



Course Specification

(Postgraduate Programs)

Course Title: Advanced Computer Networks

Course Code: CE6024

Program: Master of Science in Computer Engineering

Department: Computer and Network Engineering

College: College of Computing

Institution: Umm Al-Qura University

Version: 1.0

Last Revision Date: 12/4/2025



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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A. University College Department Track

B. Required Elective

3. Level/year at which this course is offered: (Level 1)

4. Course General Description:

This course gives students an in-depth understanding of advanced computer networking concepts, protocols, and technologies. It covers network architectures, transport protocols, routing algorithms, Quality of Service (QoS), mobile and wireless networks, cloud and fog computing, and the Internet of Things (IoT). Students will also explore cutting-edge technologies like software-defined networking (SDN), network virtualization, and emerging trends. The course equips students with the knowledge and skills to design, implement, and manage complex and secure networking systems.

5. Pre-requirements for this course (if any):

Non

6. Co-requisites for this course (if any):

Non

7. Course Main Objective(s):

This course provides students with an understanding of advanced computer networking concepts, architectures, and protocols. It equips students with the skills to design, manage, and optimize modern network systems while addressing scalability and performance challenges. Students will gain knowledge applicable to various networking technologies and applications.



2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> Traditional classroom 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 computer networks	K1	Lectures, and reading assignments	Written exams, assignments, projects and oral presentations
1.2	Explain fundamentals, design concepts, terminologies and characteristics of computer networking, including network architectures, protocols, and technologies.	K2		
2.0	Skills			
2.1	Design and implement advanced computer networks, focusing on scalability and efficiency	S1	Lectures, project, discussions, tutorials	Written exams, assignments, projects and oral presentations



Code	Course Learning Outcomes	Code of PLOs	Teaching Strategies	Assessment Methods
2.2	Apply principles of computer networks to solve complex problems	S2		
2.3	Communicate effectively through a written report embodying the design, implementation, evaluation of computer networks	S3		
2.4	Evaluate the performance of computer networks with different protocols and technologies using engineering and mathematical techniques	S4		
3.0	Values, autonomy, and responsibility			
3.1	Demonstrate commitment to ethical and professional responsibilities in computer networks	V1	Lectures, project, discussions, assignments and projects	Group assignments and projects
3.2	Work in a team to implement a project in computer networks	V2	Group assignments and projects	Group assignments and projects

C. Course Content:

No	List of Topics	Contact Hours
1.	Foundations of Networking: Models and Architectures: overview of network architecture, OSI and TCP/IP models, layered protocols, DoD, and RINA models.	3
2.	Packet switching vs circuit switching: Fundamentals of ATM, Comparison of circuit and packet switching, resource allocation, and switching techniques.	3
3.	Internetworking Fundamentals: Basics of IP addressing (IPv4/IPv6 addressing), router operation; forwarding and filtering. subnetting; NAT; ARP, DHCP	3
4.	Transport Layer Protocols (TCP/UDP): Understanding TCP and UDP protocols, connection establishment, reliability, and congestion control.	3
5.	Routing Protocols and Algorithms: static vs. dynamic routing; Distance vector, link-state routing, OSPF, BGP, and RIP; application scenarios.	3
6.	Queueing Theory and Network Performance: fundamentals of queueing, Little's theorem, Markov models, and quality metrics.	3
7.	Quality of Service (QoS): QoS models, traffic shaping, RSVP, IntServ, differentiated services for network prioritization (DiffServ), MPLS; resource allocation.	3
8.	Mobile, Vehicular, Flying, and Delay-Tolerant Networks and wireless sensor networks (MANETs, VANETs, FANETs, DTNs) and WSN: overview of MANETs,	6



	VANETs, FANETs, DTNs, and wireless sensor networks, with applications and challenges in mobility.	
9.	Cloud Computing and Fog computing: Fundamentals of cloud and fog computing, their architectures, and implications for networking.	3
10.	Internet of Things (IoT) Networking and application: IoT protocols, sensor integration, and applications and challenges.	3
11.	Virtualization in Networking and Software-Defined Networking (SDN): Network function virtualization, SDN principles, architecture and protocols.	3
12.	Emerging Research Topics: Future trends in networking like 6G, mmWave and AI-driven networks.	9
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assessment through written assignments or tests/quizzes	3, 6, 11	50
2.	Assessment through presentations, discussions and seminars	9	20
3.	Assessment through 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	<p>Computer Networks : A Systems Approach, 6th edition, Larry L. Peterson and Bruce S. Davie , Elsevier ,2020, ISBN: 9780128237151</p> <p>Computer Networking Problems and Solutions: An innovative approach to building resilient, modern networks, 1st Edition, Russ White and Ethan Banks, Addison-Wesley, 2018, ISBN-10: 1587145049</p> <p>Computer And Communication Networks , Second Edition , Nader F. Mir, Pearson Education, 2015, ISBN-10: 0-13-381474-2</p> <p>Software-Defined Networks: A Systems Approach by Larry L. Peterson, Carmelo Cascone, Brian O'Connor, Thomas Vachuska, and Bruce Davie, 2020, ISBN 13: 9781736472101</p>
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 18 th Session Of The Academic Year 1446
DATE	15/4/2025

