Ministry of Higher Education and

Scientific Research - Iraq
Al-Mustaqbal University
College of Engineering Technique
Department of Electrical Engineering Technique

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	**DIGITAL CONTROLLERS**		**Module Delivery**	
Module Type	CORE		✓ **Theory** Lecture ✓ **Lab** Tutorial ✓ **Practical** Seminar	
Module Code	UOMU0205062			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	3	**Semester of Delivery**		2
Administering Department	DEPARTMENT OF ELECTRICAL ENGINEERING TECHNIQUES	**College**		AL-MUSTAQBAL
Module Leader	Ibrahim alkharsan	**e-mail**		ibrahim.alkharsan@uomus.edu.iq
Module Leader's Acad. Title	doctor	**Module Leader's Qualification**		doctor
Module Tutor	None	**e-mail**	None	
Peer Reviewer Name	None	**e-mail**	None	
Review Committee Approval		**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. To help the students understand the basic principles of Microcontroller based design and development 2. To help the students design and build functional prototypes for real-world applications 3. To encourage the students to better understand the state-of-the-art interfacing technologies, their potential applications, and their market views. 4. To help the students undertake problem identification, formulation, and selection of an appropriate Microcontroller.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Analyze the architecture of microcontrollers. 2- Write an assembly language program for the given problem. 3- Use instructions for different addressing modes. 4- Develop an assembly language program using an assembler.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Part A – Microcontrollers Basics.

| | • Microcontrollers Basics, Types of Microcontrollers, Applications of Microcontrollers, System Design Using Microcontroller
• Microcontroller Architecture, CPU Architecture
• Input / Output Ports, Digital Input /Output, Analogue Input / Output, Digital to Analogue conversion (DAC)
• Analogue to Digital converter (ADC), Principle of Operation, Digital Ramp ADC
• Communication Interfaces, SCI (UART), UART Parameters, USART, Timer, Counter, Output Compare
• Pulse Width Modulation (PWM), PWM signal generated by an up-counter, PWM signal generated by an up-down-counter

• Introduction to Microcontroller Programming, Assembly Language, Addressing Modes, PC-relative Addressing, and Pseudo-Opcodes [22 hrs]

Part B Arduino Microcontroller.

• Arduino Microcontroller, Arduino Pins, Arduino Software Sketch Structure, Example: "hello world" program
• Variable Definition, Variable types, Integers, Floating, Arithmetic Operators, Programming Example, Relational Operators,
• The FOR Loop, Example, The While Loop, Example, IF Statement, Example, Logical Operation, Example, Arduino Functions, The Structure of Function, Calling a Function [10 hrs] |

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

| **Strategies** | 1-**Hands-on Experiments:** Engage students in practical experiments to deepen their understanding of the operation, programming, and application of microcontrollers.
2-**Simulation Software:** Simulation Software: Use proteus software for virtual circuit design and programming based on a microcontroller.
3-**Problem-solving Exercises:** Include various problem-solving exercises for programming and the application of microcontroller techniques.
4-**Group Projects:** Assign collaborative projects for programming, and application of microcontrollers.
5-**Real-world Applications:** Discuss practical applications of microcontrollers in different devices and systems.
5-**Interactive Discussions:** Encourage student participation and critical thinking through open-ended questions.
6-**Conceptual Understanding:** Focus on intuitive understanding alongside mathematical analysis.
7-**Assessment Variety:** Use diverse assessment methods to gauge student understanding.
8-**Office Hours and Support:** Offer individualized assistance through office hours or online support. |

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 | 5.2 |

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	**Quizzes**	4	10% (10)	5, 10	LO #1, 2, and 4
	Assignments	10	10% (10)	Continuous	All
	Projects / Lab.	7	10% (10)	Continuous	All
	Report	8	10% (10)	2, 12	LO # 3, 4
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-4
	Final Exam	3 hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
1,2	**Microcontrollers Basics, Types of Microcontrollers, Applications of Microcontrollers, System Design Using Microcontroller**
3,4	**Microcontrollers Basics, Types of Microcontrollers, Applications of Microcontrollers, System Design Using Microcontroller**
5	**Input / Output Ports, Digital Input /Output, Analogue Input / Output, Digital to Analogue conversion (DAC)**
6,7	**Analogue to Digital converter (ADC), Principle of Operation, Digital Ramp ADC**
8,9	**Communication Interfaces, SCI (UART), UART Parameters, USART, Timer, Counter, Output Compare**
10	**Pulse Width Modulation (PWM), PWM signal generated by an up-counter, PWM signal generated by an up-down-counter**
11	**Introduction to Microcontroller Programming, Assembly Language, Addressing Modes, PC-relative Addressing, Pseudo-Opcodes**
12	**Arduino Microcontroller, Arduino Pins, Arduino Software Sketch Structure, Example: "hello world" program**
13	**Variable Definition, Variable types, Integers, Floating, Arithmetic Operators, Programming Example Relational Operators,**
14	**The FOR Loop, Example, The While Loop, Example, IF Statement, Example, Logical Operation, Example, Arduino Functions, The Structure of Function, Calling a Function**
15	**Final Examination**

Delivery Plan (Weekly Lab. Syllabus)
المنهاج الاسبوعي للمختبر

	Material Covered
1	**Lab 1: Arduino and Light-Emitting Diode**
2	**Lab 2: Arduino and Liquid Crystal Display**
3	**Lab 3: Push Button and Light Emitting Diode/Liquid Crystal Display**
4	**Lab 4: Push Button–Digital "LOW"**
5	**Lab 5: Push Button–Digital "HIGH"**

6	**Lab 6: Fire Sensor and Light Emitting Diode/Liquid Crystal Display**
7	**Lab 7: Passive Infrared Sensor and Light Emitting Diode/Liquid Crystal Display.**
8	**Lab 8: Arduino and Analog Devices: Ultrasonic Sensor and Liquid Crystal Display**
9	**Lab 9: Ultrasonic Sensor—Serial Out**
10	**Lab 10: Ultrasonic Sensor—PWM Out**
11	**Lab 11: Temperature Sensor and Liquid Crystal Display**
12	**Lab 12: Temperature Sensor-Analog Out**
13	**Lab 13: Humidity/Temperature Sensor—Serial Out**
14	**Lab 14: Review**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Mazidi, Muhammad Ali Mazidi Janice Gillispie, and Rolin D. McKinlay. "The 8051 microcontroller and embedded systems using assembly and C". 2016.	Yes
Recommended Texts	Ayala, Kenneth J. "Eighty Fifty-One Microcontroller: Architecture, Programming, and Applications." (1991). "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.	No
Websites	Microprocessors And Microcontrollers https://nptel.ac.in/courses/108105102	

APPENDIX:

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.