementary Analytic functions	Definition of analytic and Harmonic functions with some examples and theorems	Lecture	Discussion and tests
9	4	Elementary Analytic functions	Definitions and examples with some theorems	Lecture	Discussion and tests
10	4	Complex integrations	Definition of analytic functions, polynomials	Lecture	Discussion and tests
11	4	Contours Integrals and Contour curves	trigonometric functions with some properties	Lecture	Discussion and tests
12	4	Definite integration, Contour Integration to solve definite Integrals	some examples, and the exponential function.	Lecture	Discussion and tests
13	4	Green's theorem, Cauchy's inequality	Rational functions, Logarithmic functions	Lecture	Discussion and tests
14	4	Cauchy-Corsa theorem, Cauchy integral formulas	Hyperbolic functions Some theorems and	Lecture	Discussion and tests
15	4	Liouville's theorem, Moreira's theorem	examples Green's theorem, Cauchy's inequality with some examples	Lecture	Discussion and tests

Course Description Form

1. **Course Name:**
Topology1
2. **Course Code:**
MS 402
3. **Semester / Year:**
Seven Semester/Fourth Stage
4. **Description Preparation Date:**
2025\9\4
5. **Available Attendance Forms:**
My presence and electronically by creating an electronic class through the platform
6. **Number of Credit Hours (Total) / Number of Units (Total)**
150 Hours\ 4 credits
7. Course administrator's name (mention all, if more than one name)
Name: Luma Saad Abdalbaqi Email: lumahhany1977@tu.edu.iq
8. Course Objectives

Course Objectives Study and knowledge of topological space and types of topological space	• ..... • ..... • .....
9. Teaching and Learning Strategies	
Strategy	Applying various teaching methods, including: • Giving lectures • Discussion and electronic communication methods

10. Course Structure

	Hou	Required Learning Outcomes			Evaluation method
1	4	Topological Spaces	Topological Spaces	Electronic lectures,	Written and daily exams with assignments and reports

2	4	Euclidean Spaces	Euclidean Spaces	Electronic lectures, smart board and pen	
3	4	Sets in Topological Spaces	Open and Closed Sets	Electronic lectures, smart board and pen	Written and daily exams with assignments and reports
4	4	Topological Spaces	Definition of Continuous Functions and Open	Electronic lectures, smart board and pen	Exam
5	4	Types of Topological Spaces	Types of Topological Spaces	Electronic lectures, smart board and pen	Written and daily exams with assignments and reports
6	4	Ordinary Topological Spaces	Examples and Theorems	Electronic lectures, smart board and pen	Exam
7	4	Separation Axioms	Zero Separation Axioms	Electronic lectures, smart board and pen	Written and daily exams with assignments and reports
8	4	Separation Axioms T1…	Hausdorff Separation Axioms	Electronic lectures, smart board and pen	Exam
9	4	Open Sets Function	Normal and Regular Spaces	Electronic lectures, smart board and pen	Written and daily exams with assignments and reports
10	4	Topological Isomorphism	Open Set and Local Functions	Electronic lectures, smart board and pen	Exam
11	4	Topological Properties	Topological Identicality	Electronic lectures, smart board and pen	Written and daily exams with assignments and reports
12	4	Multiplicative Topological Spaces	Topological Properties	Electronic lectures, smart board and pen	Exam
13	4	Some Types of Open Sets	Multiplied Topological Spaces	Electronic lectures, smart board and pen	Written and daily exams with assignments and reports
14	4	Some Types of Open Sets	Regular, Alpha, Prior, Semi and Beta	Electronic lectures, smart board and pen	Exam

15	4	Some Types of Continuous Alpha and A priori Functions	Continuous, Alpha and Prior Functions	Electronic lectures, smart board and pen	Written and daily exams with assignments and reports

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports ..... etc					

Course Description Form

1. **Course Name:**
Information Theory
2. **Course Code:**
MS 403
3. **Semester / Year:**
Seven Semester/Fourth Stage
4. **Description Preparation Date:**
2025\9\4
5. **Available Attendance Forms:**
Classroom or electronic by Web(google classroom)
6. **Number of Credit Hours (Total) / Number of Units (Total)**
150 Hours/3 credits
7. **Course administrator's name (mention all, if more than one name)**
Name: Azher Abbas Mohammad Email:drazh64@tu.edu.iq
8. Course Objectives
1.Teach the student the basics of uncertainty measurement and link them to the concept of probability. 2. Teach the student how to construct an uncertainty function and its most important properties. 3. Establish the concept of the joint uncertainty function H(X,Y) and the conditional uncertainty function H(Y⁄X) and their most important properties. 4. Deal with the concepts of memoryless channels and information transfer between the sender and receiver 6. Learn how to classify channels according to capacity. 7. Deal with decoding methods, or what is called the ideal viewer. 8. Identify information sources. The mathematical model of the information source. 9. Teach the student how to deal with finite and discrete-time Markov chains. 10. How to find the stationary or stable distribution of a finite Markov chain in discrete time and determine the rank of the information source.
9. Teaching and Learning Strategies
This course is characterized by its complete reliance on the concept of uncertainty and its relationship to probability as a concept of uncertainty regarding information, which is caused by the presence of confusion in the information between the sender and the receiver. With regard to this course, learning depends primarily on following the lectures, and therefore the focus will be on the student's daily preparation and the degree of his follow-up For lectures,

and its evaluation should not be limited to the test score, but rather the method of oral discussion and learning from mistakes should be adopted to improve the student's academic level through his understanding of mathematical concepts and their application in the fields. There is no objection to assigning a student or group of students to write reports on some topics related to the course by assigning them homework in a way that develops their knowledge of the most important sources approved in this course.

10. Course Structure

	Hours	Required Learning Outcomes			Evaluation method
1	4	To gain an understanding of the basic concepts in measuring information.	Introduction to measuring information	Theoretical Lecture and discussion	Oral tests and quizzes
2	4	Mastering the axiomatic system on which information theory is based	Axioms of uncertainty measurement	Theoretical Lecture and discussion	Oral tests and quizzes
3	4	Dealing with the uncertainty function	Uncertainty function interpretations	Theoretical Lecture and discussion	Oral tests and quizzes
4	4	Properties of the joint uncertainty function, its relationship to the channel, and the most important theories on this topic	Properties of both joint and conditional uncertainty functions	Theoretical Lecture and discussion	Oral tests and quizzes
5	4	How to measure information and its relationship to noise	Measurement of information between sender and receiver and interference in information	Theoretical Lecture and discussion	Oral tests and quizzes
6	4	Learn about the concept of channel	Discrete Memoryless channels	Theoretical Lecture and discussion	Oral tests and quizzes
7	4	How information is processed across the channel between sender and receiver	Processing information across channels	Theoretical Lecture and discussion	Oral tests and quizzes

8	4	How to measure channel capacitance and some theorems about capacitance	The concept of channel capacity and how to measure capacity	Theoretical Lecture and discussion	1st Midterm exam in previous weeks(1-7)
9	4	according to their capacity Identify the types of channels, distinguish between them, and classify them according to their capacity.	Classification of information channels	Theoretical Lecture and discussion	Oral tests and quizzes
10	4	Learn the most important theoretical methods of decryption with noise	Decoding Methods and the Ideal Observer	Theoretical Lecture and discussion	Oral tests and quizzes
11	4	How to build a mathematical model of information	Information sources	Theoretical Lecture and discussion	Oral tests and quizzes
12	4	Treating finite Markov chains as a source of information	Mathematical model of information sources: finite and discrete Markov chains	Theoretical Lecture and discussion	Oral tests and quizzes
13	4	Dealing with the most important theorems of Markov chains	Some definitions and theorems about Markov chains	Theoretical Lecture and discussion	Oral tests and quizzes
14	4	How to find the stationary distribution of a Markov chain with theorems and examples	Stationary distribution of a Markov chain	Theoretical Lecture and discussion	Oral tests and quizzes
15	4	How to measure the information or uncertainty of source information	Measurement of the information or uncertainty of source information	Theoretical Lecture and discussion	2nd Midterm exam

11. Course Evaluation

Couse evolution of a student including the sum of the following two parts

1. Formative Evolution 40%
   (2 exams through the term 30% and Oral discussion 5% and Quizzes 5%)
2. Summative Evolution
   (Final Exam 60%)

12. Learning and Teaching Recourses
Required textbook(Curricular book, if any): ROBERT ASH," *Information theory*", John Wiley & Sons, Inc. , (1965)
Main References (Sources): David J.C. MacKay, "*Information Theory, Inference, and Learning Algorithms*" , Cambridge University Press (2003)
Recommended book and references (Scientific journals, reports,...): Thomas M. Cover and joy A. Thomas, "*Elements of Information Theory* " , John Wiley & Sons, Inc. , (2006)
Electronic Reference ,Web sites: https://web.stanford.edu/~montanar/RESEARCH/BOOK/partA.pdf

Course Description Form

1. **Course Name:**
Functional analysis 1
2. **Course Code:**
MS 404
3. **Semester / Year:**
Seven Semester/Fourth Stage
4. **Description Preparation Date:**
2025\9\4
5. **Available Attendance Forms:**
Attendance
6. **Number of Credit Hours (Total) / Number of Units (Total)**
150 Hours/3 credits
7. **Course Administrator's Name (Mention all, if more than one name)**
Name: Prof. Dr. Laith K. Shaakir Email: dr.laithkhaleel@tu.edu.iq
8. Course Objectives

Functional analysis aims to introduce the student to the concepts of: vector spaces - metric spaces – normed spaces - convergence in normed spaces - Banach spaces. Linear functions defined on vector spaces and normed spaces	….. ….. …..

9. Teaching and Learning Strategies	
Strategy	

10. Course Structure

	Hours	**Required Learning Outcomes**			**Evaluation method**
1	4	Vector spaces, definitions and examples	Vector spaces	Lectures	Discussion and tests

2	4	definitions and examples about symmetric and absorbing sets	symmetric and absorbing sets	Lectures	Discussion and tests
3	4	Subspaces with some examples	Subspaces	Lectures	Discussion and tests
4	4	definitions and examples with some theorems	Examples and theorems	Lectures	Discussion and tests
5	4	Concept of Basis and dimension of vector spaces	Basis and dimension	Lectures	Discussion and tests
6	4	Definition of Direct sum with some examples	Direct sum	Lectures	Discussion and tests
7	4	Convex sets, theorems and examples	Convexity	Lectures	Discussion and tests
8	4	Convex hull, theorems	Convex hull	Lectures	Discussion and tests
9	4	Definition of normed spaces	normed spaces	Lectures	Discussion and tests
10	4	Concept of product normed spaces	product normed spaces	Lectures	Discussion and tests
11	4	Equivalent normed spaces with some examples	Equivalent normed spaces	Lectures	Discussion and tests

12	4	The relation between normed spaces and metric spaces	Metric and normed spaces	Lectures	Discussion and tests
13	4	Studying some important concepts such as open sets, closed sets, and others	some topological conceptes in normed spaces	Lectures	Discussion and tests
14	4	Definitions, examples and theorems	Interior points and closure for sets	Lectures	Discussion and tests
15	4	Banach spaces with examples	Banach spaces	Lectures	Discussion and tests

9. Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports ...etc	
10. Learning and Teaching Resouces	
Required textbooks (curricular books, if any)	**مقدمة في التحليل الدالي,نوري فرحان المياحي و علي حسين بتور, 2005**
Main references(sources)	1- **Introductory Functional Analysis With Applications "Kreyszig1978 ,** 2- **Introduction To Functional Analysis " by Sharma J.Vasishtha A.R, 1975**
Reconnended books and references (scientific journals, reports,...)	
Electronic references, websites	

Course Description Form

1. **Course Name:**
Cryptography
2. **Course Code:**
required
3. **Semester / Year:**
Fourth stage, Seven semester
4. **Description Preparation Date:**
2025/9/4
5. Available Attendance Forms:
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hours
7. Course administrator's name (mention all, if more than one name)
Name: Asst. Lecturer Dr. Narmin Jamal Khaleel Email: narmin.j.khaleel@tu.edu.iq
8. Course Objectives

The course aims to introduce students to the fundamental concepts of both modern and classical cryptography, with emphasis on the mathematical foundations upon which security systems are built. The course covers cryptographic systems, key management, digital signatures, hash functions, and practical applications of cryptography in information security.	....

9. Teaching and Learning Strategies

Strategy	

10. Course Structure

	Hours	Required Learning Outcomes			Evaluation method
1	4	Introduction to Cryptography	Definition of Cryptography	Lectures	Discussion and tests

2	4	Classical encryption & Caesar Cipher	Types of classical ciphers including Caesar Cipher	Lectures	Discussion and tests
3	4	Transposition Systems	Transposition ciphers	Lectures	Discussion and tests
4	4	Route Algorithms	Path-based transposition	Lectures	Discussion and tests
5	4	Column Transposition	Columnar transposition	Lectures	Discussion and tests
6	4	Substitution Ciphers	Substitution encryption	Lectures	Discussion and tests
7	4	Affine and Multiplicative Ciphers	Affine & Multiplicative Ciphers	Lectures	Discussion and tests
8	4	Applied examples on Affine Cipher	Practical examples of Affine Cipher	Lectures	Discussion and tests
9	4	Mixed Alphabet & Key Word Mixed	Mixed Alphabet Cipher & Keyword-based substitution	Lectures	Discussion and tests
10	4	Transposed Keyword & Homophonic Cipher	-	Lectures	Discussion and tests
11	4	Applied examples on Homophonic Cipher	Practical examples	Lectures	Discussion and tests
12	4	Morse Code Cipher	Morse Cipher	Lectures	Discussion and tests

13	4	Additional Applied Examples	Practical examples	Lectures	Discussion and tests
14	4	Extended Application of Morse Code	Extended practice (Morse Code)	Lectures	Discussion and tests
15	4	Stream Cipher	Stream Cipher	Lectures	Discussion and tests

11. Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports ...etc	
12. Learning and Teaching Resouces	
Required textbooks (curricular books, if any)	
Main references(sources)	3- **Classical Cryptography Course Notes – Helen Fouché** 4- **Cryptanalysis – Helen Gaines, 1956**
Reconnended books and references (scientific journals, reports,...)	
Electronic references, websites	

Course Description Form

1. Course Name:
Complex Analysis II
2. Course Code:
MS 406
3. Semester / Year:
Semester 2/ 4 year
4. Description Preparation Date:
10-1-2026
5. Available Attendance Forms:
presence
6. Number of Credit Hours (Total) / Number of Units (Total):
3 units /60 hours
7. Course administrator's name (mention all, if more than one name)
Name: Akram S. Mohammed Email: akr_tel@tu.edu.iq
8. Course Objectives

Course Objectives	• For the student to become familiar with analytical functions and what is related to them in limits, continuity, and derivation. • To become familiar with the Cauchy-Riemann equations, their sufficient conditions, and harmonic functions • For the student to become familiar with prime, exponential, logarithmic, trigonometric, hyperbolic trigonometric functions, inverse trigonometric functions, and inverse hyperbolic trigonometric functions. • For the student to become familiar with definite integration and linear integration, in addition to the theorems related to integration.

9. Teaching and Learning Strategies

Strategy	

10. Course Structure

	Hours	Required Learning Outcomes			Evaluation method
1	4	Complex integrations	Definition of complex integration with some theorems and examples	Lecture	Discussion and tests
2	4	Contours Integrals and Contour curves	The basic theorems of contour integrals with some examples	Lecture	Discussion and tests
3	4	Definite integration, Contour Integration to solve definite Integrals	Some theorems and examples	Lecture	Discussion and tests
4	4	Green's theorem, Cauchy's inequality	Green's theorem, Cauchy's inequality with some examples	Lecture	Discussion and tests
5	4	Cauchy-Corsa theorem,	Theorems and examples of Cauchy-Corsa theorem	Lecture	Discussion and tests
6	4	Cauchy integral formulas	Cauchy's integral formulas	Lecture	Discussion and tests
7	4	Liouville's theorem, Moreira's theorem	Liouville's theorem, Moreira's theorem with some examples	Lecture	Discussion and tests

8	4	The average value theorem, Mean Value Theorem	The average value theorem of Chaos	Lecture	Discussion and tests
9	4	Basic theorem of algebra	the basic theorem in algebra with its result and properties.	Lecture	Discussion and tests
10	4	Sequence and series	power series	Lecture	Discussion and tests
11	4	Sequence and series	Series expansions of analytic functions	Lecture	Discussion and tests
12	4	Laurent series	Analytic continuation, Laurent series	Lecture	Discussion and tests
13	4	Singularities and the residue	Singularities and the residue theorem	Lecture	Discussion and tests
14	4	the argument principle	the argument principle	Lecture	Discussion and tests
15	4	Improper integrals	Improper integrals	Lecture	Discussion and tests

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports ..... etc					

Course Description Form

1. **Course Name:**
Topology 2
2. **Course Code:**
MS 407
3. **Semester / Year:**
Eight Semester/Fourth Stage
4. **Description Preparation Date:**
2026\1\10
5. **Available Attendance Forms:**
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
150 Hours\ 4 credits
7. Course administrator's name (mention all, if more than one name)
Name: prof . Luma Saad Abdalbaqi Email: Lumahhany1977@tu.edu.iq
8. Course Objectives

Course Objectives	Identify the concepts and basics of statement theory
9. Teaching and Learning Strategies	
Strategy	Sudden daily and continuous weekly tests. -Exercises and activities in the classroom. -Guiding students to some sources that contain examples and exercises to benefit from them. Managing the lecture in an applied manner linked to the reality of daily life to attract the student to the topic of the lesson without straying from the core of the topic so that the material is flexible and amenable to understanding and analysis. Assigning the student to some group activities and duties. Allocate a percentage of the grade to daily assignments and tests.

10. Course Structure					
	Hou	Required Learning Outcomes			Evaluation method
First	4	Topological Spaces:	Definition and Examples	theoretical	General questions and discussion
Second	4	Compactness: Compact	Covers ,compact sets , locally compact	theoretical	General questions and discussion
Third	4	Compact Spaces	(Definition and Examples)	theoretical	General questions and discussion
Fourth	4	The relationship of compact spaces to Hausdorff space	(Definition and Examples)	theoretical	General questions and discussion
Fifth	4	Locally Compact Spaces	(Definition and Examples)	theoretical	Quiz
Sixth	4	Finite intersection property and its relation to compact spaces	(Definition and Examples)	theoretical	General questions and discussion
Seventh	4	Heine-Paul theorem and its weakness in space	Definition and Examples	theoretical	General questions and discussion
Eighth	4	Connectedness	Connected Topological Spaces,.	theoretical	General questions and discussion
Ninth	4	Not Connected Topological Spaces,.	Separated sets , Examples	theoretical	General questions and discussion
Tenth	4	Path-wise Connected Spaces	connected sets, locally connected	theoretical	General questions and discussion
Eleventh	4	Locally connected Spaces	(Definition and Examples)	theoretical	Quiz
Twelfth	4	Connected Space Applications	mean value theorem	theoretical	General questions and discussion
Thirteenth	4	Path-connected spaces	(Definition and Examples)	theoretical	General questions and discussion
Fourteenth	4	homotopy theory	Introduction to homotopy theory and homotopy functions	theoretical	General questions and discussion
Fifteenth	4	Fundamental group	Understand the concept of group and some examples	theoretical	General questions and discussion

~~Distributing the score out of 100 according to the tasks assigned to the student such as daily~~ preparation, daily oral, monthly, or written exams, reports ..... etc					

Sharma J.N,Topology, Krishna Prakashan Media P Ltd , 2003

وليم بيرفن,ترجمة عطا الله ثامر العاني, أساسيات التبولوجيا العامة, جامعة بغداد-العراق, 1986.

عبد ربه محمد اسليم, فقه التبولوجيا,فلسطين, 1999.

Course Description Form

1. Course Name:	
Graph theory	
2. Course Code:	
MS 408	
3. Semester / Year:	
Second/ 4 year	
4. Description Preparation Date:	
10/1/2026	
5. Available Attendance Forms:	
Official working hours	
6. Number of Credit Hours (Total) / Number of Units (Total)	
60	
7. Course administrator's name (mention all, if more than one name)	
Name: Dr. Narmin Jamal Khaleel Email: Narmin.j.khaleel@tu.edu.iq	
8. Course Objectives	
Course Objectives	Identify the concepts and basics of statement theory .....
9. Teaching and Learning Strategies	
Strategy	-Sudden daily and continuous weekly tests. -Exercises and activities in the classroom. -Guiding students to some sources that contain examples and exercises to benefit from them. Managing the lecture in an applied manner linked to the reality of daily life to attract the student to the topic of the lesson without straying from the core of the topic so that the material is flexible and amenable to understanding and analysis. Assigning the student to some group activities and duties. Allocate a percentage of the grade to daily assignments and tests.

10. Course Structure

	Hours	Required Learning Outcomes			Evaluation method
First	4	Graph, order and size and simple, Multiple graph, and sub graph	Graph Concepts	theoretical	Through tests, general questions, and discussion
Second	4	Directed and undirected graph	Graph Concepts	theoretical	General questions and discussion
Third	4	Concepts of adjacent vertex and degree of vertex with some of examples	Adjacent vertex, degree of vertex	theoretical	General questions and discussion
Fourth	4	Some of its application	The first theorem of graph	theoretical	General questions and discussion
Fifth	4	Some of its application and theorems of degree	Degree sequences	theoretical	Quiz
Sixth	4	Intersection of graphs, complement of graph	Operations on the graph	theoretical	General questions and discussion
Seventh	4	Product of graphs, composition of graphs	Operations on the graph	theoretical	General questions and discussion
Eighth	4	Definitions, theorems and examples	Path, connected, strongly connected, weakly connect graphs	theoretical	Quiz
Ninth	4	Definitions, theorems and examples	Isomorphism of graph, self complementary graph	theoretical	General questions and discussion
Tenth	4	Definition of walk, open and closed walk, cycle path	Walk	theoretical	Monthly exam
Eleventh	4	Some important matrix, adjacent matrix, path matrix and	Matrix	theoretical	General questions and discussion

		incidence matrix			
Twelfth	4	Definitions, theorems and examples	Bipartite graph and complete	theoretical	General questions and discussion
Thirteenth	4	Definitions and some of its applications	Loop and circuits and circuit matrix	theoretical	General questions and discussion
Fourteenth	4	Eulerian path, Eulerian circuit, Eulerian graph and Eulerian cycle	Eulerian	theoretical	General questions and discussion
Fifteenth	4	Some theorems of trees and it's applications	Trees	theoretical	General questions and discussion

11. Course evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports etc

12. Learning and teaching resources

Required textbooks (methodology, if any)	Graph Theory by H. K. Taluja and D. Bhardwaj2016
Main references (sources) Recommended supporting books and references (scientific journals, reports...	Harary, Frank (2010), Graph Theory, Reading, MA: Addison-Wesley.
Electronic references, Internet sites	Discreet websites. Virtual library. Library locations in some international universities.

Course Description Form

1. **Course Name:**
Theory of Differential Equations
2. **Course Code:**
MS 409
3. **Semester / Year:**
Eight Semester/Fourth Stage
4. **Description Preparation Date:**
2026\1\10
5. **Available Attendance Forms:**
Attendance
6. **Number of Credit Hours (Total) / Number of Units (Total)**
125 Hours/3 credits
7. **Course administrator's name (mention all, if more than one name)**
Name: Dr.Esraa Habeeb Khaleel Email: esraa.h.khaleel@tu.edu.iq
8. Course Objectives

Course Objectives	• Learning about theoretical concepts of differential equations. • Studying the existence and the uniqueness theorems for solutions of differential equations. • To understand the Linear independence theorems for solutions of differential equations. • To Learn about solving linear homogeneous differential systems using eigenvalues and eigenvectors. • Identify the concept of stability of solutions of differential systems and types of critical points for systems and the phase Plane and trajectory for those points • The ability to prove the existence and the uniqueness solutions of differential equations by applying the theorems. • Gaining the ability to analyze, explain and solve problems.

	• Providing the student with the skills of communication, expression and discussion to stimulate mathematical thinking, understanding and solving mathematical issues.

9. Teaching and Learning Strategies

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

10. Course Structure

	Hours	Required Learning Outcomes			Evaluation method
1	4	System of Differential Equations	System of First Order Equations, Vector-Matrix Notation of Systems	Lectures	Discussion and tests
2	4	System of Differential Equations	Existence, Uniqueness, and Continuity, The Gronwall's Inequality	Lectures	Discussion and tests
3	4	Linear Systems, with an introduction to Phase Space Analysis	Existence and Uniqueness for Linear Systems, Linear Homogeneous Systems	Lectures	Discussion and tests
4	4	Linear Systems, with an introduction to Phase Space Analysis	Linear Nonhomogeneous Systems, Similarity of Matrices and Jordan Canonical Form	Lectures	Discussion and tests
5	4	Existence Theory	Existence Theory for Systems of First-Order Equations, Uniqueness of Solutions	Lectures	Discussion and tests
6	4	Existence Theory	Continuation of Solutions, Dependence on Initial Conditions and Parameters	Lectures	Discussion and tests
7	4	Stability of Linear and Almost Linear Systems	Definitions of Stability, Linear Systems, Almost Linear Systems	Lectures	Discussion and tests
8	4	Stability of Linear and Almost Linear Systems	Conditional Stability, Asymptotic Equivalence, Stability of Periodic Solutions	Lectures	Discussion and tests
9	4	Lyapunov's Second Method	Introductory Remarks ,Lyapunov's Theorems	Lectures	Discussion and tests
10	4	Lyapunov's Second Method	Proofs of Lyapunov's Theorems	Lectures	Discussion and tests
11	4	Lyapunov's Second Method	Proofs of Lyapunov's Theorems	Lectures	Discussion and tests

12	4	One Dimensional Movement of a Particle	Perron's Theorem, Stability of periodic solutions and other notions of stability	Lectures	Discussion and tests
13	4	One Dimensional Movement of a Particle	Classical Mechanics with One Degree on Freedom	Lectures	Discussion and tests
14	4	One Dimensional Movement of a Particle	Replicator Equation and Mathematical Biology	Lectures	Discussion and tests
15	4	One Dimensional Movement of a Particle	Replicator Equation and Mathematical Biology	Lectures	Discussion and tests

Course Description Form

1. **Course Name:**
Functional analysis 2
2. **Course Code:**
MS 410
3. **Semester / Year:**
Eight Semester/Fourth Stage
4. **Description Preparation Date:**
2026\1\10
5. **Available Attendance Forms:**
Attendance
6. **Number of Credit Hours (Total) / Number of Units (Total)**
150 Hours/3 credits
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Laith K. Shaakir Email: dr.laithkhaleel@tu.edu.iq
8. Course Objectives

Functional analysis aims to introduce the student to the concepts of: quotient spaces, the space of linear functions, the space of continuous linear functions, bounded linear functions, Hahn-Benach's theorem, Hilbert spaces, orthogonality, orthonormal sets, orthonormal basis, weak convergence, Rice's representation, adjoint operators, and projections.	• ….. • ….. • …..

9. Teaching and Learning Strategies

Strategy	

10. Course Structure

	Hours	Required Learning Outcomes			Evaluation method
1	4	the concept of Quotient spaces with some theorems	Quotient spaces	Lectures	Discussion and tests
2	4	Linear functions	The space of linear functions	Lectures	Discussion and tests
3	4	continuous linear functions with some theorems	continuous linear functions	Lectures	Discussion and tests

4	4	Bounded linear functions with some theorems	Bounded linear functions	Lectures	Discussion and tests
5	4	Study the space of bounded linear functions	the space of bounded linear functions	Lectures	Discussion and tests
6	4	Hahn –Banach theorm with some results	Hahn –Banach theorm	Lectures	Discussion and tests
7	4	Pre-Inner product spaces with some examples	Pre-Inner product spaces	Lectures	Discussion and tests
8	4	Hilbert space with examples and theorems	Hilbert space	Lectures	Discussion and tests
9	4	Orthogonal ses with examples and theorems	orthogonality	Lectures	Discussion and tests
10	4	Orthonormal sets with examples and theorems	Orthonormal sets	Lectures	Discussion and tests
11	4	orthonormal basis with examples	orthonormal basis	Lectures	Discussion and tests
12	4	Riesz theorem	Riesz representation	Lectures	Discussion and tests
13	4	Approximation theorems	Approximation	Lectures	Discussion and tests
14	4	projections	projections	Lectures	Discussion and tests
15	4	the concept of Weakly converge	Weakly converge	Lectures	Discussion and tests

9. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports ...etc

10. Learning and Teaching Resouces

Required textbooks (curricular books, if any)	**مقدمة في التحليل الدالي,نوري فرحان المياحي و علي حسين بتور, 2005**
Main references(sources)	1- **Introductory Functional Analysis With Applications "Kreyszig1978 ,** 2- **Introduction To Functional Analysis " by Sharma J.Vasishtha A.R, 1975**
Reconnended books and references (scientific	

journals, reports,...)	
Electronic references, websites	