

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Digital Electronics		Module Delivery
Module Type	S		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☒ Practical ☐ Seminar
Module Code	DIEL223		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UG2	Semester of Delivery	2
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	Dr. Ahmed Sabah Al-Araji	e-mail	Ahmed.s.alaraji@uotechnology.edu.iq
Module Leader's Acad. Title	Prof.	Module Leader's Qualification	Ph.D.
Module Tutor	Dr. Ahmed Sabah Al-Araji	e-mail	
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	1/4/2026	Version Number	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Electronic circuits	Semester	
Co-requisites module	Electric circuits	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	1. Understanding basic concepts: Understanding the concepts of digital electronic circuit analysis and digital integrated circuit design and the practical applications of these concepts. 2. Application of techniques: The student's ability to analyze problems and use the principles of transistor operation to solve them. Design models and program digital integrated circuits using advanced methods. 3. Data analysis: the ability to use scientific methods and electronic concepts in analyzing digital electronic circuits. 4. Improving performance: Learn how to analyze and design digital electronic circuits and use them to develop and improve the performance of integrated digital circuits. 5. Interaction with technology: developing the ability to deal with modern electronic technologies in the field of integrated digital electronic circuits and keeping pace with technological developments. 6. Creativity and innovation: encouraging students to use integrated digital electronic circuits creatively to solve problems and think in new ways. 7. Understanding complexity: Develop an understanding of complexity in the analysis and design of integrated digital electronic circuits and how to deal with it. 8. Teamwork: Enhancing teamwork skills through designs, projects, and challenges that require cooperation in teams. 9. Problem Solving: Improve problem solving and decision-making skills using advanced software techniques in analysis and design. 10. Evaluating and criticizing performance: The ability to evaluate the performance of models of designs for digital electronic circuits and improve them based on criticism and critical analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Providing practical models: Presenting practical examples and applications for using integrated electronic circuit technologies in various fields. This enables students to understand how to apply theoretical concepts to solve real-world problems through study, analysis, and design. 2. Practical projects: motivating students to implement practical projects that use programming techniques to analyze and design integrated digital electronic circuits, which helps in applying theoretical understanding and developing programming skills. 3. Solving case studies: providing case studies that address real challenges and

	problems that can be solved using integrated circuits. This encourages applied thinking and analysis of the complex problem. 4. Workshops and Discussions: organizing workshops and discussion sessions to encourage interaction and exchange of ideas among students. This enhances understanding of concepts and contributes to exchanging experiences, knowing the edge of scientific progress, and keeping pace with it. 5. Use of technology: using modern software and tools related to digital electronic circuits to provide interactive learning experiences and stimulate deep understanding. 6. Motivating self-research: encouraging students to conduct self-research on specific topics in the design of integrated digital electronic circuits, which enhances research and exploration skills. 7. Interactive evaluation: Using interactive evaluation techniques, such as providing feedback on individual or group projects, to promote continuous improvement. 8. Providing various resources: Providing various learning resources, such as explanatory videos, e-books, and articles, to meet the needs of different students. 9. Encouraging cooperative learning: organizing group learning activities where students cooperate to solve problems and exchange knowledge. 10. Stimulating innovation: encouraging students to develop new solutions and innovations in the field of digital electronics.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Logic families explain the logic families based the integrated circuit such as Bipolar Logic Families Unipolar Logic Families, Saturated Logic Families, Non-saturated Logic Families, then explain the prosperities of the logic families such as Noise Margin, Propagation Delay Time, Switching Speed Limitations, Operating Temperature, Switching speed limitations, and Power Dissipation. Design integrated circuit based on Resistor-Transistor Logic family, design OR gate, AND gate, Not gate, NAND gate, NOR gate and design Transistor-Transistor Logic Families based on OR gate, AND gate, Not gate, NAND gate, NOR gate, Open Collector TTL, and Tri-State TTL. Analyze and design two different types of the operational amplifiers applications: linear applications and non-linear applications. Design an oscillators and waveform generators with different IC are used. Explain and design the ADC and DAC Converters.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Teaching strategies adopted in digital electronic circuit analysis class and design circuit encourage students to stimulate their imagination in understanding digital

	electronic integrated circuits and component operations in different digital electronic systems. Also, help them to improve skills in discovering digital electronic integrated circuit. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.
--	---

Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
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	❖ Logic families ▪ Bipolar Logic Families ▪ Unipolar Logic Families ▪ Saturated Logic Families ▪ Non-saturated Logic Families ▪ Noise Margin, ▪ Propagation Delay Time, ▪ Switching Speed Limitations, ▪ Operating Temperature, ▪ Switching speed limitations, ▪ Power Dissipation,
Week 2	❖ Resistor-Transistor Logic IC Design ▪ OR gate, AND gate, Not gate, NAND gate, NOR gate ▪ Diode-Transistor Logic IC Design ▪ OR gate, AND gate, Not gate, NAND gate, NOR gate
Week 3	▪ Direct Coupled Transistor Logic ▪ Integrated Injection Logic ▪ High Threshold Logic
Week 4	❖ Transistor-Transistor Logic Families ▪ OR gate, AND gate, Not gate, NAND gate, NOR gate ▪ Open Collector TTL ▪ Tri-State TTL
Week 5	▪ Fan-in Fan-out ▪ Schottky Transistor Logic
Week 6	❖ Complementary metal–oxide–semiconductor CMOS Logic Families ▪ OR gate, AND gate, Not gate, NAND gate, NOR gate ▪ TTL to CMOS and CMOS to TTL Voltage Level
Week 7	❖ Array Logic: PAL, PLA, GAL, RAM ,Memory Decoding, SPD, CPLD
Week 8	❖ Field Programmable Gate Arrays FPGA
Week 9	❖ Operational amplifiers. ▪ Introduction. Non-inverting Op-Amp. Inverting Op-Amp. ▪ Voltage follower.
Week 10	▪ Voltage adder and subtractor. ▪ Integrator. ▪ Differentiator.
Week 11	▪ Current to Voltage Converter. ▪ Voltage to Current Converter. ▪ Electronics Analog Computation.

Week 12	❖ Nonlinear Applications of Operational Amplifiers ▪ Comparator. ▪ Window Comparator
Week 13	▪ Oscillators and Waveform Generators. ▪ Timer 555 IC
Week 14	❖ D/A converters. ▪ Resistive divider DAC. ▪ Binary ladder DAC. ▪ DAC accuracy and resolution
Week 15	❖ A/D Converters. ▪ Simultaneous ADC. ▪ Continuous ADC Single Slope and dual slope. ▪ Counter-type ADC. ▪ Successive approximation ADC ▪ Flash ADC
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Characteristics of TTL Gates (Totem-Pole Output) – Part 1
Week 2	Characteristics of TTL Gates (Totem-Pole Output) – Part 2
Week 3	Characteristics of open collector TTL gates – Part 1
Week 4	Characteristics of open collector TTL gates – Part 2
Week 5	Characteristics of tri-state TTL gates – Part 1
Week 6	Characteristics of tri-state TTL gates – Part 2
Week 7	Introduction to OP-AMP Amplifier (OP-AMP) – Part 1
Week	Introduction to OP-AMP Amplifier (OP-AMP) – Part 2
Week 9	Inverting and Non-Inverting Operational Amplifier (OPAMP)– Part 1
Week 10	Inverting and Non-Inverting Operational Amplifier (OPAMP)– Part 2
Week 11	IC Timer-Based Multivibrators – Part 1
Week12	IC Timer-Based Multivibrators – Part 2

Week13	The Monostable multivibrator – Part 1
Week14	The Monostable multivibrator – Part 2
Week15	ALU arithmetic logic unit

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Shiv Shanker "Digital Circuit and Systems II ", 2009	Yes
Recommended Texts	M. Morris Mano "Digital Design" 4 th edition , 2007	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.