MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Wireless Networks**			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**WICN314**			☐**Lecture**	
ECTS Credits	5			☐ **Lab**	
SWL (hr/sem)	**125**			☒ **Tutorial** ☒ **Practical** ☐ **Seminar**	
Module Level	3		**Semester of Delivery**	1	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader			**e-mail**		
Module Leader's Acad. Title	**Lecturer**		**Module Leader's Qualification**	Ph.D.	
Module Tutor	**None**		**e-mail**	**None**	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	**1 / 4 /2026**		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Computer Networks	**Semester**	II/1
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- Understand the fundamental concepts and importance of modulation techniques (FSK, PSK, QAM, OFDM) in wireless communication. 2- Learn about the principles of wireless networks, including their evolution, applications, and challenges such as interference and mobility. 3- Develop an understanding of wireless transmission fundamentals, including radio frequency (RF) communication, signal propagation, fading, and MIMO technology. 4- Explore the architectures of wireless networks, including WLAN, and sensor networks (WSN, IoT, LPWAN). 5- Gain knowledge of wireless MAC protocols, including CSMA/CA, TDMA, FDMA, CDMA, and specific MAC protocols for Wi-Fi and sensor networks. 6- Analyze various wireless network standards, such as IEEE 802.11 (Wi-Fi), Bluetooth 7- Develop practical skills in modulation and wireless networking technologies, enabling students to evaluate and implement real-world wireless communication systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Explain the need for modulation in wireless communication and differentiate between key modulation techniques, including FSK, PSK, QAM, and OFDM. 2- Describe the fundamental principles of wireless networks, their evolution, applications, and challenges such as interference and mobility. 3- Analyze wireless transmission fundamentals, including RF communication, signal propagation, path loss, fading, multipath effects, and MIMO technology. 4- Compare and contrast different wireless network architectures, such as WLAN,WSN, IoT, and LPWAN. 5- Evaluate and apply various wireless MAC protocols, including CSMA/CA, TDMA, FDMA, CDMA, and MAC protocols for Wi-Fi and sensor networks. 6- Demonstrate practical skills in modulation and wireless networking technologies through simulations, experiments, or case studies. 7- Apply knowledge of wireless communication principles to analyze real-world scenarios and propose solutions for improving network performance and efficiency
	Introduction to Wireless Networks (6 hrs)

Indicative Contents المحتويات الإرشادية	• Overview of wireless communication. • Evolution of wireless networks. • Applications of wireless networks in various domains. • Comparison of wired vs. wireless networks. • Challenges in wireless networking: interference. **Introduction to Modulation (4 hrs)** • Need for modulation in wireless communication. • Types of modulation: Analog vs. Digital. • Advantages of digital modulation over analog modulation. • Overview of frequency, phase, and amplitude modulation. **Digital Modulation Techniques (8 hrs)** • FSK (Frequency Shift Keying): Principles, advantages, applications. • PSK (Phase Shift Keying): BPSK, QPSK, and 8-PSK modulation techniques. • QAM (Quadrature Amplitude Modulation): 16-QAM, 64-QAM, 256-QAM. • OFDM (Orthogonal Frequency Division Multiplexing): Concept, advantages, implementation in modern networks. • Comparison of digital modulation techniques in real-world scenarios. **Wireless Transmission Fundamentals (8 hrs)** • Basics of radio frequency (RF) communication. • Signal propagation: Path loss, fading, multipath effects. • Antennas and MIMO (Multiple Input Multiple Output) technology. • Spectrum allocation, frequency bands, and regulatory aspects.

	Wireless Network Architectures (12 hrs) • Wireless Sensor Networks (WSN) and IoT: LPWAN technologies. • Network deployment strategies and performance considerations. **Wireless MAC Protocols (12 hrs)** • Medium Access Control (MAC) layer challenges in wireless networks. • CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance). • TDMA, FDMA, and CDMA techniques. • IEEE 802.11 MAC protocols and their impact on network performance. • MAC protocols for sensor networks and IoT. **Wireless Network Standards (10 hrs)** • IEEE 802.11 (Wi-Fi) standards: 802.11a/b/g/n/ac/ax. • Bluetooth and IEEE 802.15 (WPAN).

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- **Lectures** • Instructors will deliver structured lectures to introduce key concepts in wireless networks. • These sessions will cover theoretical foundations, real-world applications, and case studies of modern wireless technologies. 2- **Interactive Discussions:** • Engaging students in discussions about real-world wireless communication challenges. • Exploring topics like interference, network evolution, and modulation trade-offs through problem-solving activities. 3- **Hands-on Simulations:** • Students will use simulation tools (e.g., MATLAB, Simulink, NS3) to analyze modulation schemes and wireless network behaviors. • Practical demonstrations on how modulation impacts signal quality and network performance. 4- **Group Projects:** • Students will collaborate on projects like designing a wireless network architecture or optimizing modulation techniques for different applications. • Projects will involve problem-solving, teamwork, and applying theoretical knowledge to practical scenarios. 5- **Use of Visuals and Multimedia:** • Interactive diagrams, waveforms, spectrum analysis, and animations to illustrate key modulation concepts. • Videos demonstrating real-world applications of wireless networks, such as 5G and IoT. 6- **Assessment and Feedback:** • Regular quizzes, assignments, and exams to evaluate students' grasp of modulation principles and wireless networking concepts. • Feedback on lab results, project work, and problem-solving exercises to guide learning improvements.

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	**7**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**87**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**3**
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- #5 and #6 - #8
	Assignments	2	10% (10)	3 and 12	LO #2 and #5, #7, #8
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5 - #7
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	LO #1 - #6
	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 Wireless Networks: Overview of wireless communication, Evolution of wireless networks, Applications of wireless networks, Comparison of wired vs. wireless networks, Challenges in wireless networking (Interference).
Week 2	Wireless Transmission Fundamentals: Basics of RF communication, Signal propagation (path loss, fading, multipath), Antennas and MIMO (Multiple Input Multiple Output), Spectrum allocation and regulation.
Week 3	Introduction to Modulation: Need for modulation, Types of modulation (Analog vs. Digital).
Week 4	Digital Modulation Techniques: Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary PSK (BPSK), Quadrature PSK (QPSK), 8-PSK.
Week 5	Quadrature Amplitude Modulation (QAM): 16-QAM, 64-QAM, 256-QAM, Applications of QAM.
Week 6	Orthogonal Frequency Division Multiplexing (OFDM): Principles of OFDM, Advantages and Applications.
Week 7	Wireless Network Architectures: Wireless Sensor Networks (WSN), IoT and LPWAN.
Week 8	Mid-term Exam **+ Review of Modulation and Wireless Network Fundamentals.**
Week 9	Wireless MAC Protocols: Medium Access Control (MAC) layer challenges, CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance).
Week 10	Wireless MAC Protocols (cont.): TDMA, FDMA, CDMA, IEEE 802.11 (Wi-Fi) MAC protocols, MAC protocols for sensor networks.
Week 11	Wireless Network Standards: IEEE 802.11 (Wi-Fi) standards (802.11a/b/g/n/ac/ax)
Week 12	Bluetooth and IEEE 802.15 (WPAN), Zigbee and 6LoWPAN.
Week 13	Case Study & Review: Analysis of real-world wireless network deployments and modulation techniques in modern systems.
Week 14	Preparatory Week before the Final Exam (Q&A, Revision).
Week 15	Final Exam.

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1- Mischa Schwartz, *Mobile Wireless Communications*, Cambridge University Press, 2005, ISBN: 0-521-84347-	
Recommended Texts	1. William Stallings, *Wireless Communication and Networks*, Pearson Education, 3rd Edition, 2002. 2. Theodore S. Rappaport, *Wireless Communications: Principles and Practice*, Pearson, 2nd Edition.	Yes
Websites	1- Cisco Networking Academy (https://www.netacad.com) 2- https://simu5g.org/install	

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.