



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Linear Algebra & Number theory		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	CYS163		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	1	Semester of Delivery	
Administering Department	Dept. of Cybersecurity	College	College of Information Technology
Module Leader	Dr. Mohammed Al-Shibly	e-mail	dr.alshibly@uofallujah.edu.iq
Module Leader's Acad. Title	Lect.	Module Leader's Qualification	Ph.D.
Module Tutor	Asst. Prof. Dr. Omar Salah Shareef	e-mail	omar.alshareef@uofallujah.edu.iq
Peer Reviewer Name	Asst. Prof. Dr. Ahmad AlSabhany	e-mail	Ahmad.alsabhany@uofallujah.edu.iq
Scientific Committee Approval Date	25-5-2026	Version Number	1.0

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Develop a solid understanding of the fundamental concepts of linear algebra and number theory that underpin modern computing and cybersecurity. 2. Apply matrix operations, vector spaces, and systems of linear equations to solve computational problems. 3. Analyze the properties of integers, divisibility, modular arithmetic, prime numbers, and related mathematical structures. 4. Apply mathematical techniques used in cryptographic algorithms, coding theory, and secure communication systems. 5. Strengthen logical reasoning, analytical thinking, and mathematical problem-solving skills for computer science and cybersecurity applications. 6. Build the mathematical foundation required for advanced courses in cryptography, coding and information theory, machine learning, and cybersecurity.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Explain the fundamental concepts of linear algebra and number theory relevant to computer science and cybersecurity. 2. Solve systems of linear equations and perform matrix and vector operations using appropriate mathematical techniques. 3. Apply the principles of divisibility, modular arithmetic, prime numbers, greatest common divisors, and related number-theoretic concepts to solve mathematical problems. 4. Analyze mathematical structures and algorithms commonly used in cryptography and coding theory. 5. Use mathematical reasoning and problem-solving techniques to address computational and cybersecurity-related challenges. 6. Demonstrate the mathematical foundation necessary for advanced study in cryptography, coding and information theory, machine learning, and cybersecurity.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	This module is delivered through interactive lectures, guided problem-solving sessions, and tutorial exercises that emphasize conceptual understanding and mathematical reasoning. Students develop analytical and computational skills by solving progressively challenging problems in linear algebra and number theory, with examples drawn from computer science, cryptography, coding theory, and cybersecurity. Regular quizzes, assignments, and collaborative discussions are used to reinforce learning and promote logical thinking and independent problem-solving.
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Student Workload (SWL)

الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	3
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Assignments	2	10% (10)	5 and 10	All
	Quiz	1	10% (10)	4	LO #1 - #2
	Quiz	1	10% (10)	9	LO #4 - #6
	Lab	1	10% (10)	13	All
Summative assessment	Midterm Exam	2hr	10% (10)	7	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	Introduction to Linear Algebra: Vectors, Scalars, and Matrix Fundamentals
Week 2	Matrix Operations, Matrix Properties, and Elementary Row Operations
Week 3	Systems of Linear Equations, Gaussian Elimination, and Matrix Inverses

Week 4	Determinants, Vector Spaces, Linear Independence, and Basis
Week 5	Linear Transformations, Eigenvalues, Eigenvectors, and Applications
Week 6	Introduction to Number Theory: Integers, Divisibility, Prime Numbers, and the Euclidean Algorithm
Week 7	Greatest Common Divisor (GCD), Least Common Multiple (LCM), Extended Euclidean Algorithm, and Bézout's Identity
Week 8	Midterm Exam
Week 9	Modular Arithmetic, Congruence Relations, and Modular Operations
Week 10	Modular Inverses, Euler's Totient Function, Euler's Theorem, and Fermat's Little Theorem
Week 11	Chinese Remainder Theorem and Fast Modular Exponentiation
Week 12	Introduction to Finite Fields and Basic Algebraic Structures
Week 13	Applications of Linear Algebra in Computing and Machine Learning
Week 14	Applications of Number Theory in Cryptography and Coding Theory
Week 15	Review, Integrated Problem Solving, and Course Summary
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1. Gilbert Strang, <i>Introduction to Linear Algebra</i> , 6th Edition, Wellesley-Cambridge Press, 2023. 2. Kenneth H. Rosen, <i>Elementary Number Theory and Its Applications</i> , 7th Edition, Pearson, 2010.	Yes
Recommended Texts	3. David C. Lay, Steven R. Lay, and Judi J. McDonald, <i>Linear Algebra and Its Applications</i> , 6th Edition, Pearson, 2021. 4. Gareth A. Jones and J. Mary Jones, <i>Elementary Number Theory</i> , Springer Undergraduate Mathematics Series, 1998.	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.				