MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Antenna and Wave propagation**			**Module Delivery**	
Module Type	**Core**			☒**Theory**	
Module Code	ATU11503			☒**Lecture**	
ECTS Credits	**6**			☒**Lab**	
SWL (hr/sem)	**150**			☐**Tutorial**	
				☐**Practical**	
				☐**Seminar**	
Module Level	UGIII	**Semester of Delivery**	1		
Administering Department		**College**	NETC		
Module Leader		**e-mail**			
Module Leader's Acad. Title		**Module Leader's Qualification**			
Module Tutor	Name (if available)	**e-mail**			
Peer Reviewer Name	Nasir Hussein Selman	**e-mail**	Coj.nas@atu.edu.iq		
Scientific Committee Approval Date	01/05/2025	**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	1. To provide an introduction to the fundamentals of electromagnetic wave propagation in both guided structures and open media 2. Introduce essentially a review of basic electromagnetic theory. 3. Introduce the fundamental principles of antenna theory and apply them to the analysis, design, and measurements of antennas. 4. It is devoted to the study of antenna arrays. 5. introduce the student to a technology that will advance antenna theory and design, and revolutionize wireless communications 6. deals with the issues related to the propagation of radio waves
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding the relative between Maxwell's equation and antenna system. 2. Recognize the radiation mechanism. 3. Basic understanding of the Properties of Antenna. 4. Comprehend the antenna parameters. 5. Categorise and analysis most types of linear antenna. 6. Basic knowledge about antenna array & the wave propagation.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A - Theoretical content 1- Review of basic electromagnetic theory. 2- The field computation to antennas. 3- Study of antenna arrays & Propagation of radio waves. Part B – LAB-

	1- Design, analysis, and visualization of antenna elements and arrays. 2- Compute impedance, current distribution, radiation patterns. 3- Antenna coordinate systems & RF propagation models.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

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	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	
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 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	10	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Maxwell equations -Antenna Definition - Properties of Antenna - Types of Antennas - Block Diagram of Communication Systems - The Isotropic - Radiation Mechanism.
Week 2	Antenna Parameters - Radiation Pattern - Field Regions - Radian and Steradian - Radiation Intensity
Week 3	Pattern beamwidth- Directivity - Power Gain
Week 4	Input Impedance of Antenna
Week 5	Antenna Polarization- Polarization Mismatch
Week 6	Radiation Efficiency - Effective Length - Effective Area - Antenna Bandwidth
Week 7	Antennas In Communication (Friis Formula) - Antennas in Radar System
Week 8	Thin Linear Antenna –Short Dipole
Week 9	Monopole - Dipole Antenna - Loop antenna-small loop
Week 10	**Mid-Term Exam**
Week 11	Aperture Antenna - Folded Dipole Antenna - Yagi-Uda Antenna
Week 12	Helical antenna -Spiral antenna - Microstrip patch antenna
Week 13	Antenna Arrays - Linear Array - Pattern Multiplication - Two Element, Uniform Array - End Fire Array - Broad Side Array
Week 14	Radio Wave Propagation - Ground Wave - Free Space Propagation - Ground Reflection - Surface Waves - Diffraction -.
Week 15	Wave Propagation in Complex Environment - Troposphere Propagation - Troposphere Scatter - Ionosphere Propagation

Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Antenna Library- Structure of Antenna- Properties of Antenna- Plot Radiation Pattern of Antenna- Plot Azimuth and Elevation Pattern of Antenna
Week 2	Directivity of Antenna- E-fields of Antenna- Polarizations and Axial Ratio of Antenna
Week 3	Return Loss and Voltage Standing Wave Ratio (VSWR) of Antenna
Week 4	Current and Charge Distribution of Antenna- Mesh of Antenna
Week 5	Rectangular Coordinate System- Spherical Coordinate System- Polar Plot
Week 6	Design and Analysis Using Antenna Designer
Week 7	Array Modeling and Analysis
Week 8	RF Propagation and Visualization
Week 9	Introduction to Computer Software Technology (CST)
Week 10	**Mid-Term Exam**
Week 11	Analysis of Monopole and dipole Antenna parameters using CST
Week 12	Analysis of Yagi-Uda Antenna parameters using CST
Week 13	Analysis of Spiral antenna parameters using CST
Week 14	Analysis of Microstrip patch antenna parameters using CST
Week 15	Analysis of Array Antenna parameters using CST
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Antenna Theory Analysis and Design by C.A> Balanis, John Wille Sons	Yes
Recommended Texts	Elements of Electromagnetics by Matthew N. O. Sadiku (2nd Edition)	No
Websites	https://www.antenna-theory.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.