COLLEGE OF ENGINEERING
ALAYEN IRAQI UNIVERSITY

MODULE DESCRIPTION FORM

ALAYEN IRAQI
UNIVERSITY
AUIQ

Module Information

Module Title	**Electronics I**	**Module Delivery**	
Module Type	**Core**	☑ **Theory** ☑ **Lecture** ☑ **Lab** ☐ **Tutorial** ☑ **Practical** ☐ **Seminar**	
Module Code	**MDER210**		
ECTS Credits	**7**		
SWL (hr/sem)	**175**		
Module Level	2	**Semester of Delivery**	3
Administering Department	Type Dept. Code	**College**	Type College Code
Module Leader	Hazem Ali Jasim	**e-mail**	Hazem.Ali.Jasim@alayen.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	M.Sc.
Module Tutor	Hazem Ali Jasim	**e-mail**	Hazem.Ali.Jasim@alayen.edu.iq
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date	4/12/2024	**Version Number**	1.0

Relation with other Modules

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	1. - Understanding basic electronic components. 2. - Design and analysis of electronic circuits. 3. - Ability to use engineering tools (Multisim, PSpice). 4. - Understanding frequency response of circuits and signal modulation. 5. - Applying electronics in practical applications and linking theory with practice. 6. - Developing research and analytical thinking skills.

وزارة التعليم العالي والبحث العلمي
جامعة العين العراقية
مكتب عميد كلية الهندسة

Module Learning Outcomes	1. Understand the properties of semiconductors and their role in electronic circuits. 2. Explain the operation and characteristics of diodes. 3. Analyze diode applications in rectifiers and signal processing. 4. Compare half-wave and full-wave rectifier circuits. 5. Design and analyze clippers and clampers for waveform shaping. 6. Understand the operation of transistors and their applications. 7. Apply DC biasing techniques for transistor stability. 8. Analyze AC biasing in amplifiers for small signal operation. 9. Design basic amplifier circuits for biomedical applications. 10. Use simulation tools (e.g., Multisim, Proteus) to model and analyze circuits. 11. Build and test diode and transistor circuits in the lab. 12. Troubleshoot and optimize circuit designs for practical applications. 13. Relate circuit design concepts to biomedical device development. 14. Evaluate circuit performance through experimental and simulation results.
Indicative Contents	Indicative content includes the following. 1. Introduction to Electronic Circuits • Fundamental concepts: Voltage, current, power, and energy in electrical circuits. • Circuit elements: Resistors, capacitors, inductors, and their behaviors in AC and DC circuits. 2. Semiconductor Basics • Physics of Semiconductors: • Intrinsic and extrinsic semiconductors. • Charge carriers (electrons and holes) and their dynamics. • Doping and the formation of PN junctions. • Applications in Biomedical Devices: • Use of semiconductors in sensors and diagnostic equipment. 3. Diodes and Their Applications • Diode Characteristics and Models: • I-V characteristics, forward/reverse bias, and breakdown voltage. • Ideal vs. practical diode models. • Applications: • Rectification: • Half-wave and full-wave rectifiers (center-tap and bridge configurations). • Filtering and smoothing circuits using capacitors. • Voltage regulation: Zener diodes in power supply circuits. • Clipping circuits for signal shaping. • Clamping circuits to shift DC levels in biomedical signals. 4. Transistors and Their Applications • Bipolar Junction Transistors (BJTs): • Structure and operation in active, cutoff, and saturation modes. • Current gain (β) and base-emitter characteristics. • Field Effect Transistors (FETs): • JFET and MOSFET structures, operations, and characteristics. • Applications in switching and amplification. • Biomedical Relevance:

	• Signal amplification in devices such as ECG, EMG, and EEG. 5. Biasing Techniques • DC Biasing: • Fixed bias, collector-to-base feedback, and voltage-divider biasing methods for BJTs. • Bias stability and thermal considerations. • AC Biasing: • Capacitive coupling and bypass capacitors in amplifier circuits. • Signal distortion and stability analysis. 6. Amplifiers • Small-Signal Amplifiers: • Common emitter (CE), common base (CB), and common collector (CC) configurations. • Input and output impedance, voltage gain, and current gain. • Frequency Response: • Bandwidth and gain-frequency relationships. • High-pass, low-pass, and band-pass filtering concepts. • Operational Amplifiers (Op-Amps): • Inverting, non-inverting, summing, and differential amplifiers. • Applications in signal conditioning and biomedical instrumentation. 7. Circuit Design for Biomedical Applications • Signal Conditioning: • Amplification and filtering for biomedical signals (e.g., ECG, EEG). • Noise reduction techniques in analog circuits. • Biomedical-Specific Applications: • Circuits for sensor interfacing (e.g., temperature, pressure sensors). • Power supply and voltage regulation in portable biomedical devices. 8. Laboratory and Practical Applications • Circuit Assembly and Testing: • Hands-on experience with breadboards, power supplies, and testing tools (multimeters, oscilloscopes). • Testing of diodes, rectifiers, and transistor-based circuits. • Simulation Tools: • Use of software like Multisim, Proteus, LTSpice, or MATLAB for circuit simulation. • Virtual analysis of rectifiers, amplifiers, and transistor circuits. • Design Projects: • Designing and simulating biomedical-related circuits (e.g., ECG amplifiers, signal filters). • Troubleshooting and Optimization: • Identifying and resolving issues in circuit operation. • Comparing theoretical results with experimental outcomes. 9. Advanced Topics (Optional) • Power Electronics: • Introduction to switching regulators and DC-DC converters. • Application in powering biomedical devices. • Microelectronics in Biomedical Engineering.

Learning and Teaching Strategies	
Strategies	• Lectures: Interactive sessions with visual aids and real-world examples to explain key concepts. • Laboratory Sessions: Practical experiments for building and testing circuits, with hands-on troubleshooting. • Simulation-Based Learning: Using tools like Multisim and LTSpice for virtual circuit analysis and design. • Tutorials and Problem-Solving: Collaborative sessions focusing on solving circuit-related problems and clarifying doubts. • Project-Based Learning: Design and implementation of biomedical circuits, followed by presentations and evaluations. • Continuous Assessments: Regular quizzes, assignments, and feedback to track progress and reinforce learning. • Multimedia and Online Resources: Access to e-books, tutorials, and online platforms for self-paced study. • Guest Lectures and Seminars: Industry professionals discussing real-world applications of electronic circuits. • Active and Collaborative Learning: Encouraging teamwork and participation through group activities and discussions. • Problem-Based Learning (PBL): Addressing real-life biomedical engineering challenges with circuit design solutions.

Student Workload (SWL)			
Structured SWL (h/sem)	124	**Structured SWL (h/w)**	8
Unstructured SWL (h/sem)	51	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**175**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	10% (10)	2,4,6 & 8	LO #1, #2 and #10, #11
	Assignments	4	10% (10)	2,3,5,7	LO #3, #4 and #6, #7
	Projects / Lab.	1	15% (15)	Continuous	All
	Report	1	5% (5)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	10	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Semiconductor Diodes: PN Junction, Forward & Reverse Biased.
Week 2	Diode Equivalent Circuits, Dc characteristics.
Week 3	Diode Applications: Rectifiers.
Week 4	Clipping & Clamping Circuits.
Week 5	Zener Diodes.
Week 6	Bipolar Junction Transistor (BJT): Operation of pnp and npn transistor.
Week 7	Characteristics of CE, CB & CC Configurations Operating Point and Operating Regions.
Week 8	Biasing the BJT.
Week 9	Equivalent circuit model, Dc analysis of transistor.
Week 10	Design of dc bias circuits, design of current gain stabilized.
Week 11	Midterm Exam.
Week 12	Small Signal Low Frequency Analysis: Transistor amplifier.
Week 13	Comparison of BJT Amplifier Configurations.
Week 14	Cascading Amplifiers, Simplified Models.
Week 15	Frequency response of RC coupled amplifier & high performance of RC coupled amplifier.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Semiconductor Diodes I-V Characteristics.
Week 2	Lab 2: Half-Wave Rectification Circuits.
Week 3	Lab 3: Full-Wave Bridge Rectification Circuits.
Week 4	Lab 4: Clipper & Clamper Circuits
Week 5	Lab 5: BJT input and output Characteristics.
Week 6	Lab 6: BJT Biasing.
Week 7	Lab 7: Amplifier.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Electronic Devices and Circuit Theory. Robert L. Boylestad, Louis Nashelsky.	Yes
Recommended Texts	"The Art of Electronics" by Paul Horowitz and Winfield Hill. "Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N. O. Sadiku.	No
Websites	https://www.academia.edu/49994995/Electronic_Devices_and_Circuits_RL_Boylestad_and_Louis_Nashelsky	

Grading Scheme				
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.