



COMSATS University Islamabad

Department of Computer Science

Course Syllabus

Course Information

Course Code: CSC339	Course Title: Data Communications and Computer Networks
Credit Hours: 3(2,1)	Lecture Hours/Week: 3
Lab Hours/Week: 3	Pre-Requisites: None

Catalogue Description:

This course introduces the concepts of computer networks along with communication standards and protocols. Topics include: Introduction; Physical Components; Internet Backbones; Layered Architecture; Application Layer Services & Protocols; Transport Layer Services; Transport Layer Protocols; Network Layer; The Internet Protocol; Routing Algorithms; Link Layer; Error Detection Techniques; MAC Protocols; Physical Layer; Transmission Impairment; Wireless & Mobile Networks; Cellular Networks; and Security in Computer Networks.

Text and Reference Books

Text Book:

1. Computer Networking: A Top-Down Approach, James F. Kurose, Keith Ross Pearson, 2021.

Reference Book:

1. Data Communications and Networking with TCP/IP Protocol Suite, Behrouz A. Forouzan, McGraw-Hill, 2021.

Week wise Plan:

Lecture #	Teaching Hours (Hrs.)	CDF Unit #	Topics Covered	Reading Material
1.	1	1	Introduction & Overview: Basic Concepts of Networking & Internet; Access Networks, Physical Components of a Network, and Physical/Wireless Media.	Kurose: Ch1, Ref. Material
2.	1.5	1	ISPs and Internet Backbones, Network Topologies (Bus, Star, Ring, Mesh, hierarchical); LAN Technologies; and Circuit Switching vs Packet Switching.	Kurose: Ch1, Ref. Material
3.	0.5	1	Concepts of Loss, Throughput, and End-to-End Delay (Transmission Delay, Queuing Delay, Propagation Delay, Processing Delay).	Kurose: Ch1
4.	3	1	End-to-End Delay; Layered Architectures (OSI, TCP/IP), and Role of different Layers.	Kurose: Ch1
5.	1.5	2	Application Layer: Client-Server Paradigm, Peer-to-Peer Paradigm, Communicating Processes Addressing, Transport Services; HTTP: Persistent vs Non-Persistent Connections, and RTT.	Kurose: Ch2
6.	1	2	Performance Comparison in Terms of Delay (HTTP Persistent vs Non-Persistent Connection), Web Caching, and Cookies.	Kurose: Ch2
7.	1	2	SMTP, Mail Access Protocols, (POP3, IMAP), and DHT (Distributed Hash Table).	Kurose: Ch2
8.	2.5	2	DNS, CDN, Video Streaming, P2P Applications.	Kurose: Ch2
9.	1	3	Transport Layer: Transport Layer Protocols (UDP, TCP), TCP & UDP Segment Structures; Transport Layer Services: Multiplexing, De-Multiplexing	Kurose: Ch3

10.	2	3	Socket Programming, and Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol (RDT 1.0, 2.X & 3.0).	Kurose: Ch3
11.	1.5	3	Pipelined Reliable Data Transfer Protocol (Go Back N, Selective Repeat Protocol), Throughput, and TCP Connection Establishment.	Kurose: Ch3
12.	1.5	3	TCP Reliability (Acknowledgements & Timeout), and Flow Control.	Kurose: Ch3
13.	1.5	3	Congestion Control & Avoidance; and Fairness.	Kurose: Ch3
14.	1	4	The Network Layer: Forwarding & Routing, Virtual Circuits, Datagram Networks, and What's inside a Router?	Kurose: Ch4
15.	2	4	IP Protocol: Datagram Format, IPv4 Addressing, and Subnetting.	Kurose: Ch4
16.	1	4	IPv6 Addressing, and Routing (Unicast, Broadcast & Multicast, NAT, Internet Control Message Protocol (ICMP)), and DHCP.	Kurose: Ch4
17.	Mid Term Exam			
18.				
19.	2	4	Static and Dynamic Routing, Link State and Distance Vector Routing Protocols.	Kurose: Ch4
20.	1.5	4	Routing in the Internet (Intra-AS Routing & Inter-AS Routing).	Kurose: Ch4
21.	1	5	Link Layer: Introduction, Link Layer Services, Link Layer Addressing; Link Layer Error Detection Techniques: Parity Check and Check Summing Method.	Kurose: Ch5
22.	2	5	CRC, Channel Partitioning Protocols (TDMA, FDMA, CDMA), and Multiple Access Protocols (ALOHA, Slotted ALOHA).	Kurose: Ch5
23.	2	5	Multiple Access Protocols (CSMA/CD, CSMA/CA), and ARP.	Kurose: Ch5
24.	1.5	5	RARP; Link Layer Switches: Forwarding & Learning, and Switches vs Routers.	Kurose: Ch5
25.	1	5	Retrospective: A Day in the life of a webpage request (DHCP, UDP, IP, Ethernet), DNS & ARP, and Intra-Domain Routing to DNS Server, VLANs, Inter VLAN Routing, and VTP.	Kurose: Ch5
26.	1.5	6	Physical Layer: Analog & Digital Data, Analog & Digital Signals, Periodic & Non-Periodic Signals, and Periodic Analog Signals (Sine Wave, Phase, Wavelength, Time & Frequency, Time & Frequency Domains, Composite Signals, and Bandwidth).	Ref. Material
27.	1.5	6	Digital Signals (Bitrate, Bit Length, Transmission of Digital Signals); Transmission Impairments: Attenuation, Distortion, Noise; Data Rate Limits: Noiseless Channel (Nyquist Bit Rate), and Noisy Channel (Shannon Capacity).	Ref. Material
28.	2	7	Wireless & Mobile Networks: 802.11 Wireless; LANs: Architecture, MAC Protocol, Mobility, Personal Area Networks: Bluetooth, and Zigbee.	Kurose: Ch6
29.	2	7	Accessing Internet Using Cellular Networks, Cellular Network Architecture, and Cellular Technologies (3G, 4G, 5G).	Kurose: Ch6
30.	1.5	7	Mobility Management, Mobile IP, Managing Mobility in Cellular Networks, and Advance Topics in Computer Networks.	Kurose: Ch6
31.	1	7	Network Security: Security Services (Message Confidentiality, Message Integrity, Message Authentication, Message Non-Repudiation, Entity Authentication), Confidentiality	Kurose: Ch8, Ref. Material

			(Symmetric & Asymmetric Key Cryptography), and Message Integrity (Message & Message Digest, Fingerprint, and Hash Function).	
32.	1	7	Message Authentication, Digital Signature, Entity Authentication (Passwords, Challenge Response), Key Management; Latest Trends in Computer Networks: Software Defined Networks (SDN), Name Defined Networks (NDN), and Internet of Things (IoT).	Kurose: Ch8, Ref. Material
Final Term Exam				

Student Outcomes (SOs)				
S.#	Description			
1	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements			
2	Identify, formulate, research literature, and solve <i>complex</i> computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines			
3	Design and evaluate solutions for <i>complex</i> computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations			
4	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to <i>complex</i> computing activities, with an understanding of the limitations			
5	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.			
9	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional			
Course Learning Outcomes (CLOs)				
Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	SO
CLO's for Theory				
CLO-1	1	Summarize the fundamental concepts of computer networks.	<i>Understanding</i>	1
CLO-2	1-2,6	Apply the concepts of computer networks to solve its related problems	<i>Applying</i>	2
CLO-3	2-5	Analyze various protocols, algorithms, and their functions in a network.	<i>Analyzing</i>	2
CLO-4	7	Comprehend the fundamentals of wireless and mobile networks along with the security issues.	<i>Understanding</i>	1
CLO's for Lab				
CLO-5	2-4	Basic network design and configurations	<i>Applying</i>	2-4,9
CLO-6	1-7	Implementation of network services and applications	<i>Creating</i>	2-5,9

CLO Assessment Mechanism						
Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5	CLO-6
Quizzes	Quiz 1	Quiz 2	Quiz 3	Quiz 4	-	-
Assignments	Assignment 1	Assignment 2	Assignment 3	Assignment 4	Lab Assignments	-
Mid Term Exam	Mid Term Exam	Mid Term Exam	Mid Term Exam	-	Lab Mid Term	-
Final Term Exam	Final Term Exam				-	-
Project	-				Lab Project/Terminal	