Ministry of Higher Education and Scientific Research - Iraq
Al-Naji University
College of Engineering
Department of Computer Engineering

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**ELECTRICAL CIRCUITS**	**Module Delivery**	
Module Type	**CORE**	Class Lecture + Lab.	
Module Code	**COE104**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
Module Level	1	**Semester of Delivery**	1
Administering Department	computer	**College**	Engineering
Module Leader	Hussain Jomaa Abbas	**e-mail**	hussain.ioma@alnaii-uni.edu.iq
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	Ph.D.
Module Tutor	Hussain Jomaa Abbas	**e-mail**	hussain.joma@alnaji-uni.edu.iq
Peer Reviewer Name		**e-mail**	
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	COE101 Mathematics 1	**Semester**	1

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. **Understanding Basic Electrical Concepts**: To provide students with a comprehensive understanding of fundamental electrical concepts, including current, voltage, resistance, and conductance. 2. **Applying Ohm's Law and Kirchhoff's Laws**: To enable students to apply Ohm's Law and Kirchhoff's Laws in analyzing electrical circuits. 3. **Exploring Temperature Effects and Resistor Types**: To familiarize students with the effects of temperature on resistance and the various types of resistors and their applications. 4. **Analyzing Series and Parallel Circuits**: To develop students' ability to analyze and solve problems related to series and parallel circuits. 5. **Understanding Source Grouping and Conversion**: To teach students how to group and convert electrical sources and understand the role of dependent sources. 6. **Mastering Circuit Analysis Techniques**: To provide in-depth knowledge and practical skills in using various circuit analysis methods, including branch current, mesh, and nodal analysis. 7. **Utilizing Superposition, Thevenin's, and Norton's Theorems**: To equip students with the ability to simplify and analyze complex circuits using superposition, Thevenin's, and Norton's theorems. 8. **Maximizing Power Transfer and Performing Transformations**: To understand the principles of maximum power transfer and perform Y-Δ and Δ-Y transformations. 9. **Introducing Circuit Simulation Tools**: To introduce students to modern software tools for circuit simulation and design, preparing them for practical applications in engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. **Explain Basic Electrical Concepts.** 2. **Apply Ohm's Law and Kirchhoff's Laws.**: Utilize Ohm's Law and Kirchhoff's Laws to analyze and solve electrical circuit problems. 3. **Analyze the Effects of Temperature on Resistance**. 4. **Solve Series and Parallel Circuits**, **Interpret Open and Short Circuits**: Understand the effects of open and short circuits within electrical networks and their implications on circuit functionality. 5. **Perform Circuit Analysis Using Various Methods**: Apply branch current, mesh, and nodal analysis methods to determine currents, voltages, and other parameters in electrical circuits. 6. **Utilize Superposition, Thevenin's, and Norton's Theorems**: Simplify and analyze complex electrical circuits using superposition, Thevenin's, and Norton's theorems. 7. **Maximize Power Transfer and Perform Transformations**.

	8. **Use Circuit Simulation Software**: Demonstrate proficiency in using modern software tools for circuit simulation and design, integrating theoretical knowledge with practical application.
Indicative Contents المحتويات الإرشادية	**Basics of Electricity** • Introduction to electric current • Voltage difference and electromotive force (EMF) • Resistance and resistivity: concepts and definitions • Conductance and conductivity: relationships and calculations **Fundamental Laws and Concepts** • Ohm's law: understanding and applications • Linear resistance: properties and examples • Non-linear resistance: characteristics and examples **Temperature and Resistors** • Temperature effects on resistance: positive and negative temperature coefficients • Types of resistors: fixed, variable, and special resistors • Color coding of resistors: decoding and calculations **Basic Circuit Analysis** • Series circuits: properties, voltage and current distribution • Parallel circuits: properties, voltage and current distribution • Kirchhoff's voltage law (KVL): principles and applications • Kirchhoff's current law (KCL): principles and applications **Open and Short Circuits** • Definition and impact of open circuits in electrical networks • Definition and impact of short circuits in electrical networks • Practical examples and problem-solving **Source Grouping and Conversion** • Grouping of electrical sources: series and parallel combinations • Conversion of sources: from voltage to current sources and vice versa • Dependent sources: types and applications **Circuit Analysis Methods** • Branch current method: principles and applications • Mesh analysis: formulation and solution of mesh equations • Nodal analysis: formulation and solution of nodal equations

	• Superposition theorem: principles and problem-solving **Theorems for Circuit Analysis** • Thevenin's theorem: understanding and practical applications • Norton's theorem: understanding and practical applications **Power Transfer and Transformations** • Maximum power transfer theorem: principles and applications • Y-Δ (Delta) transformation: techniques and problem-solving • Δ-Y (Delta to Wye) transformation: techniques and problem-solving **Software Tools for Circuit Simulation** • Introduction to circuit simulation software (e.g., SPICE, Multisim, or equivalent) • Basic functions and features of simulation tools • Practical exercises in circuit simulation and design
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1.Lectures: The module may include traditional lectures where the instructor presents the theoretical concepts, principles, and mathematical techniques related to mathematical modeling and electrical circuits. The lectures can provide a foundation for understanding the subject matter. 2. Interactive Discussions: Interactive discussions can be incorporated to encourage student participation and engagement. This can involve questioning and problem-solving activities related to mathematical modeling and electrical circuits. Discussions can help clarify concepts and stimulate critical thinking. 3. LAB Experiment. Sessions: Hands-on LAB.sessions can allow students to apply the theoretical knowledge to real-world scenarios. Students may work with electrical circuit components, measurement devices, and software tools for circuit simulation and analysis. LAB Experiment provide valuable experiential learning opportunities. 4. Computer-based Learning: Computer-based learning resources, such as online tutorials, interactive simulations, and educational software, can be used to supplement the learning process. These resources can assist students in visualizing electrical circuits, simulating their behavior, and exploring mathematical modeling concepts. 6. Group Projects: Collaborative group projects can encourage teamwork and the application of mathematical modeling principles to solve complex electrical circuit problems. Students can work together to design and analyze circuits, formulate mathematical models, and present their findings to the class. 7. Assessment Methods: Various assessment methods can be employed, including quizzes, tests, assignments, and project reports. These assessments can evaluate students' understanding of mathematical modeling and electrical circuits, their ability to apply the learned concepts, and their problem-solving skills.

	8. Self-directed Learning: Encouraging students to engage in self-directed learning by exploring additional resources, conducting research, and practicing problems independently can further enhance their understanding and mastery of the subject matter.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.267
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	46	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.067
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	10% (10)	3,7,11	LO #1-5
	Assignments	2	5% (5)	8,14	LO #1-8
	Lab.	7	20%(20)	1-15	LO #3, 4, 5, 6 ,7 and 8
Summative assessment	**Projects**	1	5% (5)	12	LO #3,4 ,5,6 and 8
	Mid Exam	1	10% (10)	15	LO # 1-4
	Final Exam	4 hr	50% (50)	16	LO #1-7
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Electric current, voltage difference, resistance and resistivity, conductance and conductivity
Week 2	Ohm's law, linear and non-linear resistance

Week 3	Temperature effect and coefficients of resistance, types of resistors, color coding of resistors
Week 4	Series and parallel circuits
Week 5	Kirchhoff's laws
Week 6	Effect of open and short circuits
Week 7	Grouping sources, conversion of sources, dependent sources
Week 8	Branch current method
Week 9	Mesh analysis
Week 10	nodal analysis
Week 11	Superposition
Week 12	Thevenin and Norton's theorems
Week 13	Maximum power transfer
Week 14	Y-D and D-Y transformation
Week 15	Introduction to software tools for circuit simulation and design
Week 16	Review and revision and Final examination preparation

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to Lab Equipment and Basic Measurements
Week 2	EXP 1: Ohm's Law and Basic Components
Week 3	cont.
Week 4	EXP 2:KVL
Week 5	EXP 3: KCL
Week 7	EXP 4: superposition
Week 8	EXP 5: Thevenin's and Norton's Theorems
Week 9	cont.
Week 10	EXP 6: Maximum power transfer
Week 11	cont.
Week 12	EXP 7: Circuit Simulation Tools
Week 13	cont.
Week 14	Final Project and Review
Week 15	Final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس		
	Text	**Available in the Library ?**
Required Texts	1-Fundamentals of Modern Electric Circuit Analysis and Filter Synthesis A Transfer Function Approach Second Edition© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2023 2-Fundamentals of Electric Circuits Charles K. Alexander Professor Emeritus of Electrical Engineering and Computer Science Cleveland State University ,Matthew N. O. Sadiku Department of Electrical and Computer Engineering Prairie View A&M University Published by McGraw-Hill Education, 2 Penn Plaza, New York, NY 10121. Copyright © 2021 by McGraw-Hill Education. 3."Engineering Circuit Analysis" by William H. Hayt Jr. and Jack E. Kemmerly: This textbook provides a comprehensive introduction to electrical circuits, covering topics such as circuit analysis techniques, network theorems, and AC circuit analysis. 5."Introduction to Electric Circuits" by Richard C. Dorf and James A. Svoboda: This textbook offers a practical approach to understanding electric circuits. It covers topics such as circuit analysis techniques, network theorems, AC circuit analysis, and introduces mathematical modeling principles. 4."Mathematical Modeling and Simulation: Introduction for Scientists and Engineers" by Kai Velten: This textbook focuses specifically on mathematical modeling techniques and their application in various scientific and engineering fields. It covers topics such as modeling principles, differential equations, simulation methods, and includes examples relevant to electrical circuits.	Yes Soft copy
Recommended Texts	1."Electric Circuits" by James W. Nilsson and Susan A. Riedel: This textbook offers a clear and concise introduction to electrical circuits and circuit analysis. It covers topics such as Kirchhoff's laws, network theorems, AC circuit analysis, and introduces mathematical modeling techniques. 2."Mathematical Modeling and Simulation: Introduction for Scientists and Engineers" by Kai Velten: This textbook focuses specifically on mathematical modeling techniques and their application in various scientific and engineering fields. It covers topics such as modeling principles, differential equations, simulation methods, and includes examples relevant to electrical circuits. 3.Basic Engineering Circuit Analysis J. DAVID IRWIN Auburn University R. MARK NELMS Auburn University 2021 12th Edition 4-Fundamentals of Modern Electric Circuit Analysis and Filter Synthesis A Transfer Function Approach Second Edition© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2023 5-Fundamentals of Electric Circuits Charles K. Alexander Professor Emeritus of Electrical Engineering and Computer Science Cleveland	Yes pdf

	State University ,Matthew N. O. Sadiku Department of Electrical and Computer Engineering Prairie View A&M University Published by McGraw-Hill Education, 2 Penn Plaza, New York, NY 10121. Copyright © 2021 by McGraw-Hill Education.	
Websites	1.MATLAB(www.mathworks.com/products/matlab.html 2. Simulink (www.mathworks.com/products/simulink.html) 3. CircuitLab (www.circuitlab.com) 4. Multisim Live (www.multisim.com/live/)	

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.