University Name: University of Diyala

Faculty/Institute: College of Engineering

Scientific Department: Department of Electrical Power and Machines Engineering

Academic or Professional Program Name: Bachelor

Final Certificate Name: Bachelor of science in Electrical Power and Machines Engineering

Description Preparation Date: 17/8/2026

Completion Date: 17/8/2026

Signature:

Head of Department Name:
Assit. Prof. Balasim M. Hussein

Date: 17/8/2026

Signature:

Scientific Associate Name:

Prof. Dr. Jabbar Gottmah

Date:17/8/2026

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Date: 17/8/2026

Signature:

Approval of the Dean

Prof. Dr. Anees A. Khadom

MODULE DESCRIPTION FORM

Module Information

Module Title	**Electrical Power I**	**Module Delivery**
Module Type	**Core**	☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	**EP301**	
ECTS Credits	**6**	
SWL (hr/sem)	**150**	

Module Level	3	**Semester of Delivery**	5
Administering Department	Type Dept. Code	**College**	Type College Code
Module Leader	Name: Husham Idan Hussein	**e-mail**	E-mail: hushamidan@uodiyala.edu.iq
Module Leader's Acad. Title	Prof.	**Module Leader's Qualification**	M.Sc.
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Name	**e-mail**	E-mail
Scientific Committee Approval Date	01/01/2024	**Version Number**	1.0

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	**Electric Circuits II**	**Semester**	4
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	• Study the basic principles of power system. • Qualifying students to be able to become familiar with the theoretical and scientific aspects of power system. • Study the types of transmission lines, their types, working principles, properties and applications, and explain the importance of their uses in practical life. • Urging students to benefit from the course in their field of work as engineers in the field of electrical power engineering in the future

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**On completion of the course the students should be able:** • To have detailed knowledge of the physical background and terminology of the power system theory for electrical engineering problems • To understand the power system behavior. • To select and use appropriate theoretical models for analysis, problem solving and finding solutions related to the power system.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Part A - Basic Concepts** Electrical Power Generation ,Energy resources,Various types of power stations. Load curves and load factors. Introduction, [18 hrs]. **Part B - Basic Laws** Introduction, conductor materials, cables selection and properties, Skin effect [15 hrs] **Part C - Methods of Analysis** Transmission power system Parameters, Resistance, Inductance, and capacitance. [12 hrs] **Part D - Circuit Theorems** Performance of the power transmission line Analysis, Short line Analysis, medium line Analysis, long line Analysis [24 hrs]. Revision problem classes [6 hrs]
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**1. Behavior management** Behavior management strategies foster an atmosphere of mutual respect, reduce disruptive behavior and ensure students have an equal opportunity to fulfill their potential in the classroom. It's crucial to provide them with both a positive and productive learning environment. Examples include establishing a reward system with an interactive chart where students move up or down depending on their performance and behavior in class. **2. Blended learning** With a blended learning teaching strategy, technology is incorporated with traditional learning. This allows students to work at their own pace, research their ideas and become

	more physically engaged during lessons. Examples include providing interactive tablets or whiteboards with engaging activities and posting classwork online for easier access. **3. Cooperative learning** Group work is a cooperative learning strategy that allows students with various learning levels to work together. By encouraging them to express their own ideas and listen to others' ideas as a group, you help students develop communication and critical thinking skills. Examples include solving math puzzles together, performing skits as a team or working on group presentations. **4. Formative assessment** A formative assessment is used periodically to monitor student learning incrementally. This can more effectively measure the process of learning as opposed to end-of-unit tests and can help you to improve your teaching methods throughout the year. Examples of this teaching strategy include self-evaluation exercises and summarizing a topic in multiple ways. **5. Student-led teaching** The student-led teaching strategy lets students become the teacher. In a classroom with learners at different levels, you can better engage those learning faster by showing them how to teach and give feedback to their peers.They may team-teach or work in groups to teach a new topic. Examples include letting a student teach an entire lesson or having advanced writers lead a peer-editing session as well as provide constructive criticism.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	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	Construction of electrical power systems Electrical Power Generation, Energy resources.
Week 2	Various types of power stations.
Week 3	Load curves and load factors.
Week 4	Types of Loads
Week 5	Economic choice of transmission voltage Conductor material
Week 6	Electrical Design of Overhead Lines
Week 7	Parameters of overhead transmission lines
Week 8	Resistance Inductance Capacitance
Week 9	Design of electric power transmission lines
Week 10	Inductance (Flux Linkages)
Week 11	Design of electric power transmission lines
Week 12	Flux linkages in parallel current carrying conductors.
Week 13	Design of electric power transmission lines

Week 14	Capacitance of Transmission Line ,Capacitance of three – phase line:
Week 15	Performance of Transmission Lines Classification of Overhead Transmission Lines: Short line. Medium line Long line.
Week 16	Final exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1- Elements of Power system analysis, W. D. Stevenson.	Yes
Recommended Texts	2- A Text Book in Power system Engineering, P. V. Gupta.	No
	3- Principles of power system V. K. Mehta.	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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	***Engineering Analysis***			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**EPE303**			☒ **Lecture**	
ECTS Credits	**4**			☐ **Lab**	
SWL (hr/sem)	**100**			☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Level	3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: Osama Sahib Jafar		**e-mail**	E-mail: assamasahib@uodiyala.edu.iq	
Module Leader's Acad. Title	Lect.		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/01/2024		**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	. This module aims to: • Develop an in-depth understanding of advanced mathematical and computational techniques for engineering analysis.

	• Equip students with the ability to apply analytical and numerical methods to solve complex engineering problems. • Foster the ability to critically analyze engineering models and assess their validity. • Enhance skills in using computational tools for engineering simulations and data analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On the completion of this course student should be able to understand the following topics: The **Fourier Transform** module aims to provide students with a deep understanding of the mathematical foundations and applications of Fourier transforms in engineering, physics, and signal processing. The **Matrix Analysis** module focuses on advanced matrix theory and its applications in engineering, physics, and applied mathematics. The **Z-Transform** module focuses on discrete-time signal analysis, system behavior, and applications in digital signal processing and control systems. The **Power Series Method for Differential Equations** module focuses on solving differential equations using series expansions, particularly when traditional analytical methods fail. The **Special Functions** module focuses on a class of mathematical functions that frequently appear in engineering, physics, and applied mathematics. These functions often arise as solutions to differential equations and have well-defined properties that make them useful in scientific applications.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Part A - Basic Concepts** Introduction, Systems of Units, Charge and Current, Voltage, Power and Energy, Circuit Elements [18 hrs] **Part B - Basic Laws** Ohm's Law, Nodes, Branches, and Loops, Kirchhoff's Laws, Series Resistors and Voltage Division, Parallel Resistors and Current Division, Wye-Delta Transformations. [15 hrs] **Part C - Methods of Analysis** Nodal Analysis, Nodal Analysis with Voltage Sources, Mesh Analysis, Mesh Analysis with Current Sources [12 hrs] **Part D - Circuit Theorems** Superposition, Source Transformation, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer [24 hrs] Revision problem classes [6 hrs]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	**1. Behavior management** Behavior management strategies foster an atmosphere of mutual respect, reduce disruptive behavior and ensure students have an equal opportunity to fulfill their potential in the classroom. It's crucial to provide them with both a positive and productive learning environment. Examples include establishing a reward system with an interactive chart where students move up or down depending on their performance and behavior in class. **2. Blended learning** With a blended learning teaching strategy, technology is incorporated with traditional learning. This allows students to work at their own pace, research their ideas and become more physically engaged during lessons. Examples include providing interactive tablets or whiteboards with engaging activities and posting classwork online for easier access. **3. Cooperative learning** Group work is a cooperative learning strategy that allows students with various learning levels to work together. By encouraging them to express their own ideas and listen to others' ideas as a group, you help students develop communication and critical thinking skills. Examples include solving math puzzles together, performing skits as a team or working on group presentations. **4. Formative assessment** A formative assessment is used periodically to monitor student learning incrementally. This can more effectively measure the process of learning as opposed to end-of-unit tests and can help you to improve your teaching methods throughout the year. Examples of this teaching strategy include self-evaluation exercises and summarizing a topic in multiple ways. **5. Student-led teaching** The student-led teaching strategy lets students become the teacher. In a classroom with learners at different levels, you can better engage those learning faster by showing them how to teach and give feedback to their peers. They may team-teach or work in groups to teach a new topic. Examples include letting a student teach an entire lesson or having advanced writers lead a peer-editing session as well as provide constructive criticism.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.5

الحمل الدراسي غير المنتظم للطالب خلال الفصل		الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	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	**Mathematical engineering analysis Overview** *Review for the related topics from applied mathematics I and II; Course topics*
Week 2	**Fourier Transform:** *Review of Fourier series, trigonometric and exponential form, Fourier transform for non-periodic functions. Fouries sine and cosine inegrals on non-periodic functions, spectrum analysis.*
Week 3	**Fourier Transformation of different functions.:** *Fourier transform for different functions (Dirace delta func, unit step, exponential, sine and cosine, sgn, constants… etc.)*

Week 4	**Fourier Transform properties:** Linearity, scaling, complex conjugate, time shifting(delay), frequency shifting, differential property, integration property, convolution in time, Paseval theorem.
Week 5	**Matrix Analysis:** General review and definitions, basic operations on matrices, determinants, transposition, matrix inverse,
Week 6	**Matrix Analysis:** Linear transformation, Eigenvalues and Eigenvectors, matrix diagonalization, multiple eigenvalues, repeated eigenvalues,
Week 7	**Matrix Analysis:** Reduction to diagonal form, The Hamilton theorem.
Week 8	**Mid-term Exam**
Week 9	**Matrix Analysis:** Solution of a system of differential equations using matrix method, symmetric, skew-symmetric and orthogonal matrices, orthogonal transformations and orthogonal matrices.
Week 10	**Z- Transform:** Introduction, definition, Z.T of some functions., preperties of Z. T, linearity , shifting, multiplication by exponential, initial value theorem, final value theorem.
Week 11	**Z- Transform:** Inverse Z- transform, partial fraction method, power series inverstion method, discrete convolution.
Week 12	**Solution of differential equations by Power Series:** *Polynomials, Legendre differential equation kinds.*
Week 13	**Solution of differential equations by Power Series:** *Bessel function of the first order,.*
Week 14	**Solution of differential equations by Power Series:** *Bessel function of the second order.*
Week 15	**Special functions:**

	Gamma and Beta functions.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**1. Advanced Engineering Mathematics by Erwin Kreyszig, 9thedition, USA, 2006.** **2. Signals and Systems , B. Gerod, R. Rabenstien, A. Stenger,USA, 2001,**	Yes
Recommended Texts	**1. Advanced Engineering Mathematics by C. Ray Wylie.** **2. Signals and Systems, Hwei P. Hsu, USA, 1995.**	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	**AC-Machines I**		**Module Delivery**
Module Type	**Core**		☒**Theory** ☒**Lecture** ☒**Lab** ☒**Tutorial** ☐**Practical** ☐**Seminar**
Module Code	**EPE309**		
ECTS Credits	7		
SWL(hr/sem)	175		
Module Level	3	**Semester of Delivery**	5
Administering Department	**Bachelor of Electrical Power and Machines**	**College**	College of Engineering
Module Leader	Ali Najim Abdullah	**e-mail**	alinajim@uodiyala.edu,iq
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date	1/09/2024	**Version Number**	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**Electrical Machines**	**Semester**	3
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. Providing the student with basic information about constructional features of synchronous machines (generator and motor). 2. Providing an introduction to principle operation of alternating current machine. 3. Familiarity with the famous Load Characteristics of Alternators. 4. Knowledge of student to methods of predetermination of voltage regulation. 5. Obtain sufficient information about operation of salient pole synchronous machine 6. Obtain sufficient information about parallel operation of alternators. 7. Providing the student with principle operation of synchronous motor and methods of starting. 8. Providing an introduction to synchronous motor applications
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A- Cognitive goals A1- Explain the construction and operation principles of synchronous machines, including both (generators and motors). A2- Distinguish between salient-pole rotor and non-salient (cylindrical) rotor machines and understand their applications. A3- Analysis and study the steady-state operation of synchronous machines under various loading conditions. A4- Perform phasor diagram analysis to understand machine behaviour during operation. A5- Calculate the performance quantities, such as voltage regulation, efficiency, torque, and power factor. A6- Describe the synchronization process and conditions required to connect synchronous generators to bus bare of the grid. A7- Evaluate excitation systems and their impact on machine performance and system stability. A8- Understand and apply different methods of starting for synchronous motors. A9- Identify common faults and maintenance procedures related to synchronous machines. A10- Apply safety regulations and industry standards during installation, testing, and operation of synchronous machines. B - Skills objectives of the course. B1- Identify and Assemble the main components of synchronous machines, including stators, rotors, and excitation systems. B2- Operate the synchronous motors and generators under supervised lab or simulated, by applying correct start up and shutdown procedures. B3- Perform measurements of voltage, current, power, and power factor using appropriate instruments during synchronous machine operation. B4- Conduct synchronization procedures for connecting synchronous generators to bus bar of the grid, following correct safety and technical protocols. B5- Draw and interpret phasor diagrams and circuit models to support machine analysis and troubleshooting. B6- Use diagnostic tools and techniques to identify faults in synchronous machines and recommend corrective actions. B7- Apply testing procedures to determine performance characteristics such as open-circuit and short-circuit tests, voltage regulation, and efficiency.

	B8- Implement various excitation methods and assess their influence on machine performance in practical methods. B9- Utilize simulation software or lab equipment to model and analyze synchronous machine behaviour under different loading conditions. B10- Follow industry safety standards and maintenance practices when working with high-voltage machines and rotating equipment.
Indicative Contents المحتويات الإرشادية	1. Introduction to Synchronous Machines. Definition and basic principles of synchronous machines. Classification, synchronous motors and synchronous generators. Applications of synchronous machines in industry and power systems. 2. Construction and Components. Stator: Construction, types of winding. Rotor: Salient-pole, non-salient-pole (cylindrical rotor), rotor construction. Excitation System: Exciter types (static, rotating), field excitation and the control of field current. 3. Working Principle. Electromagnetic induction and the principle of operation. Interaction between the stator magnetic field and rotor. Synchronous speed and the relationship between frequency, poles, and speed. 4. Phasor Diagrams and Equivalent Circuits. Steady-state operation analysis using phasor diagrams. Equivalent circuit models for synchronous motors and generators. Power flow, losses, and efficiency calculation. 5. Performance Characteristics. Torque-speed characteristics of synchronous motors. Power factor and efficiency analysis under different loading conditions. Voltage regulation and its calculation methods, open-circuit and short-circuit tests. Power factor correction. 6. Synchronization of Synchronous Generators. Conditions for synchronization with the grid (voltage, frequency, phase matching). Methods of synchronization (manual vs. automatic). Role of synchronizing devices and synchroscope. 7. Starting Methods for Synchronous Motors. Direct-on-line starting for synchronous motors. Pony motor or auxiliary motor start. Damper windings: Importance in starting and stability. Out-of-phase starting. 8. Excitation Systems and Control Types of excitation systems (e.g., automatic voltage regulators, static excitation systems). Field control in synchronous motors and generators. Impact of excitation on power factor and machine stability. 9. Faults and Diagnostics. Common faults in synchronous machines (e.g., loss of excitation, short circuits, overheating). Diagnostic tools and techniques for fault detection. Preventive maintenance strategies. 10. Applications of Synchronous Machines. Role of synchronous generators in power stations and grid systems. Use of synchronous motors for constant-speed drives (e.g., pumps, compressors). Synchronous machines in power factor correction and voltage regulation.
Description	This course focuses on the principles, construction, and operation of three-phase synchronous machines. It covers synchronous generators and motors, excitation systems, synchronization, voltage regulation, and power-angle characteristics. Study the machine performance, testing, and applications in power generation and industrial systems A synchronous machine is an electric machine that operates at a constant speed, known as synchronous speed, which is synchronized with the supply frequency. It can function as either a synchronous motor or a synchronous generator.

	Synchronous Motors: These motors run at a fixed speed determined by the power supply's frequency, making them ideal for applications requiring precise, constant-speed operation, such as pumps and compressors. Synchronous Generators: These machines generate electricity at a fixed frequency and are commonly used in power plants to supply electricity to the grid. The characteristic of synchronous machines is that the rotor rotates at the same speed as the rotating magnetic field produced by the stator, which is determined by the number of poles in the machine and the supply frequency. They are widely used for power factor correction, voltage regulation, and in applications requiring stable speed or frequency.

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	**In this course, students are guided by:** • Studying the theoretical and practical academic program for the specialty lessons • The theoretical program is taught using the smart board, whiteboard or data show connected to the personal computer, discussing ideas and facts with the students. • Adopting the study through virtual electronic classes as an aid to the real classes. • Present a simple project or seminar to fellow students to boost their self-confidence.

Student Workload (SWL) الحمل الدراسي للطالب محسوبة بال 15 اسبوع			
Structured SWL(h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**94**	**Structured SWL(h/w)** الحمل الدراسي المنتظم للطالب اسبوعيا	**6**
Unstructured SWL (h/sem) الحمل الدراسي اللامنتظم للطالب خلال الفصل	**81**	**Unstructured SWL(h/w)** الحمل الدراسي اللامنتظم للطالب خلال الفصل أسبوعيا	**5**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**175**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight(Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Month Exam	2	15%(15)	6 and 12	
	Quizzes	4	5%(10)	2 and 14	
	Projects/ Lab.	10	10%(10)	Continuous	All
	Report	1	5%(5)	13	
	H.W	4	5%(5)	Continuous	
Summative assessment	Midterm Exam	2hr	10%(10)	10	
	Final Exam	3hr	50%(50)	16	All
Total assessment			100%(100Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Constructional Features of Synchronous Machines: Principle of Operation, Constructional Requirements (Field System), Frequency of Induced EMF, Prime-Movers for Synchronous Generators, Stator and Rotor Construction, Electrical and Mechanical Degrees,.
Week 2	Three Phase Winding and Winding Factors, EMF Equation and Open Circuit Characteristic for Synchronous Generators, Rating of Alternators.
Week 3	Load Characteristics of Alternators: Alternator Operation, Voltage Variations due to (Winding Resistance, Leakage Reactance and Armature Reaction), Representation of Smooth Cylindrical Type Alternator, Phasor Diagrams for (Lagging, Unity and Leading) Power Factor, Load Angle and Load Characteristics.
Week 4	Introduction to Voltage Regulation: Definition of Voltage Regulation, Regulation Characteristics, Excitation for Constant Terminal Voltage, Equations For Power Generated and Power Output, Self-Excited for Single and Three Phase Alternators
Week 5	Predetermination of Voltage Regulation: Necessity for Predetermination, Methods of Predetermination Voltage Regulation (Synchronous Impedance/EMF Method and Ampere-Turn/MMF Method).
Week 6	Predetermination of Voltage Regulation by POTIER/ZPF Method.
Week 7	Operation of Salient Pole Synchronous Machine, Phasor Diagram for a Salient Pole Synchronous Machine, Calculations from Phasor Diagram, Power Developed by a Synchonous Generator
Week 8	Parallel Operation of Alternators, Synchronizing Methods (procedure) of Alternators, Synchronizing Power and Torque.
Week 9	Load Sharing: Prime-mover Characteristic, Effect of Change in Prime-mover Input, Effect of Change in Excitation, Generator in Parallel
Week 10	Midterm Exam
Week 11	Operation on Infinite Bus-bars: Infinite Bus-bars, General Operation at zero and other than zero power factor, General Load diagram, Motor Operation, Determination of Voltage Regulation by Bus Bar Loading.
Week 12	Synchronous Motors: Characteristics Features, Principles of Operation, Methods of Starting, Speed-Torque Characteristics.
Week 13	Network Equations, Phasor Diagrams for Lagging, Unity and Leading Power Factor, Torque-Angle Characteristics.
Week 14	Construction of V-curves, V and Inverted V Curves and Hunting of Synchronous machines.
Week 15	Two Reaction Theory: Effect of Saliency in Armature Reaction (Slip Test and Direct and Quadrature Reactance), Phasor Diagram for Generator and Motor Operation, Power Angle Relation, Reluctance power, Advantages of Salient Pole Machines.
Week 16	Final Exam

Delivery Plan (Weekly-Lab Syllabus) المنهاج الأسبوعي للمختبر	
	Material Covered
Week 1	Study the Construction of Three Phase Synchronous Machines
Week 2	Measuring Synchronous Generator Model Parameters Part (1): The Armature Resistance Measurement of a 3-Phase Synchronous Generator.
Week 3	Measuring Synchronous Generator Model Parameters Part (2): Open Circuit Characteristic(OCC) (No-Load Saturation Characteristic)
Week 4	Measuring Synchronous Generator Model Parameters Part (3): Short Circuit Characteristic (SCC)
Week 5	Alternator Characteristics
Week 6	Regulation of a Three Phase Alternator by Synchronous Impedance (EMF) Method.
Week 7	Regulation of a Three Phase Alternator by Ampere Turns (MMF) Method.
Week 8	Regulation of a Three Phase Alternator by Potier/Zero Power Factor Method.
Week 9	Excitation Characteristics of Alternator
Week 10	Automatic Voltage Regulation for Excitation (AVR)
Week 11	Connection and Synchronous Motor Direction control
Week 12	Excitation Characteristic of Synchronous Motor
Week 13	Load Characteristic of Synchronous Motor
Week 14	Determination of Xd and Xq of a Salient Pole Synchronous Machine.
Week 15	V and Inverted V curves of a Three Phase Synchronous Motor
Week 16	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• M.G.Say, Alternating Current Machines, Pitman Pub. • 2. A.S. Langsdorf, Theory of AC Machinery, McGRAW-HILL Pub.	Yes Yes

Recommended Texts	• Induction and Synchronous Machines by K. Murugesh Kumar • Electrical and Electronic principles and technology	No
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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Power Electronics I			**Module Delivery**	
Module Type	Core			☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	EPE311				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: Ammar Issa Ismael		**e-mail**	E-mail: ammarissa@uodiyala.edu.iq	
Module Leader's Acad. Title	Asst. Prof.		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2025		**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	• Study the basic principles of power electronic. • Qualifying students to be able to become familiar with the theoretical and scientific aspects of power electronic. • Study the types of inverters and converters, their types, working principles, properties and applications, and explain the importance of their uses in practical life. • Urging students to benefit from the course in their field of work as engineers in the field of electrical power engineering in the future
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Learn about the basic concepts of power electronic. 2. Learn about construction of inverters and converters. 3. Know the types of inverters and converters. 4. Knowing the pulse width modulation (PWM). 5. Study the characteristics of power electronic. 6. Know the conditions for operating the control in power electronic. 7. identify DC/DC Convertor (Choppers). 8. Learn to operate electric motors and control their speed. 9. Study types of Power Semiconductor Devices 10. Identify the harmonics and power factor considerations
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: **<u>Part A Power Semiconductor Devices</u>** Power Diode, Thyristor, Diac, Triac, BJT Transistor, Mosfet.. [18 hrs.] **<u>Part B – converters (Rectifier)</u>** Introduction, Principle Working of AC/ DC converter, Uncontrolled and Controlled Half and Full wave Rectifier. DC/AC Convertor (Inverters),. [15 hrs.] **<u>Part C – DC/DC Convertor (Choppers),</u>** Introduction, Principle Working of DC/DC Convertor, Buck converter, Boost converter. [24 hrs] **<u>Part D - AC/AC Convertor (Cycloconverters).</u>** Introduction, Principle Working AC/AC Convertor (Cycloconverters). Static Switches [6 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**1. Behavior management** Behavior management strategies foster an atmosphere of mutual respect, reduce disruptive behavior and ensure students have an equal opportunity to fulfill their potential in the classroom. It's crucial to provide them with both a positive and productive learning environment. Examples include establishing a reward system with an interactive chart where students move up or down depending on their performance and behavior in class. **2. Blended learning** With a blended learning teaching strategy, technology is incorporated with traditional learning. This allows students to work at their own pace, research their ideas and become more physically engaged during lessons. Examples include providing interactive tablets or whiteboards with engaging activities and posting classwork online for easier access. **3. Cooperative learning** Group work is a cooperative learning strategy that allows students with various learning levels to work together. By encouraging them to express their own ideas and listen to others' ideas as a group, you help students develop communication and critical thinking skills. Examples include solving math puzzles together, performing skits as a team or working on group presentations. **4. Formative assessment** A formative assessment is used periodically to monitor student learning incrementally. This can more effectively measure the process of learning as opposed to end-of-unit tests and can help you to improve your teaching methods throughout the year. Examples of this teaching strategy include self-evaluation exercises and summarizing a topic in multiple ways. **5. Student-led teaching** The student-led teaching strategy lets students become the teacher. In a classroom with learners at different levels, you can better engage those learning faster by showing them how to teach and give feedback to their peers. They may team-teach or work in groups to teach a new topic. Examples include letting a student teach an entire lesson or having advanced writers lead a peer-editing session as well as provide constructive criticism.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	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	• Introduction to Power electronics switches:
Week 2	• Power Diode,
Week 3	• Thyristor , Triac
Week 4	• BJT Transistor, MOSFET
Week 5	• Calculation of standing (Blocking) voltage of a converter
Week 7	• AC/DC converters(Rectifier)
Week 8	• Switching losses
Week 9	• **Mid-term Exam**
Week 10	• Uncontrolled Half and Full wave Rectifier
Week 11	• Controlled Half and Full wave Rectifier
Week 12	• DC/DC Convertor (Choppers),
Week 13	• DC/AC single phase (Inverters),
Week 14	• DC/AC three phase(Inverters),
Week 15	• AC/AC Convertor (Cycloconverters).
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:. Introduction about devices and Lab's
Week 2	Lab 2: power supply
Week 3	Lab 3: UJT characteristics and application
Week 4	Lab 4: UJT applications
Week 5	Lab 5: PUT characteristics
Week 6	Lab 6: PUT applications
Week 7	Lab 7 SCR characteristics
Week 8	Lab 8: SCR applications
Week 9	Lab 9: speed control
Week 10	Lab 10: :SCS characteristics
Week 11	Lab 11: SCS Trigger
Week 13	Lab 13: SCR DC motor forward revers
Week 14	Lab 14: Diac and Traic
Week 15	**Final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	• Power electronic Hand Book, by Muhammad H. Rashid	Yes
Recommended Texts	• INTRODUCTION TO MODERN POWER ELECTRONICS, By **Andrzej M. Trzynadlowski**	No
Websites	• Peruse scientific websites for recent developments in the prescribed article	

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.

MODULEDESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلوماتالمادةالدراسية					
ModuleTitle	**Control Theory I**			**Module Delivery**	
ModuleType	**Basic**			☒**Theory** ☐**Lecture** ☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
ModuleCode	**EP313**				
ECTS Credits	3				
SWL(hr/sem)	75				
Module Level		3	**Semesterof Delivery**		5
Administering Department		**Bachelor of Electrical Power and Machines**	**College**	College of Engineering	
Module Leader	Zeyad Assi Obaid		**e-mail**	Zeyad.a.obaid@uodiyala.edu,iq	
Module Leader's Acad. Title		Assist.Prof	**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		1/09/2024	**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	9. Prepare the students to engage theoretically and practically in Electrical Power and Machines Engineering profession in public and private sectors including, but not limited to, relevant governmental sectors, consulting firms, contracting companies, marketing and real estate investments. 10. Prepare the students to Engage in ongoing professional development activities by pursuing graduate studies and/or other learning opportunities to respond to the arising challenges. 11. Advance in responsibility and leadership in their careers and compete with their peers according to the profession ethics. 12. Promote students with the necessary scientific and practical skills in the discipline for solving engineering problems and treating them logically and scientifically. 13. Promote students with the necessary skills administration, time management, team-work, communication and language skills, soft computing and programming skills. 14. Providing students with scientific, practical and personal skills that enable them to solve practical problems and deal with them using scientific concepts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A- Cognitive goals A 1- Acquiring knowledge of mathematics, computers, engineering and customary sciences, employing them and preparing the student for scientific research. A 2- The ability to diagnose engineering problems within the jurisdiction and know their causes and appropriate solutions. A 3- To familiarize students with the basic theories of power engineering, machines, electrical machines, power plants, and various industrial applications and applications. A4 - The student will be familiar with the basics of communication and control systems, electronics, digital technologies and their applications. B - Skills objectives of the course. B1 - Empowering students with the basics of working on power systems, electromagnetic fields, high pressure, and skills of analysis and design programs for electrical networks. B2 - Skills of analyzing and designing electrical networks for transmission and distribution and designs of building networks, as well as enabling students to obtain knowledge of the practical framework in the field of energy types, energy transmission and distribution, operation and control. B3 - Enable students to obtain knowledge and understanding of conventional electric power generation, renewable energy of all kinds, and thermal power plants. B4 - Enabling students to obtain knowledge and understanding of fault diagnosis, protection and maintenance of devices and applications of machines, equipment and electric drivers.
Indicative Contents المحتوياتالإرشادية	**Indicative content includes the following.** • Basic Components of a Control System. • its applications. • Open & Closed -Loop Control Systems. • Feedback & its effects. • Types of Feedback Control Systems. • Mathematical Foundation. • Laplace Transform. • Modeling of Physical Systems. • Electrical Networks.

	• Mechanical Systems Elements. • Block Diagrams of Control Systems. • B.D. reduction rules. • Signal-Flow Graphs (SFGs). • Steady – state error in unity- feedback control system. • Time response for different inputs.
Description	This course presents students to Introduction: Basic Components of a Control System ,its Applications ,Open & Closed -Loop Control Systems, What is Feedback & its effects ?Types of Feedback Control Systems mathematical Foundation, Laplace Transform , Modeling of Physical Systems, Electrical Networks Mechanical Systems Elements, Block Diagrams of Control Systems &B.D. reduction Signal-Flow Graphs (SFGs), Actions on System Performance, Steady – state error in unity- feedback control system.

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	**In this course, students are guided by:** • Studying the theoretical and practical academic program for the specialty lessons • The theoretical program is taught using the smart board, whiteboard or data show connected to the personal computer, discussing ideas and facts with the students. • Adopting the study through virtual electronic classes as an aid to the real classes. • Present a simple project or seminar to fellow students to boost their self-confidence.

Student Workload (SWL) الحمل الدراسي للطالب محسوبة بال 15 اسبوع			
Structured SWL(h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**49**	**Structured SWL(h/w)** الحمل الدراسي المنتظم للطالب اسبوعيا	**3**
Unstructured SWL (h/sem) الحمل الدراسي اللامنتظم للطالب خلال الفصل	**26**	**Unstructured SWL(h/w)** الحمل الدراسي اللامنتظم للطالب خلال الفصل أسبوعيا	**2**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight(Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10%(10)	6 and 12	
	Assignments	2	10%(10)	2 and 13	
	Projects/ Lab.	1	10%(10)	Continuous	All
	Report	1	10%(10)	13	
Summative assessment	Midterm Exam	2hr	10%(10)	9	
	Final Exam	3hr	50%(50)	16	All
Total assessment			100%(100Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week1	Introduction: A brief history to the control system, its applications and a group of examples of real applications to controllers in our lives.
Week2	Open & Closed -Loop Control Systems, what is Feedback & its effects.
Week3	Types of Feedback Control Systems Mathematical Foundation, Laplace Transform.
Week4	Block Diagrams of Control Systems and transfer function.
Week5	Test 1
Week6	Modelling of Physical Systems – Electrical systems.
Week7	Modelling of Physical Systems- Mechanical systems.
Week8	Modelling of real machines and its block diagram and transfer function.
Week9	Test 2
Week 10	Block diagram reduction rules – theory
Week 11	Block diagram reduction rules – exercises
Week 12	Signal flow graph - theory
Week 13	Signal flow graph - exercises
Week 14	Time response analysis – step response, ramp .. etc

Week 15	Time response analysis – first order system and second order system.
Week 16	Test 3

Delivery Plan (Weekly-Lab Syllabus) المنهاج الأسبوعي للمختبر	
	Material Covered
Week1	Introduction to MATLAB, Simulink, M-file… etc
Week2	Example of open loop control system.
Week3	Example of closed loop control system.
Week4	Generating the transfer function using M-file in MATLAB.
Week5	Test 1
Week6	Using a real model of machine and comparing the closed and open loop response.
Week7	Generating the results of the output using normal scope and array vector to clock.
Week8	Test 2
Week9	Building a closed loop system using Simulink.
Week 10	Building a closed loop system using M-file.
Week 11	Test 3
Week 12	Simulation of Second order Systems how to print the response results
Week 13	How to generate the result and printing the system from MATLAB to Word file.
Week 14	Group Project – Part 1
Week 15	Group Project – Part 2
Week 16	Examining the results of group project

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	• Modern control system by "OGATA. • Advanced control system by 'ROLAND S.BURNS'.	yes Yes
Recommended Texts	• MATLAB An Introduction with Applications • Applied Mathematical Modelling of Engineering Problems • Introduction to Simulink with Engineering Applications • Any available content for control theory should be useful.	No
Websites	https://www.mathworks.com https://www.tutorialspoint.com YouTube channel for the Module leader.	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Measurement & Instruments**			**Module Delivery**	
Module Type	**Basic**			☒ **Theory**	
Module Code	**EPE305**			☒ **Lecture**	
ECTS Credits	**2**			☐ **Lab**	
SWL (hr/sem)	**50**			☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Level	3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: islam Khalid Abdul razzeq		**e-mail**	E-mail: moon94844@gmail.com	
Module Leader's Acad. Title	Asst. Lect.		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/01/2024		**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	• The main aim in this module is to Study the basic principles of measuring devices, identify measurement units, and study the design of electrical measuring devices.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**On completion of the course the students should be able:** • To have detailed knowledge of the Systems of Units and Standards of Measurement, Systems of units, international system of units, electrical standard, time and frequency standards for electrical engineering. • To understand the IEEE standards. Measurement and Error: Definitions, accuracy, precision, resolution, composition of measuring system behavior by using Basic Electrical Parameters, Bridges and their Applications, Oscilloscopes, Transducers. • To select and use Photosensitive transducers. Data Recording Instruments, Limits to sensitivity, accuracy & speed in both analog and digital systems.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Part A - Basic Concepts** Introduction, Systems of Units, Charge and Current, Voltage, Power and Energy, Circuit Elements [18 hrs] **Part B - Basic Laws** Ohm's Law, Nodes, Branches, and Loops, Kirchhoff's Laws, Series Resistors and Voltage Division, Parallel Resistors and Current Division, Wye-Delta Transformations. [15 hrs] **Part C - Methods of Analysis** Nodal Analysis, Nodal Analysis with Voltage Sources, Mesh Analysis, Mesh Analysis with Current Sources [12 hrs]

	Part D - Circuit Theorems Superposition, Source Transformation, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer [24 hrs] Revision problem classes [6 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**1. Behavior management** Behavior management strategies foster an atmosphere of mutual respect, reduce disruptive behavior and ensure students have an equal opportunity to fulfill their potential in the classroom. It's crucial to provide them with both a positive and productive learning environment. Examples include establishing a reward system with an interactive chart where students move up or down depending on their performance and behavior in class. **2. Blended learning** With a blended learning teaching strategy, technology is incorporated with traditional learning. This allows students to work at their own pace, research their ideas and become more physically engaged during lessons. Examples include providing interactive tablets or whiteboards with engaging activities and posting classwork online for easier access. **3. Cooperative learning** Group work is a cooperative learning strategy that allows students with various learning levels to work together. By encouraging them to express their own ideas and listen to others' ideas as a group, you help students develop communication and critical thinking skills. Examples include solving math puzzles together, performing skits as a team or working on group presentations. **4. Formative assessment** A formative assessment is used periodically to monitor student learning incrementally. This can more effectively measure the process of learning as opposed to end-of-unit tests and can help you to improve your teaching methods throughout the year. Examples of this teaching strategy include self-evaluation exercises and summarizing a topic in multiple ways.

	5. Student-led teaching The student-led teaching strategy lets students become the teacher. In a classroom with learners at different levels, you can better engage those learning faster by showing them how to teach and give feedback to their peers.They may team-teach or work in groups to teach a new topic. Examples include letting a student teach an entire lesson or having advanced writers lead a peer-editing session as well as provide constructive criticism.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**50**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	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	**What is main of the** *Systems of units and types of the international system of units,* *electrical standard for time and frequency.*
Week 2	**Measurement and Error:** *Definitions, accuracy, precision, resolution, composition of measuring system* *selection factors and trends, types of error: gross, systematic, random, and limiting* *errors.*
Week 3	**Statistical Analysis of Data:** *Types of data, Gaussian distribution, mean, median* *standard deviation.* ***probability of:*** *error in data and their distribution*
Week 4	**Instruments for Measuring Basic Electrical Parameters:** *Electromechanical and electric instruments* *design, static and dynamic characteristics* *Meter readings, error and compensation.*
Week 5	**Bridges and their Applications** *DC and AC bridges: basic electrical parameters measurement, frequency, measurement.*
Week 6	**Oscilloscopes:** *CRT deflection, probes and functions, measuring techniques, types*
Week 7	**Transducers:**

	Position, pressure, velocity, acceleration and force, torque, temperature for Photosensitive transducers.
Week 8	**Mid-term Exam**
Week 9	**Data Recording Instruments:** *Chart recorders and magnetic recorders with Graphic plotters, data loggers.*
Week 10	**Noise** *Limits to sensitivity, accuracy, speed in both analog and digital systems, S/N enhancement techniques (signal averaging, … etc).*
Week 11	**Computer-based Instrumentation and Measurement** *The steady of Basic concepts field.*
Week 12	**Computer-based Instrumentation and Measurement** *Instrument integration, instrumentation bus (IEEE-488, GPIB buses).*
Week 13	**Computer-based Instrumentation and Measurement** *Software instrumental control.*
Week 14	**Computer-based Instrumentation and Measurement** *output data processing methods.*
Week 15	**Computer-based Instrumentation and Measurement** *least squares fitting.*
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	• Matthew, N. O. "**Sadiku Elements of Electromagnetics**." (2018).. • Electromagnetics By Joseph Edminister (Schaum's Outline Series): Joseph Edminister, Vishnu Priye Mc Graw Hill Education	Yes
Recommended Texts	• Hayt, William Hart. **Engineering Electromagnetics**. McGraw-Hill Companies, Sixth Edition, 2001.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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.

MODULEDESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلوماتالمادةالدراسية					
ModuleTitle	**Advanced Programming**			**Module Delivery**	
ModuleType	**Basic**			☒**Theory** ☐**Lecture** ☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
ModuleCode	**EPE205**				
ECTS Credits	**2**				
SWL(hr/sem)	**50**				
Module Level		3	**Semesterof Delivery**		5
Administering Department		**Bachelor of Electrical Power and Machines**	**College**	College of Engineering	
Module Leader	Hayder Salim Hameed		**e-mail**	haydersalim@uodiyala.edu,iq	
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		1/09/2024	**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	15. Providing the student with basic information about the various well-known engineering programs. 16. Providing an introduction to the C++ programming. 17. Familiarity with the famous mathematical and engineering analysis program (MATLAB). 18. The student's knowledge of the programming statements of the MATLAB language and how to benefit from them in writing programs to solve mathematical problems of the basics of electrical engineering for which there are no programs in ready-made systems. 19. Obtain sufficient information about using the program in mathematical analysis, programming, and the use of matrices, as well as solving and drawing complex mathematical equations. 20. During the semester, students learn to understand the microcontroller, its components, programming languages, applications, the main differences between it and the microprocessor, and the most important applications of both types. They also learn about embedded systems and the revolution they have brought about in the field of current and future technology.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A- Cognitive goals A1 - Teach the student to understand the principle of programming. A2- Teaching students to know the basics of programming in C++ programming and Matlab. A3- Teaching the student how to explain and express the programming problem using C++ programming and MATLAB. A4- Enable students to obtain knowledge and understanding of building any computer application using MATLAB. A 5- Students' knowledge of linking programs with external devices those are under its control. B - Skills objectives of the course. B1 - Translate the software problem into a computer program using Matlab. B2 - Apply various computer programs. B3 - Produce computer programs in Matlab according to the given problem. B 4- Computer skills in writing various programs.
Indicative Contents المحتوياتالإرشادية	**Indicative content includes the following.** • Course introduction • Starting with C++ programming • Working with operators and INPUT/OUTPUT statements and Control structures • Working with Functions and their declaration. • Starting with MATLAB • **Creating Arrays** • Built-In Functions for Analyzing Arrays • **Two-Dimensional Plots** • User-Defined Functions and Function • Introduction, what is Simulink? • MATLAB & Simulink Working Together • The Solver: Zero-Crossing Options • Creation of Mask & Subsystem.

	• Introduction to Microcontroller Architecture. • Embedded System Fundamentals. • Programming Microcontrollers.
Description	This course presents students to the C++ programming language as a well-known programming language. Students will be enriched with the essential principles of programming which can be applicable to achieve programming in any other languages. Topics included in this course cover the fundamentals of creating and developing a good-designed program as well as making students familiar with basic data types, control commands, loops. Introduction to MATLAB. Algebra & trigonometric function. Boolean & Matrix Operation. Complex Number. Array Indexing. Graphing. The switch Construct. If construct. while statement loop. Introduction to Simulink. Algebra & Trigonometric function representation as a block diagram. Simulation of First order systems & check their response. Simulation of Second order systems & check their response. Import & export data from/to workspace. Import & export data from/to M-file. Creation of Mask & Subsystem. By the end of the module, students will be able to design, implement, and evaluate microcontroller-based systems for a range of engineering and industrial applications.

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	**In this course, students are guided by:** • Studying the theoretical and practical academic program for the specialty lessons • The theoretical program is taught using the smart board, whiteboard or data show connected to the personal computer, discussing ideas and facts with the students. • Adopting the study through virtual electronic classes as an aid to the real classes. • Present a simple project or seminar to fellow students to boost their self-confidence.

Student Workload (SWL) الحمل الدراسي للطالب محسوبة بال 15 اسبوع			
Structured SWL(h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	34	**Structured SWL(h/w)** الحمل الدراسي المنتظم للطالب اسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي اللامنتظم للطالب خلال الفصل	16	**Unstructured SWL(h/w)** الحمل الدراسي اللامنتظم للطالب خلال الفصل أسبوعيا	1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight(Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10%(10)	6 and 12	
	Assignments	2	10%(10)	2 and 13	
	Projects/ Lab.	1	10%(10)	Continuous	All
	Report	1	10%(10)	13	
Summative assessment	Midterm Exam	2hr	10%(10)	9	
	Final Exam	3hr	50%(50)	16	All
Total assessment			100%(100Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week1	Introduction: A brief history to the importance of C++/ Structure of a C++ program, writing first simple program in C++. Data types: Variable declaration statements and assignment statements.
Week2	Operators in C++ programming: Assignment operators, compound assignment operators and relational operators. Operators in C++ programming: Logical operators, Bitwise operators, Increment and decrement operators and precedence of operators.
Week3	Input/output: Input & output statement: (cin>> statement and cout<<statement). Control structures (part 1): if statement, and if/else statement. Control structures (part 2): selection switch statement. Control structures (part 3): while, and do/while statements or loop statement. Control structures (part 4): for loop/ Nested for loop statements, and break and continue statement
Week4	Introduction To MATLAB. Algebra & Trigonometric, Boolean & Matrix Operation
Week5	Complex Number, Array Indexing. Graphing, Relational and Logical Operators,
Week6	The Switch Construct, If Construct. While Statement Loop
Week7	LOOPS (For-End Loops, While-End Loops, NESTED LOOPS AND NESTED CONDITIONAL STATEMENTS)
Week8	User-Defined Functions and Function
Week9	Introduction To Simulink
Week 10	Algebra & Trigonometric Function Representation as A Block Diagram
Week 11	Simulation Of First Order Systems & Check Their Response.
Week 12	Simulation Of Second Order Systems & Check Their Response
Week 13	MATLAB & Simulink Working Together, Import & Export Data From/To M-File and Creation of Mask & Subsystem
Week 14	Introduction to Microcontroller Architecture, Embedded System Fundamentals Programming Microcontrollers.
Week 15	Introduction to the Arduino Microcontroller, Arduino Sketch Structure Example: Using a Solderless Breadboard, Servomotors
Week 16	Arduino Programing with MATLAB environment

Delivery Plan (Weekly-Lab Syllabus) المنهاج الأسبوعي للمختبر	
	Material Covered
Week1	Introduction: A brief history to the importance of C++/ Structure of a C++ program, writing first simple program in C++. Data types: Variable declaration statements and assignment statements.
Week2	Operators in C++ programming: Assignment operators, compound assignment operators and relational operators. Operators in C++ programming: Logical operators, Bitwise operators, Increment and decrement operators and precedence of operators.
Week3	Input/output: Input & output statement: (cin>> statement and cout<<statement). Control structures (part 1): if statement, and if/else statement. Control structures (part 2): selection switch statement. Control structures (part 3): while, and do/while statements or loop statement. Control structures (part 4): for loop/ Nested for loop statements, and break and continue statement
Week4	Introduction To MATLAB. Algebra & Trigonometric, Boolean & Matrix Operation
Week5	Complex Number, Array Indexing. Graphing, Relational and Logical Operators,
Week6	The Switch Construct, If Construct. While Statement Loop
Week7	LOOPS (For-End Loops, While-End Loops, NESTED LOOPS AND NESTED CONDITIONAL STATEMENTS)
Week8	User-Defined Functions and Function
Week9	Introduction To Simulink
Week 10	Algebra & Trigonometric Function Representation as a Block Diagram
Week 11	Simulation Of First Order Systems & Check Their Response.
Week 12	Simulation Of Second Order Systems & Check Their Response
Week 13	MATLAB & Simulink Working Together, Import & Export Data From/To M-File and Creation of Mask & Subsystem
Week 14	Introduction to Microcontroller Architecture, Embedded System Fundamentals Programming Microcontrollers.
Week 15	Introduction to the Arduino Microcontroller, Arduino Sketch Structure Example: Using a Solderless Breadboard, Servomotors
Week 16	Arduino Programing with MATLAB environment

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	• MATLAB Programming for Engineers • Modeling and simulation of systems using M**ATLAB** • Ortega, James M., and Andrew S. Grimshaw. *An introduction to C++ and numerical methods*. Oxford University Press, Inc., 1998. • Cohoon, James P., and Jack W. Davidson. *C++ Program Design: An introduction to programming*. McGraw Hill, 2002, 2002.	No Yes Yes
Recommended Texts	• MATLAB An Introduction with Applications • ELECTRONICS and CIRCUIT ANALYSIS using MATLAB • Applied Mathematical Modelling of Engineering Problems • Introduction to Simulink®with Engineering Applications • D Oualline, Steve. Practical C++ programming. " O'Reilly Media, Inc.", 2003. • Kirch-Prinz, Ulla, and Peter Prinz. *A complete guide to programming in C++*. Jones & Bartlett Learning, 2002. • 1.Microcontroller & Embeddeed Systems • 2.Microcontroller: Architecture, Programming & Applecations	No
Websites	https://www.mygreatlearning.com/academy/learn-for-free/courses/c- tutorial?gl_blog_id=74312 https://www.programiz.com/cpp-programming/examples/print-sentence https://www.mathworks.com https://www.tutorialspoint.com	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Electrical Power II**			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	***EPE302***			☒ **Lecture**	
ECTS Credits	**6**			☐ **Lab**	
SWL (hr/sem)	**150**			☒ **Tutorial** ☒ **Practical** ☐ **Seminar**	
Module Level	3		**Semester of Delivery**	6	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: Husham Idan Hussein		**e-mail**	E-mail: hushamidan@uodiyala.edu.iq	
Module Leader's Acad. Title	Prof.		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/01/2024		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**Electric Power I**	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	• Study the basic principles of power system. • Qualifying students to be able to become familiar with the theoretical and scientific aspects of power system. • Study the types of transmission lines, their types, working principles, properties and applications, and explain the importance of their uses in practical life. • Urging students to benefit from the course in their field of work as engineers in the field of electrical power engineering in the future
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**On completion of the course the students should be able:** • To have detailed knowledge of the physical background and terminology of the power system theory for electrical engineering problems • To understand the power system behavior. • To select and use appropriate theoretical models for analysis, problem solving and finding solutions related to the power system.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Part A - Basic Concepts** Introduction, Mechanical Design of Transmission line [18 hrs]. **Part B - Basic Laws**

	Introduction, Insulators, their types, materials used in their manufacture, and the distribution of voltages, Sag, Corona. [15 hrs] **Part C - Methods of Analysis** Introduction of underground cables [12 hrs] **Part D - Circuit Theorems** Performance of the power switchgear and bas bares, rely, and fuses [24 hrs]. Revision problem classes [6 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**1. Behavior management** Behavior management strategies foster an atmosphere of mutual respect, reduce disruptive behavior and ensure students have an equal opportunity to fulfill their potential in the classroom. It's crucial to provide them with both a positive and productive learning environment. Examples include establishing a reward system with an interactive chart where students move up or down depending on their performance and behavior in class. **2. Blended learning** With a blended learning teaching strategy, technology is incorporated with traditional learning. This allows students to work at their own pace, research their ideas and become more physically engaged during lessons. Examples include providing interactive tablets or whiteboards with engaging activities and posting classwork online for easier access. **3. Cooperative learning** Group work is a cooperative learning strategy that allows students with various learning levels to work together. By encouraging them to express their own ideas and listen to others' ideas as a group, you help students develop communication and critical thinking skills. Examples include solving math puzzles together, performing skits as a team or working on group presentations. **4. Formative assessment**

	A formative assessment is used periodically to monitor student learning incrementally. This can more effectively measure the process of learning as opposed to end-of-unit tests and can help you to improve your teaching methods throughout the year. Examples of this teaching strategy include self-evaluation exercises and summarizing a topic in multiple ways. **5. Student-led teaching** The student-led teaching strategy lets students become the teacher. In a classroom with learners at different levels, you can better engage those learning faster by showing them how to teach and give feedback to their peers.They may team-teach or work in groups to teach a new topic. Examples include letting a student teach an entire lesson or having advanced writers lead a peer-editing session as well as provide constructive criticism.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	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	Mechanical design of transmission lines
Week 2	Introduction of INSULATORS
Week 3	insulators properties
Week 4	Types of Insulators
Week 5	Potential Distribution over Suspension Insulator String
Week 6	Mathematical expression Methods of Improving String Efficiency
Week 7	CORONA Factors Affecting Corona
Week 8	Methods of Reducing Corona Effect Examples and question
Week 9	Sag in Overhead Lines Calculation of Sag : When supports are at equal and unequal levels:
Week 10	Effect of wind and ice loading Examples and question
Week 11	underground cables
Week 12	Cables for 3-Phase Service
Week 13	Insulation Resistance of a Single-Core Cable
Week 14	Introduction to Switchgear Essential Features of Switchgear
Week 15	Switchgear Equipment Faults in a Power System
Week 16	Final exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	4- Elements of Power system analysis, W. D. Stevenson.	Yes
Recommended Texts	5- A Text Book in Power system Engineering, P. V. Gupta.	No
	6- Principles of power system V. K. Mehta.	yes
Websites		

Grading Scheme

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	**AC-Machines II**		**Module Delivery**
Module Type	**Core**		☒**Theory** ☒**Lecture** ☒**Lab** ☒**Tutorial** ☐**Practical** ☐**Seminar**
Module Code	**EPE310**		
ECTS Credits	7		
SWL(hr/sem)	175		
Module Level	3	**Semester of Delivery**	6
Administering Department	**Bachelor of Electrical Power and Machines Engineering**	**College**	College of Engineering
Module Leader	Ali Najim Abdullah	**e-mail**	alinajim@uodiyala.edu,iq
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date	1/09/2024	**Version Number**	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**EPE309**	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	21. Understand the Basic Principles of Induction Machines: Explain the fundamental operation principles of induction machines based on electromagnetic induction. 22. Describe the Construction and Components of Induction Machines: Identify and describe the fundamental components of induction machines (stator and rotor). 23. Analyze the Operation of Induction Motors: Explain the rotating magnetic field, produce the torque in induction motors. Understand and calculate the slip and its effect on the motor performance. 24. Examine Performance Characteristics: Analyze the torque-speed characteristics, efficiency, and power factor of induction motors under different loading conditions. Evaluate the impact of supply voltage, frequency, and rotor resistance on the motor performance. 25. Understand Methods of Starting for Induction Motors: Explain the different methods used to start induction motors. 26. Understand the Induction Generators: illustrate the concept of induction generators, how it operate in reverse (converting mechanical power to electrical power), and their applications, particularly in renewable energy systems (wind turbines). 27. Perform Calculations and Troubleshooting: Solve practical problems involving performance quantities such as slip, starting current, and torque. Diagnose and troubleshoot common faults in induction machines, including overheating, insulation failure, and mechanical wear. 28. Discuss Power Losses and Efficiency: Evaluate the losses in induction motors and propose methods for improving motor efficiency. 29. Examine Speed Control Techniques: demonstrate the different methods for speed control of induction motors, including frequency control, voltage control, and pole-changing techniques. 30. Apply Safety and Maintenance Practices: Demonstrate understanding of safety protocols when handling induction machines and perform basic maintenance practices to ensure long life operational reliability.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A- Cognitive goals A1- Understand and Explain the Operating Principles: Understand the fundamental principles of electromagnetic induction and explain how induction motors and generators operate based on the interaction between the stator's rotating magnetic field and the rotor. A2- Analyze the Performance of Induction Motors: Evaluate the torque-speed characteristics and study the effect of the slip, rotor resistance, and load to the performance of induction motors under different conditions. A3- Explain Phasor Diagrams and Equivalent Circuits: Construct phasor diagrams for induction motors and use equivalent circuit models to analyze power flow, losses, and efficiency. A4- Evaluate the Effect of Slip on Motor Operation: Analyze the concept of slip, understand how it varies with load, and evaluate its impact on motor performance, including efficiency and torque. A5- Distinguish Between Different Types of Induction Motors: Compare between squirrel-cage rotors and wound-rotor, understanding their construction, advantages, and limitations for different applications. A6- Assess the Starting and Speed Control Methods: Evaluate the advantages and disadvantages of different starting methods for induction motors and understand their effects on motor efficiency and protection. A7- Apply Mathematical Models to Solve Performance Problems: Use mathematical equations to

	calculate the quantities of induction motors, such as torque, slip, power factor, and starting current, under various loading conditions. A8- Evaluate Losses and Efficiency: evaluate the type of losses and their effect on motor performance. A9- Understand Induction Generators and Their Applications: Explain the working principle of induction generators, analyze their operation when driven by mechanical energy, and understand their applications such as in renewable energy. A10- Evaluate Efficiency Improvement Strategies: Analyze improving methods of efficiency of induction machines, including variable frequency drives (VFDs), power factor correction, and advanced rotor designs. B - Skills objectives of the course. B1- Identify and Assemble the Components of Induction Machines: Demonstrate the ability to identify the components of induction motors including stator and rotor. B2- Operate Induction Motors and compute the Performance quantities: Start and operate induction motors under various load conditions. Measure performance quantities such as torque, speed, current, voltage, and power factor. B3- Calculate and Analyze Motor Performance: Perform calculations to determine slip, torque, starting current, and efficiency for induction motors under different operating conditions. B4- Apply Various Starting Methods: Implement and compare the different starting methods of induction motors and assess their impact on motor performance. B5- Perform Efficiency Tests and Suggest Improvement Methods: Conduct tests to determine the efficiency of induction motors under different operating conditions. Propose and apply methods for improving efficiency, such as using variable frequency drives (VFDs), capacitor banks for power factor correction, and advanced rotor designs. B6- Speed Control of Motor Using Variable Frequency Drives (VFDs): Set up and operate VFDs to control the speed of induction motors, understanding the relationship between frequency, voltage, and motor speed. Evaluate how changing the frequency affects to motor performance and efficiency. B7- Implement Induction Generator Systems: Set up and operate an induction generator system, particularly in renewable energy applications (wind turbines), and connect the generator to an electrical grid. Measure and assess the output power and stability of the induction generator in different mechanical input conditions. B8- Follow Safety Protocols and Industry Standards: Ensure safe operation of induction machines by following industry-specific safety protocols and regulations, including proper handling of high-voltage equipment, correct grounding techniques, and use of personal protective equipment.
Indicative Content المحتويات الإرشادية	1. Introduction to Induction Machines: History and development, Classification: (Single-phase vs. Three-phase), Applications. 2. Basic Principles of Operation: Electromagnetic induction. Rotating magnetic field theory, Slip and its significance, Torque production mechanism. 3. Constructional Features: Stator: windings, core, Rotor types (Squirrel-cage rotor and Wound rotor). Bearings, cooling methods, and enclosures. 4. Types of Induction Machines: Based on phase (Single-phase and Three-phase), Based on rotor construction (Squirrel-cage, Wound rotor. 5. Mathematical Modeling: Equivalent circuit, Phasor diagrams, Power flow diagram (input, air-

	gap, rotor copper, mechanical output), Torque-slip characteristics. 6. Performance Characteristics: Starting torque and current, Efficiency and losses, Power factor, regulation. 7. Starting and Speed Control Methods: Starting techniques (Direct-On-Line, Star-delta starter, Autotransformer starter, Rotor resistance starter). Speed control methods (Voltage control, Frequency control, Rotor resistance control, Pole changing, Slip power recovery (for wound rotor) 8. Testing and Performance Evaluation: No-load test, Blocked rotor test, Load test, Circle diagram. 9. Applications and Case Studies: Industrial drives. HVAC systems, Electric vehicles, Renewable energy systems (wind turbines)
Description	This course provides an in-depth study of three-phase induction machines, focusing on their construction, operating principles, performance characteristics, and control methods. Emphasis is placed on understanding electromagnetic energy conversion, torque production, equivalent circuit modeling, and various starting and speed control techniques. The course also covers efficiency evaluation, testing methods, and modern applications in industry and electric drives. Suitable for students in electrical engineering and professionals seeking foundational and applied knowledge of induction motors.

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	**In this course, students are guided by:** • Studying the theoretical and practical academic program for the specialty lessons • The theoretical program is taught using the smart board, whiteboard or data show connected to the personal computer, discussing ideas and facts with the students. • Adopting the study through virtual electronic classes as an aid to the real classes. • Present a simple project or seminar to fellow students to boost their self-confidence.

Student Workload (SWL) الحمل الدراسي للطالب محسوبة بال 15 اسبوع			
Structured SWL(h/sem) الحمل الدرلسي المنتظم للطالب خلال الفصل	**94**	**Structured SWL(h/w)** الحمل الدرلسي المنتظم للطالب اسبوعيا	**6**
Unstructured SWL (h/sem) الحمل الدرلسي اللامنتظم للطالب خلال الفصل	**81**	**Unstructured SWL(h/w)** الحمل الدرلسي اللامنتظم للطالب خلال الفصل أسبوعيا	**5**
Total SWL (h/sem) الحمل الدرلسي الكلي للطالب خلال الفصل	**175**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight(Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Month Exam	2	15%(15)	6 and 12	
	Quizzes	4	5%(10)	2 and 14	
	Projects/ Lab.	10	10%(10)	Continuous	All
	Report	1	5%(5)	13	
	H.W	4	5%(5)	Continuous	
Summative assessment	Midterm Exam	2hr	10%(10)	9	
	Final Exam	3hr	50%(50)	16	All
Total assessment			100%(100Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Constructional Details: Introduction, Advantages and Disadvantages of Three-Phase Induction Motors, Stator and Rotor Construction, Symbolic Representations
Week 2	Principle of Operation: Introduction, Rotating Magnetic Field, Standstill Condition (Starting Torque, Condition for Maximum Starting Torque, Effect of Change in Supply, Starting Torque in Cage Motor and Slip-ring Motor).
Week 3	Running Condition (Slip, Torque Under Running Condition, Effect of Supply Voltage on Torque and Slip, Condition for Maximum Torque, Load Torque and Maximum Torque, Starting Torque and Maximum Torque).
Week 4	Torque-Slip Characteristics, Speed-Torque Characteristics, Modes of Operation
Week 5	Losses and Efficiency: Types of Losses, Power Stages in Induction Motors, Power Stages in Induction Generators, Efficiency.
Week 6	Equivalent Circuit of Three-phase Induction Motor: Derivation of Exact Equivalent Circuit, Approximate Equivalent Circuit, Phasor Diagram With K=1
Week 7	Performance Equations: (Power Developed, Maximum Power Developed, Torque Developed, Maximum Torque Developed, Load Torque and Maximum Torque, Starting Torque and Maximum Torque).
Week 8	Testing and Performance Prediction: No Load Test, Blocked Rotor Test, Measurement of Stator Resistance, Performance Prediction Using Equivalent Circuit
Week 9	Midterm Exam
Week 10	Performance Prediction Using Circle Diagram
Week 11	Separation of Losses (No-load Test at Synchronous Speed, No-load Test at Variable Voltage), Determination of Efficiency by Loss Subtraction Method, Direct Load Test
Week 12	Miscellaneous Topics on Three Phase Induction Machines, Crawling, Cogging, Double Cage Motor Induction Motor (Construction of Double-cage Rotor, Torque - slip Characteristics, Equivalent Circuits),
Week 13	Induction Generators, Power Flow Equations, Types of Induction Generators.
Week 14	Starting Methods of Three Phase Induction Motor.
Week 15	Speed Control and Braking of Three Phase Induction Motor
Week 16	Final Exam

Delivery Plan (Weekly-Lab Syllabus) المنهاج الأسبوعي للمختبر	
	Material Covered
Week 1	Study the Construction of Three Phase Induction Motor
Week 2	Direct-on-Line Starting of Three Phase Induction Motor
Week 3	Reverse the Direction of Rotation In a Three Phase Induction Motor.
Week 4	Direct Load Test on Three Phase Induction Motor
Week 5	Study the Speed-Torque Characteristics
Week 6	Measurement of Stator Resistance of Three Phase Induction Motor
Week 7	No-Load Test on Three Phase Induction Motor
Week 8	Blocked Rotor Test on Three Phase Induction Motor
Week 9	Star-Delta Starting of Three Phase Squirrel Cage Type Motor
Week 10	Star-Delta Starting of Three Phase Slip Ring Type Motor
Week 11	Rotor resistance starter of Three Phase Slip Ring Type Motor
Week 12	Speed Control of Three Phase Induction Motor by Changing Frequency
Week 13	Speed Control of Three Phase Induction Motor by Changing Number of Poles
Week 14	Speed Control of Three Phase Induction Motor by Changing Slip
Week 15	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• M.G.Say, Alternating Current Machines, Pitman Pub. • 2. A.S. Langsdorf, Theory of AC Machinery, McGRAW-HILL Pub.	Yes Yes
Recommended Texts	• Induction and Synchronous Machines by K. Murugesh Kumar • Electrical and Electronic principles and technology	No
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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Power Electronics II**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☒ **Practical** ☐ **Seminar**	
Module Code	**EPE312**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: Ammar Issa Ismael		**e-mail**	E-mail: ammarissa@uodiyala.edu.iq	
Module Leader's Acad. Title	Asst. Prof.		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**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	• Study the basic principles of power electronic. • Qualifying students to be able to become familiar with the theoretical and scientific aspects of power electronic. • Study the types of inverters and converters, their types, working principles, properties and applications, and explain the importance of their uses in practical life. • Urging students to benefit from the course in their field of work as engineers in the field of electrical power engineering in the future
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	11. Learn about the basic concepts of power electronic. 12. Learn about construction of inverters and converters. 13. Know the types of inverters and converters. 14. Knowing the pulse width modulation (PWM). 15. Study the characteristics of power electronic. 16. Know the conditions for operating the control in power electronic. 17. identify DC/DC Convertor (Choppers). 18. Learn to operate electric motors and control their speed. 19. Study types of Power Semiconductor Devices 20. Identify the harmonics and power factor considerations
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: **Part A Static Switches** Static Power Converters: Controlled rectifier circuits, single and poly phase inverter operation, dual converter, four quadrant operation. [18 hrs.] **Part B – Fourier series and Harmonics** harmonics and power factor considerations. Square and stepped waveforms. [15 hrs.] **Part C – PWM** Single PWM inverters. Single and three phase Sinusoidal PWM. PSCAD software. Multi-level inverter [12hrs] **Part D –applications and FACTS.** Industrial Applications: General applications, DC motor control, transportation, thyristor-controlled reactors and capacitors. Introduction to FACTS (Flexible AC Transmission Systems) Devices, STATCOM, SVC and DVR [12 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**1. Behavior management** Behavior management strategies foster an atmosphere of mutual respect, reduce disruptive behavior and ensure students have an equal opportunity to fulfill their potential in the classroom. It's crucial to provide them with both a positive and productive learning environment. Examples include establishing a reward system with an interactive chart where students move up or down depending on their performance and behavior in class. **2. Blended learning** With a blended learning teaching strategy, technology is incorporated with traditional learning. This allows students to work at their own pace, research their ideas and become more physically engaged during lessons. Examples include providing interactive tablets or whiteboards with engaging activities and posting classwork online for easier access. **3. Cooperative learning** Group work is a cooperative learning strategy that allows students with various learning levels to work together. By encouraging them to express their own ideas and listen to others' ideas as a group, you help students develop communication and critical thinking skills. Examples include solving math puzzles together, performing skits as a team or working on group presentations. **4. Formative assessment** A formative assessment is used periodically to monitor student learning incrementally. This can more effectively measure the process of learning as opposed to end-of-unit tests and can help you to improve your teaching methods throughout the year. Examples of this teaching strategy include self-evaluation exercises and summarizing a topic in multiple ways. **5. Student-led teaching** The student-led teaching strategy lets students become the teacher. In a classroom with learners at different levels, you can better engage those learning faster by showing them how to teach and give feedback to their peers. They may team-teach or work in groups to teach a new topic. Examples include letting a student teach an entire lesson or having advanced writers lead a peer-editing session as well as provide constructive criticism.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	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	• Static Power Converters: Controlled rectifier circuits
Week 2	• single and poly phase inverter operation, dual converter, four quadrant operation.
Week 3	• harmonics and power factor considerations. Square and stepped waveforms
Week 4	• Single PWM Technique
Week 5	• Multi PWM Technique
Week 7	• PSCAD software
Week 8	**Mid-term Exam**
Week 9	• Sinusoidal PWM technique
Week 10	• Three phase sinusoidal PWM technique
Week 11	• Multi-level inverter
Week 12	• Industrial Applications: General applications
Week 13	• DC motor control, transportation,
Week 14	• thyristor-controlled reactors and capacitors.
Week 15	• Introduction to FACTS (Flexible AC Transmission Systems) Devices, STATCOM, SVC and DVR
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:. Automatic Lamp
Week 2	Lab 2: FET/ MOSFET
Week 3	Lab 3: IGBT characteristics and application
Week 4	Lab 4: Zero Voltage
Week 5	Lab 5: SCR Inverter
Week 6	Lab 6: SCR rectifier
Week 7	Lab 7 over/ under voltage
Week 8	Lab 8: PUT-SCR power control
Week 9	Lab 9: UJT –SCR power control
Week 10	Lab 10: Introduction PSCAD software
Week 11	Lab 11: Application PSCAD software
Week 13	Lab 13: three phase converter
Week 14	Lab 14: three phase inverter
Week 15	**Final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	• Power electronic Hand Book, by Muhammad H. Rashid	Yes
Recommended Texts	• INTRODUCTION TO MODERN POWER ELECTRONICS, By **Andrzej M. Trzynadlowski**	No
Websites	• Peruse scientific websites for recent developments in the prescribed article	

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.

MODULEDESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلوماتالمادةالدراسية					
ModuleTitle	**Control Theory II**			**Module Delivery**	
ModuleType	**Basic**			☒**Theory** ☐**Lecture** ☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
ModuleCode	**EPE314**				
ECTS Credits	**3**				
SWL(hr/sem)	**75**				
Module Level		3	**Semesterof Delivery**		6
Administering Department		**Bachelor of Electrical Power and Machines**	**College**	College of Engineering	
Module Leader	Zeyad Assi Obaid		**e-mail**	Zeyad.a.obaid@uodiyala.edu,iq	
Module Leader's Acad. Title		Assist.Prof	**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		1/09/2024	**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Engineering	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	31. Prepare the students to engage theoretically and practically in Electrical Power and Machines Engineering profession in public and private sectors including, but not limited to, relevant governmental sectors, consulting firms, contracting companies, marketing and real estate investments. 32. Prepare the students to Engage in ongoing professional development activities by pursuing graduate studies and/or other learning opportunities to respond to the arising challenges. 33. Advance in responsibility and leadership in their careers and compete with their peers according to the profession ethics. 34. Promote students with the necessary scientific and practical skills in the discipline for solving engineering problems and treating them logically and scientifically. 35. Promote students with the necessary skills administration, time management, team-work, communication and language skills, soft computing and programming skills. 36. Providing students with scientific, practical and personal skills that enable them to solve practical problems and deal with them using scientific concepts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A- Cognitive goals A 1- Acquiring knowledge of mathematics, computers, engineering and customary sciences, employing them and preparing the student for scientific research. A 2- The ability to diagnose engineering problems within the jurisdiction and know their causes and appropriate solutions. A 3- To familiarize students with the basic theories of power engineering, machines, electrical machines, power plants, and various industrial applications and applications. A4 - The student will be familiar with the basics of communication and control systems, electronics, digital technologies and their applications. B - Skills objectives of the course. B1 - Empowering students with the basics of working on power systems, electromagnetic fields, high pressure, and skills of analysis and design programs for electrical networks. B2 - Skills of analyzing and designing electrical networks for transmission and distribution and designs of building networks, as well as enabling students to obtain knowledge of the practical framework in the field of energy types, energy transmission and distribution, operation and control. B3 - Enable students to obtain knowledge and understanding of conventional electric power generation, renewable energy of all kinds, and thermal power plants. B4 - Enabling students to obtain knowledge and understanding of fault diagnosis, protection and maintenance of devices and applications of machines, equipment and electric drivers.
Indicative Contents المحتوياتالإرشادية	• Introduction to stability of systems. • Introduction to stability theorems in time response. • Routh criterion. • Root-Locus Analysis. • Control design and PID controller. • Lead Compensation. • Lag Compensation.

	• Lag-Lead Compensation. • Frequency-Response Analysis. • Introduction to stability theorems in frequency response. • Bode diagram. • Polar plot. • Introduction to analysis of control systems in state space. • Computer analysis of transfer functions, time domain responses. • Introduction to Analogue computers and computer control.
Description	Introduction to stability theorems, Root-Locus Analysis, Lead Compensation, Lag Compensation, Lag-Lead Compensation, Frequency-Response Analysis, bode diagram, Polar plot Three term controller, Sampled data system, Analysis of control systems in state space. Computer analysis of transfer functions, time domain responses, Analogue computers, solution of differential equations.

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	**In this course, students are guided by:** • Studying the theoretical and practical academic program for the specialty lessons • The theoretical program is taught using the smart board, whiteboard or data show connected to the personal computer, discussing ideas and facts with the students. • Adopting the study through virtual electronic classes as an aid to the real classes. • Present a simple project or seminar to fellow students to boost their self-confidence.

Student Workload (SWL) الحمل الدراسي للطالب محسوبة بال 15 اسبوع			
Structured SWL(h/sem) الحمل الدرلسي المنتظم للطالب خلال الفصل	49	**Structured SWL(h/w)** الحمل الدرلسي المنتظم للطالب اسبوعيا	3
Unstructured SWL (h/sem) الحمل الدرلسي اللامنتظم للطالب خلال الفصل	26	**Unstructured SWL(h/w)** الحمل الدرلسي اللامنتظم للطالب خلال الفصل أسبوعيا	2
Total SWL (h/sem) الحمل الدرلسي الكلي للطالب خلال الفصل	75		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight(Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10%(10)	6 and 12	
	Assignments	2	10%(10)	2 and 13	
	Projects/ Lab.	1	10%(10)	Continuous	All
	Report	1	10%(10)	13	
Summative assessment	Midterm Exam	2hr	10%(10)	9	
	Final Exam	3hr	50%(50)	16	All
Total assessment			100%(100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الأسبوعي النظري

	Material Covered
Week1	Introduction to stability of systems.
Week2	Stability theorems in time response, Routh criterion.
Week3	Root-Locus Analysis - theory
Week4	Root-Locus Analysis - exercises
Week5	Test 1
Week6	Control design, PI, PD, PID controller.
Week7	Lead Compensation, Lag Compensation, Lag-Lead Compensation.
Week8	Test 2
Week9	Frequency-Response Analysis and Introduction to stability theorems in frequency response.
Week 10	Bode diagram– theory
Week 11	Bode diagram– exercises
Week 12	Polar plot analysis.

Week 13	Test 3
Week 14	Introduction to analysis of control systems in state space
Week 15	Introduction to Analogue computers and computer control.
Week 16	Review of the theory and MATLAB

Delivery Plan (Weekly-Lab Syllabus) المنهاج الأسبوعي للمختبر	
	Material Covered
Week1	Recall-Introduction to MATLAB, Simulink, M-file… etc
Week2	Recall-Example of open loop and closed loop control system.
Week3	Transfer function of machine with time response analysis.
Week4	Generating the results of system in previous week and discuss the results.
Week5	Test 1
Week6	How to test the system model with Root Locus.
Week7	Discussing the results that is generated with root locus.
Week8	Test 2
Week9	Generating the stability analysis results in frequency response.
Week 10	How to generate the stability results using Bode plot analysis.
Week 11	Test 3
Week 12	Individual Project 1 – Test the stability of a real example of any machine.
Week 13	Individual Project 1 – How to build a whole report about the results.
Week 14	Group Project – Part 1- to give the students an introduction for the final year project.
Week 15	Group Project – Part 2- How to prepare a mini project like the final year project.
Week 16	Examining the results of group project

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	• Modern control system by "OGATA. • Advanced control system by 'ROLAND S.BURNS'.	yes Yes
Recommended Texts	• MATLAB An Introduction with Applications • Applied Mathematical Modelling of Engineering Problems • Introduction to Simulink with Engineering Applications • Any available content for control theory should be useful.	No
Websites	https://www.mathworks.com https://www.tutorialspoint.com YouTube channel for the Module leader.	

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.

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Engineering	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	***Engineering Numerical Methods***			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**EPE304**			☒ **Lecture**	
ECTS Credits	**4**			☐ **Lab**	
SWL (hr/sem)	**100**			☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Level	3		**Semester of Delivery**	6	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: Osama Sahib Jafar		**e-mail**	E-mail: assamasahib@uodiyala.edu.iq	
Module Leader's Acad. Title	Lect.		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/01/2024		**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	The **Engineering Numerical Methods** module typically focuses on applying numerical techniques to solve mathematical problems encountered in engineering. The aims and objectives generally include: **Aims:** • To provide an understanding of numerical methods for solving engineering problems. • To develop proficiency in implementing numerical algorithms using computational tools. • To enhance problem-solving skills by applying numerical techniques to real-world engineering scenarios. • To improve understanding of the limitations and accuracy of numerical approximations.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this module, students should be able to: 1. **Apply Numerical Methods** – Understand and implement numerical techniques to solve engineering problems. 2. **Root-Finding Techniques** – Use methods such as Bisection, Newton-Raphson, and Secant to determine the roots of nonlinear equations. 3. **Solve Linear Systems** – Apply numerical approaches like Gaussian elimination, LU decomposition, and iterative methods (e.g., Jacobi and Gauss-Seidel). 4. **Interpolation and Curve Fitting** – Use polynomial interpolation (e.g., Lagrange, Newton), spline methods, and least squares regression.

	5. **Numerical Differentiation & Integration** – Approximate derivatives and integrals using finite difference methods, Trapezoidal, and Simpson's rules. 6. **Solve Ordinary Differential Equations (ODEs)** – Implement numerical solutions using Euler's method, Runge-Kutta methods, and multistep techniques. 7. **Analyze Accuracy and Stability** – Evaluate numerical errors, convergence, and stability of different methods. 8. **Apply Numerical Methods to Real-World Problems** – Solve engineering case studies using numerical techniques. 9. **Evaluate Performance of Numerical Methods** – Compare different methods in terms of efficiency, accuracy, and computational cost.
Indicative Contents المحتويات الإرشادية	**Indicative Contents for Engineering Numerical Methods Module** This module provides an introduction to numerical techniques used in engineering problem-solving. The topics typically covered include: **1. Introduction to Numerical Methods** • Importance and applications in engineering • Error analysis: truncation, round-off, and propagation of errors • Floating-point arithmetic and numerical stability **2. Root-Finding Methods** • Bisection method • False position (Regula Falsi) method • Newton-Raphson method • Secant method • Convergence and error analysis **3. Solving Systems of Linear Equations**

- Gaussian elimination and Gauss-Jordan method
- LU decomposition
- Iterative methods: Jacobi, Gauss-Seidel.
- Condition number and stability

4. Interpolation and Curve Fitting

- Polynomial interpolation: Lagrange, Newton's divided difference
- Spline interpolation (linear, cubic)
- Least squares regression and curve fitting

5. Numerical Differentiation and Integration

- Finite difference approximations for derivatives
- Trapezoidal rule
- Simpson's rule
- Gaussian quadrature
- Error estimation

6. Numerical Solutions of Ordinary Differential Equations (ODEs)

- Euler's method and modified Euler method
- Runge-Kutta methods (RK2, RK4)
- Stiff equations and stability analysis

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	**1. Behavior management** Behavior management strategies foster an atmosphere of mutual respect, reduce disruptive behavior and ensure students have an equal opportunity to fulfill their potential in the classroom. It's crucial to provide them with both a positive and productive learning environment. Examples include establishing a reward system with an interactive chart where students move up or down depending on their performance and behavior in class. **2. Blended learning** With a blended learning teaching strategy, technology is incorporated with traditional learning. This allows students to work at their own pace, research their ideas and become more physically engaged during lessons. Examples include providing interactive tablets or whiteboards with engaging activities and posting classwork online for easier access. **3. Cooperative learning** Group work is a cooperative learning strategy that allows students with various learning levels to work together. By encouraging them to express their own ideas and listen to others' ideas as a group, you help students develop communication and critical thinking skills. Examples include solving math puzzles together, performing skits as a team or working on group presentations. **4. Formative assessment** A formative assessment is used periodically to monitor student learning incrementally. This can more effectively measure the process of learning as opposed to end-of-unit tests and can help you to improve your teaching methods throughout the year. Examples of this teaching strategy include self-evaluation exercises and summarizing a topic in multiple ways. **5. Student-led teaching** The student-led teaching strategy lets students become the teacher. In a classroom with learners at different levels, you can better engage those learning faster by showing them how to teach and give feedback to their peers. They may team-teach or work in groups to teach a new topic. Examples include letting a student teach an entire lesson or having advanced writers lead a peer-editing session as well as provide constructive criticism.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	8	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	**Introduction to Numerical Methods** • Importance and applications in engineering • Error analysis: truncation, round-off, and propagation of errors • Floating-point arithmetic and numerical stability
Week 2	***Root-Finding Methods*** • *Bisection method.* • *Newton-Raphson method*
Week 3	**Root-Finding Methods** *Newton-Raphson method.* *Fixed point method.* *Convergence and error analysis*
Week 4	**Solving Systems of Linear Equations** Gaussian elimination and Gauss-Jordan method LU decomposition
Week 5	Solving Systems of Linear Equations Iterative methods: Jacobi, Gauss-Seidel, Successive Over-Relaxation (SOR). Condition number and stability.

Week 6	**Numerical Differentiation and Integration** • Finite difference approximations for derivatives • Trapezoidal rule
Week 7	**Mid-term Exam**
Week 8	**Numerical Solutions of Ordinary Differential Equations (ODEs)** Euler's method and modified Euler method.
Week 9	**Numerical Solutions of Ordinary Differential Equations (ODEs)** Runge-Kutta methods (RK2, RK4)
Week 10	**Interpolation and Curve Fitting** Polynomial interpolation: Lagrange
Week 11	***Interpolation and Curve Fitting****Spline interpolation (linear, cubic)* *Least squares regression and curve fitting*
Week 12	**Statistics and probability:** *Definition, frequency distribution(relative and commutative, mean, standard deviation).*
Week 13	**Statistics and probability:** *Definition, mutually exclusive and conditional probability***.**
Week 14	**Statistics and probability:** *Permutations and combinations, random variables.*
Week15	**Statistics and probability:** *Probability distribution: binomial, normal and Poisson distribution.*
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. **Advanced Engineering Mathematics by Erwin Kreyszig, 9thedition, USA, 2006.** 2. **An introduction to numerical analysis, C.J. Zarowski, USA,2004** 3. **Numerical Methods Using MATLAB (3rd Edition) 3rd Edition by Kurtis D. Mathews, John H.; Fink**	Yes
Recommended Texts	**Numerical Methods for Engineers, Chapra.**	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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.

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**High Voltage Engineering**			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**EPE 104**			☒ **Lecture**	
ECTS Credits	**2**			☐ **Lab**	
SWL (hr/sem)	**50**			☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Level	3		**Semester of Delivery**	6	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: Dr. Mohammed Walled Abd		**e-mail**	E-mail:	
Module Leader's Acad. Title	Lect.		**Module Leader's Qualification**	Dr.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/01/2024		**Version Number**	1.0	
Relation with other Modules العلاقة مع المواد الدراسية الأخرى					
Prerequisite module	None		**Semester**		
Co-requisites module	None		**Semester**		

Description	This course gives the student an impression of how to deal scientifically and correctly with the components of these structures and how to deal with them because they pose a threat to the life of the person assigned to work with these systems. Therefore, the student is aware of the importance of dealing with the theoretical part in a scientific manner and reflecting it on the practical side in order to be prepared in the future to work with high-pressure systems with confidence and science.

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	Learn the basic principles of high voltage engineering and how to link the educational content of this subject in a simplified form with the electrical power system, given that the electrical system contains more than 60% of its components in structures and equipment operating at high voltages 11-33-132-400 kilovolts. This course gives the student an impression of how to deal scientifically and correctly with the components of these structures and how to deal with them because they pose a threat to the life of the person assigned to work with these systems. Therefore, the student is aware of the importance of dealing with the theoretical part in a scientific manner and reflecting it on the practical side in order to be prepared in the future to work with high-pressure systems with confidence and science.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A1-Learn the basic principles of high voltage engineering and how to link the educational content of this subject in a simplified form with the electrical power system, A2- given that the electrical system contains more than 60% of its components in structures and equipment operating at high voltages 11-33-132-400 kilovolts. A3-This course gives the student an impression of how to deal scientifically and correctly with the components of these structures and how to deal with them because they pose a threat to the life of the person assigned to work with these systems. B1-student is aware of the importance of dealing with the theoretical part in a scientific manner and reflecting it on the practical side in order to be prepared in B2- future to work with high-pressure systems with confidence and science.
Indicative Contents المحتويات الإرشادية	D1- Ability to work with others disciplined within one work team, presenting ideas and discussing them orally, in writing and electronically D2 - A full awareness of the moral and practical responsibility for the work that the student will practice after graduation D3 - The ability to understand and communicate in English within the technical level related to the field of competence and the use of related engineering software.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**In this course, students are guided by:** • Using different examples. • Using different styles of discussion that aim to connect the theoretical and practical sides.

	• Asking questions and giving exercises that require analysis and conclusions related to lectures. • Encourage students to participate in discussions and do the practical work. Encourage students to work in groups.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**50**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 12	LO #1, #4 and #8, #11
	Assignments	2	10% (10)	3 and 13	LO #3, #4 and #10, #14
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	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	Introduction to high voltage engineering
Week 2	effect of capacitance on single phase line
Week 3	Alternating voltage generation
Week 4	Direct voltage generation
Week 5	Impulse voltage generation
Week 6	High voltage measurement
Week 7	Electrical breakdown in gasses-uniform field
Week 8	Fundamental processes in gasses
Week 9	Breakdown in electronegative gases
Week 10	Breakdown in solid
Week 11	Overvoltage's in power system
Week 12	Lightning overvoltage's
Week 13	Protection of transmission line against lightening.
Week 14	Protection of power systems against overvoltage's
Week 15	Insulation co-ordination
Week 16	Preparatory week before the final exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	High voltage Engineering Fundamental, KUFFEL ABDULAH	Yes
Recommended Texts	High Voltage Engineering Measurement and Testing	No
Websites	https://www.mygreatlearning.com/academy/learn-for-free/courses/c-tutorial?gl_blog_id=74312 https://www.programiz.com/cpp-programming/examples/print-sentence	

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.

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية				
Module Title	Communication Systems		Module Delivery	
Module Type	**Basic**		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**EPE308**			
ECTS Credits	2			
SWL (hr/sem)	50			
Module Level	3		Semester of Delivery	
Administering Department	Bachelor of Electrical Power and Machines		College	College of Engineering
Module Leader	Assist Saja M. Sami		e-mail	**S.M.sami** @uodiyala.edu.iq engsaja11@gmail.com
Module Leader's Acad. Title			Module Leader's Qualification	
Module Tutor	Name (if available)		e-mail	E-mail
Peer Reviewer Name	Name		e-mail	E-mail
Scientific Committee Approval Date			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	•Prepare the students to engage theoretically and practically in Electrical Power and Machines Engineering profession in public and private sectors including, but not limited to, relevant governmental sectors, consulting firms, contracting companies, marketing and real estate investments. •Prepare the students to Engage in ongoing professional development activities by pursuing graduate studies and/or other learning opportunities to respond to the arising challenges. •Advance in responsibility and leadership in their careers and compete with their peers according to the profession ethics. •Promote students with the necessary scientific and practical skills in the discipline for solving engineering problems and treating them logically and scientifically. •Promote students with the necessary skills administration, time management, team-work, communication and language skills, soft computing and programming skills. •Providing students with scientific, practical and personal skills that enable them to solve practical problems and deal with them using scientific concepts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A- Cognitive objective A1- During the academic year, the student learns the basics of communications A2- Knowing the most important circuits used to conduct communication. A3- Learns the parts of any communication system and how to build it. A4- The student learns the types of modulation And To understand and analyze fundamental analog and digital electronic circuits. - To study the characteristics and applications of multistage and feedback amplifiers. - To analyze large signal amplifiers and power applications.

	- To learn the principles of designing and applying operational amplifiers and oscillators. - To acquire basic knowledge of programmable logic devices and system interfacing. - To develop problem-solving skills in electronic circuit design and analysis. B. The skills goals special to the course. B1-Knowledge of building AM, FM, and PM circuits. B2-Learn how to distinguish between each type of modulation. B3-The most important points that distinguish each type of modulation B4-Knowledge of the circuits used in sender and the receiver
Indicative Contents المحتويات الإرشادية	C1- Urging the student to understand the goal of studying the communication systems subject. C2- Introducing the student to how electronic circuits work and the importance of each circuit. C3- Introducing the student to the importance of the subject of communication systems for the engineer in particular and for all other scientific specializations in general. C4- Giving the student the ability to deal with communication systems of various types
Description	The communication system is a system model that describes a communication exchange between two stations, transmitter, and receiver. Signals or information passes from source to destination through a channel. It represents a way in which the signal uses it to move from a source toward its destination. To transmit signals in a communication system, it should first be processed by beginning from signal representation, to signal shaping until encoding and modulation. After the transmitted signal is prepared, it is passed to the transmission line of the channel. Due to signal crossing this media, it is faced with much impairment like noise, attenuation, and distortion. The process of transferring the information between two points is called communication. The main elements needed to communicate are the transmitter to send the information, the medium to send the information and the receiver to receive the information on the other end. Introduction to communication system, channel band width and rate transmission. AM Concepts Modulation Index and Percentage of Modulation Sidebands and the Frequency Domain Pulse Modulation AM Power Single-Sideband Modulation

	Disadvantages of DSB and SSB Applications of DSB and SSB. Fundamentals of Frequency Modulation Basic Principles of Frequency Modulation FM Signal Bandwidth Noise-Suppression Effects of FM Pre-emphasis Generation of FM Demodulation of FM (Balanced slope detection): Frequency Modulation Versus Amplitude Modulation ,SNR . Introduction to digital communication systems The sampling theorem, reconstruction and aliasing, PCM. **A**n electronic system is a network of electronic components that work together to perform a specific function by controlling, amplifying, or converting the flow of electric current. These systems process information, data, or raw materials received through inputs, manipulate it using signal processing circuits, and then output the processed information through actuators or other devices**.**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In this course, students are guided by: • Using different examples. • Using different styles of discussion that aim to connect the theoretical and practical sides. • Asking questions and giving exercises that require analysis and conclusions related to lectures. • Encourage students to participate in discussions and do the practical work. • Encourage students to work in groups.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	6 and 12	LO #1 to #3 and #4 to #6
	Assignments	2	10% (10)	2 and 13	LO #3 to #6
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #3, #4 and #6
Summative assessment	Midterm Exam	2hr	10% (10)	8	LO #1 - #4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1and 2	**Introduction to communication system ,channel band width and rate transmission**
Week 3to 4Week	**AM Concepts Modulation Index and Percentage of Modulation Sidebands and the Frequency Domain Pulse Modulation AM Power Single-Sideband Modulation Disadvantages of DSB and SSB Applications of DSB and SSB**
Week 5 to 6Week	**Fundamentals of Frequency Modulation Basic Principles of Frequency Modulation FM Signal Bandwidth Noise-Suppression Effects of FM Pre-emphasis Generation of FM Demodulation of FM (Balanced slope detection): Frequency Modulation Versus Amplitude Modulation ,SNR**
Week 7	**Introduction to digital communication systems** **The sampling theorem , reconstruction and aliasing ,PCM**
Weak 8	**Multistage Amplifiers & Frequency Response Introduction** **- Concept of** General cascaded systems **and overall gain.** - RC-coupled amplifiers**: basic analysis, capacitor effects.** - Direct-coupled amplifiers**: advantages and disadvantages.** **- Introduction to** Frequency response**: concepts of low, high frequency, and bandwidt**

Weak 9	**Feedback Amplifiers** Feedback concepts**: definition, positive vs. negative feedback.** **-** Properties of negative feedback amplifiers**: effects on gain, impedance, bandwidth, distortion.** **-** Connection types**: conceptual understanding of the four basic types.** **-** General analysis **of feedback amplifiers: closed-loop gain equations.**
Weak 10	**Operational Amplifiers (OP-Amps) and Applications** **Ideal and practical** OP-Amp characteristics**.** **- Basic** OP-Amp circuits**: Inverting, Non-inverting, Summing, Integrator, Differentiator (selected applications).** **- Practical examples of OP-Amp applications**
Weak11	**Oscillators & Introduction to Power Amplifiers** Oscillators**: Operating principle** **- Examples of oscillator types (RC Phase Shift, Wien Bridge - focus on operating principle).** **- Introduction to** Large Signal Amplifiers (Power Amplifiers)**: power and efficiency concepts.** **-** Class A Amplifier**: basic analysis and efficiency.**
Weak12	Power Amplifiers & Thermal Management **-** Amplifier classes **(Class B, Class AB, Class C): efficiency comparison and operating principle (emphasize Crossover Distortion in Class B).** **-** Power BJTs **and** Power VMOS**: characteristics and basic applications.** **-** Thermal management**:** junction temperature**,** thermal resistance**,** power dissipation versus temperature**,** transistor case and heatsink**.** **-** Integrated circuit power amplifier**: general concept.**

Weak 13	Introduction to PLDs & Digital/Analog Interfacing - Introduction to Programmable Logic Devices (PLDs)**: concept and role in digital design (without delving into architectural details).** - Digital and analog interfacing**: the need for conversion.** - D/A conversions **(Digital-to-Analog): R-2R Ladder principle.** - A/D conversions **(Analog-to-Digital): Successive Approximation principle.**
Weak 14 to 15	System Interfacing & Arithmetic Processes - Internal system interfacing **and** standard buses**: concepts of Data Bus, Address Bus, Control Bus.** - Digital system application**: simple examples.** - Arithmetic Processes**: quick review of digital addition and subtraction (using two's complement).**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Prerequisites: · • Fundamentals of Communications (CPE 211) · Applied Mathematics II (E 202) • "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky	

	Textbook: · • Hewi Hsu, Ph.D, Analog and Digital Communications, 4th Edition, 2009, SCHAUM'S outlines • "Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith • "Digital Fundamentals" by Thomas L. Floyd	
Recommended Texts	• British BS-Std American IEEE, ANSI and German VDE	
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
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