MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Electromagnetics**			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**EPE208**			☒ **Lecture**	
ECTS Credits	**7**			☐ **Lab**	
SWL (hr/sem)	**175**			☒ **Tutorial** ☒ **Practical** ☐ **Seminar**	
Module Level	1		**Semester of Delivery**	1	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name: Yasir Ghazi Rashid		**e-mail**	E-mail: yasserghazee_enge@uodiyala.edu.iq	
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 goal of studying the electromagnetic theory course is to identify the basic principles of this theory, as follows • Study vectors in general in systems of perpendicular, cylindrical and spherical axes. And also, a study of field dispersion, Chaos's theorem, field rotation, Stock's theorem, and finally Crane's theorem. • Studying the stable electric field in vacuum and treating the Laplace and Poisin equations and their solutions in Cartesian, cylindrical and spherical coordinate systems. Also, a study of the electric dipole and electric quadrupole, the single solution theorem, and the method of electrical images. • Study the stable electric field in insulating materials and understand the phenomenon of polarization in these materials. In addition to calculating electrical displacement, electrical influence, and dielectric constant, as well as studying the Laplace and Poise equations in insulating materials. • The objective of the subject of electromagnetic theory in the second course is to introduce the student to the concept of voltage and the potential difference on a charge or system of charges and the potential field, as well as the relationship between voltage and the electric field and ways to extract them mathematically, in addition to getting to know the concepts of the electric duo and electric flux and knowing their laws and ways to extract them. In this course, the student also learns about the types of materials such as conductors, insulators, and semiconductors, as well as the types of currents and their densities that pass through the three types of materials. The student also learns about the concept of electrical polarization. The student also learns about the concept of insulators and their direct relationship to the electrical capacity and energy stored in them, the operation of capacitors and methods of connecting them. Finally, the concept of magnetic flux and how it arises is learned, and the laws of Biot-Svart & We then discuss the magnetic field, how to measure it on a strip of electric current, and magnetic flux density and its relationship to the magnetic field. The student also learns how to extract these concepts mathematically.

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 electromagnetic field theory for electrical engineering problems • To understand the electromagnetic field behaviour. • To select and use appropriate theoretical models for analysis, problem solving and finding solutions related to the electrostatic, electrodynamics and electromagnetic fields.
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	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	82	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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	**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	**Electromagnetics Overview** *What is electromagnetics?; Why study electromagnetics?; Course topics*
Week 2	**Vector Algebra:** *Scalars and Vectors; Unit Vector; Vector Addition and Subtraction; Position and Distance Vectors; Vector Multiplication; Components of a Vector*
Week 3	**Coordinate Systems and Transformation:** *Cartesian Coordinates (x, y, z); Circular Cylindrical Coordinates (ρ, φ, z); Spherical Coordinates (r, ∅, φ); Constant-Coordinate Surfaces, the transformation between coordinate system.* **Vector Calculus:** *Differential Length, Area, and Volume; Line, Surface, and Volume Integrals Del Operator; Gradient of a Scalar; Divergence of a Vector and Divergence Theorem.*
Week 4	**Coulomb's Law and Electric Field Intensity:** *The experimental law of Coulomb, Electric field intensity; Field of n point charges; Electric fields due to continuous charge distributions (line charge, surface charge and volume charge distributions), Steam line and sketches of fields; Electric flux density.*
Week 5	**Gauss's Law-Electric Flux Density:** *Gauss's law; Some symmetrical charge distribution, Application of gauss's law; Maxwell's first equation (for electrostatics); The vector operator and the divergence theorem.*
Week 6	**Electrostatic Fields** *Coulomb's Law and Field Intensity; Electric Flux Density, and Gauss's Law; Applications of Gauss's Law; Energy and Potential.*
Week 7	**Energy and Potential:**

	Energy and potential-energy expended in moving a point charge in an electric field; The line integrals; Potential difference and potential, The potential field of a point charge; The potential field of a system of charges; Conservative property; Potential gradient; The dipole energy density in the electrostatic field.
Week 8	**Mid-term Exam**
Week 9	**Electric Fields in Material Space:** *Properties of Materials; Convection and Conduction Currents; Conductor properties and boundary conditions; The method of mages; Semiconductors; The nature of dielectric materials; Boundary conditions for perfect dielectric materials.*
Week 10	**Capacitance:** *Capacitance; Capacitance of some useful configuration; Capacitance of a two-wire line; Poisson's and Laplace's equations-Poisson's and Laplace equations; Uniqueness theorem; Solution of Laplace's equation in certain situation; Solution of Poisson's equation in certain situation; Product solution of Laplace's equation.*
Week 11	**Magnetostatic Fields:** *The steady of magnetic field; Biot- savart law; the curl; Stocke's theorem*
Week 12	**Magnetostatic Fields:** *Ampere's circuit law; Application of ampere's law; Magnetic flux and magnetic flux density; The scalar and vector magnetic potential; Derivation of steady magnetic field laws.*
Week 13	**Magnetostatic Fields:** *Magnetic forces; Materials and inductance-force on a moving charge; Force on a differential current element; Force between differential current elements.*
Week 14	**Magnetostatic Fields:** *Force and torque on a closed circuit; The nature of magnetic materials; Magnetization and permeability; Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials; Inductance and mutual inductance; Time varying fields.*

Week 15	**Maxwell's Equations:** *Maxwell's equations-faraday's law; displacement current; Maxwell's equations in point form; Maxwell's equations integral form; the retarded potentials.*
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	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded

(0 – 49)	**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.