Course Specification

(Postgraduate Programs)

Course Title:	Digital Communications
Course Code:	CE6011
Program:	Master of Science in Computer Engineering
Department:	Computer and Network Engineering
College:	College of Computing
Institution:	Umm Al-Qura University
Version:	2.0
Last Revision Date:	12/4/2025

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☒ Required Required in the Wireless Communication and Networks Track		☒ Elective in all other tracks	
3. Level/year at which this course is offered: (Level 3)				
4. Course General Description:				
This course provides an overview of digital and wireless communication systems, covering digital communication principles, wireless propagation, and channel models. Topics include modulation techniques, error detection and correction, channel coding, antenna design, and transmission methods. The course also addresses cellular network architectures and explores emerging trends in communication technologies.				
5. Pre-requirements for this course (if any)**:**				
Non				
6. Pre-requirements for this course (if any)**:**				
Non				
7. Course Main Objective(s):				
To provide an understanding of digital and wireless communication systems, covering concepts of wireless propagation, channel models, modulation techniques, error correction, and emerging trends in communication technologies.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid • Traditional classroom		

No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	36
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)……Seminars**	9
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Identify challenges in the design of digital and wireless communications	K1	Lectures, and reading assignments	Written exams, assignments, projects and oral presentations
1.2	Explain fundamentals, concepts, terminologies and characteristics of digital and wireless communications	K2		
2.0	**Skills**			
2.1	Design and implement modern digital and wireless communication techniques while ensuring reliable communication	S1	Lectures, project, discussions, tutorials	Written exams, assignments, projects and oral presentations
2.2	Apply principles of math, science, and engineering to solve complex problems related to digital and wireless communication systems (such as modulation, demodulation, channel encoding, decoding, error detection and correction)	S2		

Code	Course Learning Outcomes	Code of PLOs	Teaching Strategies	Assessment Methods
2.3	Communicate effectively through a written report embodying the design, implementation, evaluation of digital and wireless communication systems	S3		
2.4	Evaluate the performance of digital and wireless communication systems	S4		
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate commitment to ethical and professional responsibilities in digital and wireless communication systems	V1	Lectures, project, discussions, assignments and projects	Group assignments and projects
3.2	Work in a team to implement a project in digital and wireless communication systems	V2	Group assignments and projects	Group assignments and projects

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to Digital and Wireless Communication Systems:** History, basic concepts of digital vs. analog communication, components of wireless systems, and applications of wireless networks.	**3**
2.	**Fundamentals of Digital Communication Systems:** Sampling, quantization, encoding, Nyquist/Shannon theorems, system models, and trade-offs in digital communication.	**3**
3.	**Principles of Wireless Communication:** Frequency spectrum, signal propagation, multipath effects, and mobility challenges.	**3**
4.	**Wireless Propagation and Fading Models: P**ath loss models, shadowing, Rayleigh and Rician fading, Doppler effects, diversity techniques, and equalization methods.	**3**
5.	**Baseband and Passband Digital Modulation Techniques:** ASK, FSK, PSK, QPSK, OFDM, higher-order modulations, and error performance in noisy and fading environments.	**3**
6.	**Error Detection, Correction, and Channel Coding: P**arity checks (checksum), Cyclic Redundancy Check (CRC), Forward error correction (FEC), Hamming codes, LDPC, Reed-Soloman and error correction trade-offs for wireless systems.	**6**

7.	**Antennas and Wireless Transmission Techniques:** Antenna types, beamforming, radiation patterns, MIMO, and spatial diversity and adaptive transmission methods.	**3**
8.	**Cellular Networks: Architecture and Concepts:** Frequency reuse, handoff management, LTE, 5G architecture, small cells, and network slicing.	**3**
9.	**Resource Allocation and Power Control in Wireless Systems:** Spectrum sharing, interference management, power control techniques, energy-efficient protocols, and load balancing.	**3**
10.	**Digital Multimedia Communication Systems:** JPEG, MPEG, H.264, MP3, streaming protocols, adaptive bitrate streaming, and real-time multimedia communication challenges.	**3**
11.	**Low-Latency and Ultra-Reliable Communication Systems:** URLLC in 5G, latency optimization, reliability enhancement, autonomous systems, and real-time industrial IoT applications.	**3**
12.	**Emerging trends and Research Topics in Digital communication systems:** Future trends in areas such as optimization of 5G / 6G network designs, satellite communication, mmWave , energy-efficient systems, MIMO, adaptive coding.	**9**
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Written assignments or tests/quizzes	3, 6, 11	50
2.	Presentations, discussions and seminars	9	20
3.	Projects	11	30

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Computer Networks: A Systems Approach, 4th Edition, Larry L. Peterson & Bruce S. Davie, Elsevier ,2007, ISBN 13: 978-0-12-370548-8 Computer Networking Problems and Solutions: An innovative approach to building resilient, modern networks, Fist Edition, Russ White and Ethan Banks, Addison-Wesley, 2018, SBN-10: 1587145049 Computer And Communication Networks, Second Edition, Nader F. Mir, Pearson Education, 2015, ISBN-10: 0-13-381474-2
Supportive References	
Electronic Materials	The instructor may provide as per requirements.
Other Learning Materials	The instructor may provide as per requirements.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
Facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Projector
Other equipment (Depending on the nature of the specialty)	The instructor may provide as per requirements.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Leaders	Indirect
Effectiveness of students' assessment	Program Leaders	Direct
Quality of learning resources	Students, Faculty	Indirect
The extent to which CLOs have been achieved	Students, Faculty, Program Leaders	Direct and Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**Computer and Network Engineering Department Council**
REFERENCE NO.	**The 18th Session Of The Academic Year 1446**
DATE	**15/4/2025**