MODULE DESCRIPTION FORM

Module Information					
Module Title	**Signals & Systems**			**Module Delivery**	
Module Type	**B**			☑ Theory ☑ Lecture ☑ Lab ☑ Tutorial ☐ Practical ☐ Seminar	
Module Code	**AIE 311**				
ECTS Credits	**5**				
SWL (hr/sem)	**125 H/Sem.**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Artificial Intelligence Eng.		**College**	College of Engineering	
Module Leader	Amjed Baqer Jumaah		**e-mail**	Amjed.baqer@alayen.edu.iq	
Module Leader's Acad. Title	Asst. Lec.		**Module Leader's Qualification**	MSc	
Module Tutor	Amjed Baqer Jumaah		**e-mail**	Amjed.baqer@alayen.edu.iq	
Peer Reviewer Name			**e-mail**	Hasnaa.Mohammad@alayen.edu.iq	
Scientific Committee Approval Date	27/9/2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Fundamental principles of signals and systems – continuous and discrete-time signals – system classification and properties – time-domain analysis (convolution, correlation) – frequency-domain analysis using Fourier Series and Fourier Transform – Laplace and Z-transforms – linear time-invariant (LTI) systems – sampling theorem and signal reconstruction – modulation and filtering concepts – MATLAB simulation and analysis of signals and systems.

وزارة التعليم العالي والبحث العلمي
جامعة العين العراقية
كلية الهندسة
قسم الذكاء الاصطناعي

Module Learning Outcomes	Knowledge	A1	A1.1: Understand the fundamental concepts of continuous-time and discrete-time signals and systems. A1.2: Explain signal characteristics, system properties, and time-domain representations.
		A3	A3.1: Apply mathematical tools such as Fourier and Laplace transforms to analyze signals and systems. A3.2: Demonstrate understanding of the relationship between time and frequency domain representations.
	Skills	B1	B1.1: Function efficiently as an individual. B1.2: Function as a member of multidisciplinary and multicultural teams.
		B2	B.2.1 Communicate effectively – graphically with a range of audiences using contemporary tools. B.2.2 Communicate verbally and in writing with a range of audiences using contemporary tools.
	Ethics	C1	C1.1: Define professional and ethical responsibilities. C1.2: Demonstrate diversity in their commitment to ethical responsibilities.

Indicative Contents

Indicative content includes the following.

Unit 1: Introduction to Signals and Systems (8 hours)

• Classification of signals: continuous-time, discrete-time, periodic, non-periodic, even, odd. Classification of systems: linear, nonlinear, time-invariant, time-variant, causal, stable.

Unit 2: Time-Domain Analysis (8 hours)

• Basic operations on signals: scaling, shifting, and inversion. System properties and convolution in continuous and discrete domains.

Unit 3: Fourier Series and Fourier Transform (8 hours)

• Trigonometric and exponential Fourier series. Continuous-time Fourier Transform (CTFT) and its applications.

Unit 4: Laplace Transform and Z-Transform (6 hours)

• Laplace Transform for continuous-time systems. Z-Transform for discrete-time systems – region of convergence and stability.

Unit 5: Sampling and Reconstruction (6 hours)

	• Sampling theorem – aliasing – practical reconstruction methods. Discrete-time signal generation and sampling using MATLAB. Unit 6: Modulation and Filtering (6 hours) • Amplitude and frequency modulation principles. Signal filtering and noise reduction techniques. Unit 7: Simulation and Applications (6 hours) • MATLAB-based analysis and visualization of signals and systems. Application examples in communication and control systems.

Learning and Teaching Strategies	
Strategies	• Lectures • Laboratory Sessions • Interactive Learning • Simulation and Digital Tools • Group Projects and Presentations • Self-Learning and Assignments

Student Workload (SWL)			
Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	47	**Unstructured SWL (h/w)**	5.4
Total SWL (h/sem)	**125**		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري		
	Material Covered	**LOs**
Week 1	Introduction to MATLAB environment and basic signal plotting.	
Week 2	Generation of continuous and discrete signals (sine, square, exponential).	A1, B1
Week 3	Time shifting, scaling, and inversion of signals in MATLAB.	A1, A3
Week 4	Analysis of linear and time-invariant (LTI) systems using convolution.	A3, B1
Week 5	Fourier Series representation of periodic signals.	A3, B1
Week 6	Fourier Transform applications for non-periodic signals.	A1, B1

Week 7	Midterm Practical Exam.	A1, B1
Week 8	Laplace and Z-Transform implementation in MATLAB.	A1
Week 9	Sampling theorem and reconstruction demonstration.	A1, B1
Week 10	Signal modulation and demodulation simulation.	A3, B1, B1
Week 11	Signal filtering (low-pass, high-pass, band-pass) in MATLAB.	A3, B1, B1
Week 12	System analysis using Simulink.	A3, B1
Week 13	Project: design and simulation of a simple signal processing system.	A3, B2, C1
Week 14	Practical project presentations and revision.	A3, B1, B2
Week 15	Final Practical Exam.	A3, B1, B2, C1
Week 16	Lab Experiment / Practical Activity	All

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر		
	Material Covered	**LOS**
Week 1	Introduction to MATLAB environment and basic signal plotting.	
Week 2	Generation of continuous and discrete signals (sine, cosine, exponential, step, ramp).	A3, B1
Week 3	Signal operations: shifting, scaling, and inversion using MATLAB.	A3, B1, B2
Week 4	Classification of systems and verification of linearity and time invariance.	A3, B1
Week 5	Convolution and correlation of continuous and discrete signals.	A3, A3, B1
Week 6	Fourier Series: representation of periodic signals using MATLAB.	A3, B1
Week 7	Fourier Transform: frequency-domain analysis of non-periodic signals.	A3, A3, B1
Week 8	Midterm Practical Exam.	A3, B1
Week 9	Laplace Transform applications for continuous-time systems.	A3, A3
Week 10	Z-Transform implementation for discrete-time systems.	A3, A3
Week 11	Sampling theorem demonstration and aliasing effects.	A3, B1, B2
Week 12	Amplitude and frequency modulation and demodulation simulation.	A3, B1
Week 13	Filtering of signals (low-pass, high-pass, and band-pass filters).	A3, B1, B2
Week 14	MATLAB and Simulink-based system simulation and performance evaluation.	A3, B1, B2
Week 15	Project: design and simulation of a simple signal processing system.	A3, B1
Week 16	Final exam	

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	A1,A3
	Assignments	2	10% (10)	2, 4,6,8,10 and 12	A1,A3
	Projects / Lab.	1	10% (10)	14	A1
	Report	1	10% (10)	13	A1,A3
Summative assessment	Midterm Exam	1hr	10% (10)	7	A1
	Final Exam	3hr	50% (50)	15	A1,A3
Total assessment			100% (100 Marks)		

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Signals and Systems – Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab. 2. Linear System Theory and Design – Chi-Tsong Chen	Yes
Recommended Texts	Signal and Systems Analysis Using MATLAB – Luis F. Chaparro. 2. Discrete-Time Signal Processing – Alan V. Oppenheim & Ronald W. Schafer.	NO
Websites	https://eng.alayen.edu.iq//colleges/e/42	

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.