

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Digital Signal Processing		Module Delivery
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ATU11609		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIII	Semester of Delivery	
Administering Department		College	NETC
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor	Name (if available)	e-mail	
Peer Reviewer Name	Nasir Hussein Selman	e-mail	Coj.nas@atu.edu.iq
Scientific Committee Approval Date	01/05/2025	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	- Understand how to mathematically describe signals and how to perform calculations on signals. - Studying the performance of convolution between signals and understanding its impact on the analysis of time invariant linear systems. Understand the idea of impulsive response. Learn to calculate the output of an LTI system given the input and impulse response by torsion sum and torsion integral. - Study the calculation of a Fourier series or Fourier transform of a well-defined set of signals from first principles. Furthermore, using the properties of the Fourier transform to compute the Fourier transform (and its inverse) for a broader class of signals. - A good understanding of the fundamentals of discrete-time signals and systems - Familiarity with techniques of analysis of discrete-time signals and the use of Z-transforms. - Knowledge of spectral properties of discrete-time systems through the use of Discrete Fourier transform (FFT) of sequences. - Skills in the design of digital filters.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Illustrate digital signals, systems and their significance. 2. Analyses the digital signals using various digital transforms DFT, FFT etc. 3. Design and develop the basic digital system. 4. Interpret the finite word length effects on functioning of digital filters.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A - Functions</u> 1. Concept of frequency in continuous time and discrete time signals –Sampling theorem – Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution and correlation. 2. THE Z-TRANSFORM 3. Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation. 4. System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain. 5. Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Poly phase decompositions. Application of DSP – Model of Speech Wave Form.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in presenting this unit is to encourage students to participate in solving exercises, and at the same time improve and expand their critical thinking skills through some group and individual scientific activities and competitions.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	102	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	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	Convolution and correlation
Week 2	Analysis of Linear time invariant systems –Z transform
Week 3	Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms
Week 4	Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation
Week 5	System Design of Discrete time IIR filter from continuous time filter
Week 6	IIR filter design by Impulse Invariance. Bilinear transformation –Design of IIR filter in the Frequency domain
Week 7	Realization of the System Design of Discrete time IIR filter from continuous time filter
Week 8	Realization of the System Design of Discrete time FIR filter from continuous time filter
Week 9	Linear phase filter – Windowing techniques – rectangular, triangular, Blackman and Kaiser windows
Week 10	Mid Term
Week 11	Frequency sampling techniques – Structure for FIR systems
Week 12	Quantization, round off errors and overflow errors.
Week 13	Poly phase decompositions. Application of DSP – Model of Speech Wave Form
Weeks 14&15	Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators.
Week 16	Final Exam.

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	.Oppenheim A V and Sehafer R W, “Discrete Time Signal Processing”	No
Recommended Texts	Proakis J G and Manolakis D G, “Digital Signal Processing”, Pearson Education India.	No
Websites	https://umdearborn.edu/cecs/departments/electrical-and-computer-engineering/undergraduateprograms/bse-electrical-engineering/program-educational-objectives	

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.