

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Embedded System Programming		Module Delivery	
Module Type	Core		<input type="checkbox"/> Theory <input checked="" type="checkbox"/> Lecture <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar	
Module Code	BME-324			
ECTS Credits	3			
SWL (hr/sem)	75			
Module Level	3	Semester of Delivery		2
Administering Department	Type Dept. Code	College	Type College Code	
Module Leader	Asst.Lec karrar aqeel		e-mail	karrar.aqeel@uowa.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Asst.Lec	
Module Tutor	Name (if available)	e-mail	E-mail	
Peer Reviewer Name	Name	e-mail	E-mail	
Scientific Committee Approval Date	11/08/2025	Version Number	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p>Module Aims أهداف المادة الدراسية</p>	<ol style="list-style-type: none">1. To introduce students to the fundamentals of MATLAB programming and matrix-based computation.2. To provide students with the knowledge and skills to perform mathematical operations, data analysis, and visualization using MATLAB.3. To introduce the principles of Arduino hardware and programming for control and measurement applications.4. To equip students with the ability to integrate MATLAB and Arduino for real-time data acquisition and system control.
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<ol style="list-style-type: none">1. Equip students with the foundational knowledge of MATLAB programming, variables, matrices, and basic operations for engineering applications.2. Enable students to analyze and solve mathematical, algebraic, and differential equations using MATLAB functions and tools.3. Develop students' ability to manage and manipulate data, including importing, processing, and visualizing results through MATLAB plots and graphs.4. Build understanding of Arduino hardware components, architecture, and programming syntax for measurement and control systems.5. Enable students to interface Arduino with sensors, actuators, and displays for real-time data acquisition and control.6. Strengthen students' skills in implementing programming structures such as loops, conditionals, and functions in both MATLAB and Arduino environments.7. Foster the ability to integrate MATLAB and Arduino for interactive projects involving data logging, motor control, and wireless communication.8. Enhance students' competence in designing, testing, and troubleshooting MATLAB-Arduino systems for practical engineering applications.
<p>Indicative Contents المحتويات الإرشادية</p>	<p>Indicative content includes the following.</p> <p>MATLAB: Introduction to MATLAB, variables and matrices, workspace management (save and load workspace data), basic arithmetic operations, equation writing, data types (single and integer), who function, dot product, cross product, sum function, solving linear equations, solving differential equations, solving algebraic equations, generating different types of matrices, matrix transpose, mean function, cumulative sum (cumsum) and cumulative product (cumprod), finding maximum and minimum values in large datasets, matrix multiplication and elementwise multiplication, extracting elements from matrices, extracting data from large Excel sheets, for loops, while loops, if-else conditional statements, plotting sine waves, plotting graphs, and plotting multiple graphs.</p>

	Arduino: Arduino platform overview, hardware architecture, IDE and programming syntax, digital and analog I/O, PWM signal generation, sensors and actuator interfacing, serial communication with MATLAB, real-time data acquisition, motor control applications, LED and display interfacing, data logging, wireless modules, and integration of Arduino with MATLAB for measurement and control systems.
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy for delivering this module is to actively engage students in practical exercises and hands-on activities, while fostering their problem-solving and analytical skills. This will be achieved through lectures, interactive programming tutorials, and laboratory sessions that combine MATLAB coding tasks with Arduino experiments. Students will work on small-scale projects and data acquisition activities that connect software analysis with hardware implementation, making the learning process both practical and engaging.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	75	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	112		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab. Report	1	10% (10)	Continuous	All
	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	Introduction to MATLAB environment, variables, and matrices
Week 2	Workspace management (save and load data) and basic arithmetic operations, equation writing
Week 3	Data types (single and integer), who function, dot product, cross product, and sum function
Week 4	Solving linear equations, solving algebraic equations, generating different types of matrices
Week 5	Matrix transpose, mean function, cumsum and cumprod functions, finding maximum and minimum values in large datasets
Week 6	Matrix multiplication, elementwise multiplication, extracting elements from matrices and Excel sheets
Week 7	for loops, while loops, and if-else conditional statements
Week 8	Plotting sine waves, plotting single and multiple graphs
Week 9	Introduction to Arduino platform, hardware architecture, IDE, and programming syntax
Week 10	Digital and analog I/O, PWM signal generation, LED interfacing
Week 11	Sensor and actuator interfacing, real-time data acquisition
Week 12	Serial communication between Arduino and MATLAB, data logging
Week 13	Motor control applications, display interfacing (LCD, OLED)
Week 14	Wireless module integration (Bluetooth, Wi-Fi) and MATLAB-Arduino control systems
Week 15	Project development and integration of MATLAB with Arduino for measurement and control systems
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	MATLAB Basics <ul style="list-style-type: none"> • Exploring MATLAB interface and workspace. • Creating variables and performing basic arithmetic operations. • Saving and loading workspace data.
Week 2	Matrices and Operations <ul style="list-style-type: none"> • Creating and manipulating matrices. • Dot product, cross product, sum function. • Matrix transpose, mean, cumsum, and cumprod.

Week 3	Equations in MATLAB <ul style="list-style-type: none"> • Solving linear equations. • Solving algebraic equations. • Introduction to solving differential equations.
Week 4	Data Handling in MATLAB <ul style="list-style-type: none"> • Extracting elements from matrices. • Importing data from Excel sheets. • Finding max/min in large datasets.
Week 5	Programming in MATLAB <ul style="list-style-type: none"> • for loops, while loops. • if-else statements. • Writing basic MATLAB scripts.
Week 6	Plotting in MATLAB <ul style="list-style-type: none"> • Plotting sine waves and mathematical functions. • Creating multiple plots on the same graph. • Customizing plot appearance (titles, labels, legends).
Week 7	Introduction to Arduino <ul style="list-style-type: none"> • Overview of Arduino board and IDE. • Writing and uploading basic Arduino programs. • Digital I/O with LEDs and buttons.
Week 8	Analog I/O and PWM <ul style="list-style-type: none"> • Reading analog sensors (potentiometer, temperature sensor). • Generating PWM signals. • Controlling LED brightness.
Week 9	Sensor Interfacing <ul style="list-style-type: none"> • Interfacing Arduino with sensors (ultrasonic, LDR). • Reading and displaying sensor data in the Serial Monitor.
Week 10	MATLAB–Arduino Communication <ul style="list-style-type: none"> • Setting up serial communication. • Sending data from Arduino to MATLAB. • Real-time data plotting in MATLAB.
Week 11	Actuator Control <ul style="list-style-type: none"> • Controlling DC motors and servo motors. • Display interfacing (LCD or OLED). • Data logging from Arduino in MATLAB.
Week 12	Integrated Project Lab <ul style="list-style-type: none"> • Students design and implement a mini-project combining MATLAB and Arduino. • Examples: real-time temperature monitoring system, motor speed control with MATLAB GUI, wireless sensor data acquisition.

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	M. Rahmani-Andebili, MATLAB Lessons, Examples, and Exercises. Cham: Springer Nature Switzerland, 2024. doi: 10.1007/978-3-031-76177-5.	NO
Recommended Texts	M. Borgo, A. Soranzo, M. Grassi, and L. Battaglini, MATLAB for Psychologists. Cham: Springer Nature Switzerland, 2025. doi: 10.1007/978-3-031-82330-5.	NO
Websites	https://www.mathworks.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.