MODULE DESCRIPTION FORM

Module Information					
Module Title	**Electrical Circuits II**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**LAER120**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		1	**Semester of Delivery**		2
Administering Department		Laser & Opto-electronics.	**College**	College of Engineering.	
Module Leader	Hazem Ali Jasim		**e-mail**	Hazem.Ali.Jasim@alayen.edu.iq	
Module Leader's Acad. Title		Asst. 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		09/03/2025	**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. Introduce the fundamental behavior and mathematical representation of alternating current (AC) signals. 2. Equip students with analytical tools to solve AC circuits using time-domain and phasor-domain techniques. 3. Analyze AC circuits containing resistors, capacitors, and inductors in series and parallel configurations. 4. Prepare students for advanced studies in resonance, filters, and power factor correction 5. Apply impedance concepts to solve circuits using mesh and nodal analysis in the phasor domain. 6. Understand resonance phenomena and conditions for maximum power transfer.
Module Learning Outcomes	- Explain the generation and characteristics of sinusoidal AC waveforms. - Derive and interpret expressions for instantaneous voltage and current in AC circuits. - Calculate peak, average, and RMS values of various periodic waveforms. - Represent sinusoidal quantities using phasor notation. - Understand and apply concepts of phase shift, angular frequency, and waveform comparison. - Determine the impedance of individual and combined R, L, and C elements. - Analyze series and parallel AC circuits using Ohm's Law and Kirchhoff's Laws. - Evaluate power in AC circuits: true power, reactive power, apparent power, and power factor. - Analyze series-parallel combinations of R, L, and C components in AC circuits. - Apply mesh and nodal analysis using phasors and complex impedance. - Evaluate resonance conditions in RLC circuits and determine resonant frequency, bandwidth, and quality factor. - Perform complete power analysis including reactive, real, and apparent power. - Apply power factor correction methods using capacitive compensation. - Use admittance (Y), conductance (G), and susceptance (B) in parallel circuit analysis. - Use frequency response and impedance variation techniques for circuit analysis.

Indicative Contents	**Indicative content includes the following:** - AC vs DC behavior and applications - Generation of sinusoidal waveforms - General equation for sinusoidal voltage and current - Angular velocity and its relationship with frequency - Effects of waveform amplitude and frequency on circuit response. - Instantaneous values and sinusoidal functions - Period, frequency, and angular frequency - Phase relationships and phase angle interpretation - RMS, average, and peak values - Phase shifts between voltage and current - Introduction to waveform comparison. - Behavior of resistors, inductors, and capacitors under AC - Phase relationships for R, L, and C elements - Phasor representation of sinusoidal signals - Impedance and its graphical (phasor diagram) interpretation - Complex number representation of circuit quantities - Use of polar and rectangular forms in circuit analysis. - Series AC circuits with R, L, and C - Parallel AC circuits with R, L, and C - Application of Ohm's and Kirchhoff's Laws to AC circuits - Voltage and current phasor diagrams - Resonance in series and parallel circuits (introductory) - Power analysis in AC circuits. - Combination of R, L, and C in series-parallel AC circuits - Equivalent impedance for mixed configurations - Voltage division and current division in AC circuits - Phasor diagrams for complex networks - Practical circuit reduction techniques. - Mesh analysis using phasors - Nodal analysis using complex admittances - Superposition theorem in AC networks - Thevenin's and Norton's theorems in AC analysis - Source transformations and simplification. - Series resonance in RLC circuits - Parallel resonance (tank circuit behavior) - Bandwidth and quality factor (Q) - Selectivity and filter design principles.

Learning and Teaching Strategies	
Strategies	A- Theoretical lectures. B- Conducting laboratory experiments. C- Learning through software and simulations. D- Presentations and discussions. E- Practical lessons and workshops. F- Self-reading and scientific research.

Student Workload (SWL)			
Structured SWL (h/sem)	60	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	90	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	10% (10)	2, 5, 7 & 10	LO #1, #2 and #5, #7
	Assignments	4	10% (10)	3, 6 and 11	LO #1, #4 and #6, #9
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	4	10% (10)	Continuous	LO #2, #4 #6 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	10	LO #1 - #9
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction – Alternating Waveforms.
Week 2	Alternating Waveforms (AC , Sinusoidal Wave)
Week 3	Complex Numbers & Phasor
Week 4	Response of Basic R, L and C Elements to a Sinusoidal Voltage or Current.
Week 5	Series, Parallel and Power forms in AC Circuits.
Week 6	Series-Parallel AC Circuits.
Week 7	Source Transformation and Superposition Theorem.
Week 8	1St Mid Exam.
Week 9	Mesh Theorem and Nodal Theorem. (AC)
Week 10	Thevenin Theorem and Maximum Power Transfer Theorem. (AC)
Week 11	Norton Theorem.
Week 12	Delta-Star Networks
Week 13	Resonance in AC Circuits.
Week 14	Polyphaser Systems (Three-Phase), Transformers, AC Machines.
Week 15	2nd Mid Exam.
Week 16	**Preparatory week before the final Exam.**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to AC Electrical Circuit Components and Devices.
Week 3	Lab 2: Series R L C Circuits.
Week 5	Lab 3: Parallel R L C Circuits.
Week 7	Lab 4: Series-Parallel R L C Networks.
Week 9	Lab 5: Series Resonance.
Week 11	Lab 6: Parallel Resonance.
Week 13	Lab 7: Filters

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Boylestad, R. L. (2010). Introductory Circuit Analysis (12th ed.). Pearson Education. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education.	Yes
Recommended Texts	DC Electrical Circuit Analysis: A Practical Approach Copyright Year: 2020, dissidents.	No
Websites	---	

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.