COMSATS UNIVERSITY ISLAMABAD

BS-COMPUTER SCIENCE (COURSE DESCRIPTION FORM)

CSC339 – DATA COMMUNICATIONS AND COMPUTER NETWORKS

Number of Credit Hours:	☑3 credits	❑4 credits	
Number of Lecture Hours per Week:	❑1 hour	☑2 hours	❑3 hours
Number of Lab Hours per Week:	□ none	❑ 2 hours	☑ 3 hours
Number of Tutorial Hours per Week:	☑ none	❑ 1 hour	❑ 2 hours

Catalog Description:

This course provides the basic knowledge of Data Communications and Computer Networks. It includes the following topics-Introduction: Organization of the Internet, Switching Techniques (Packet, Circuit), Physical Components of a Network (Hosts, Routers, Switches, ISPs, Wireless,

LAN Access Points and Firewalls), Layering Principles (Encapsulation, Multiplexing, Roles of Different Layers); Networked Applications: Naming and Address Schemes (DNS, IP Addresses, Uniform Resource Identifiers), Distributed Applications, HTTP as an Application Layer Protocol, Multiplexing with TCP and UDP, Sockets APIs; Reliable Data Delivery: Error Control, Flow Control, Performance Issues (Pipelining), TCP: End to End versus Network Assisted Approach, Fairness, Principles of Congestion Control, Approaches to Congestion; Routing and Forwarding: Routing versus Forwarding, Static Routing, Internet Protocol, Scalability (Hierarchical Addressing); Local Area Networks: Multiple Access Problem, Common Approaches to Multiple Access Problem, Local Area Networks, Ethernet, Switching; Resource Allocation: Need for Resource Allocation, Fixed Allocation, Introduction to Mobility: Wireless and Mobile Networks, 802.11 network; Security: Threats to Networks.

Prerequisites:

None

Text Book:

1. Computer Networking: A Top-Down Approach, Kurose, J.F. &Ross, K.W., 7th Edition, Addison-Wesley.

Reference Books:

1. Computer Networks: A SystemsApproach, Peterson and Davie, 2019.
2. Computer Networks and Internets, Comer, D.E., 6th Edition (2014), Addison-Wesley.
3. Networking: A Beginner's Guide, Hallberg, B., 6th Edition (2013), McGraw Hill.
4. Computer Networks, Tannenbaum, 5th Edition (2010), Wetheral.

Assessment Plan for the Course:

Evaluation Methods	Theory Weight (%)[T]	Lab Weight(%)[L]
Quizzes (4)	15	-

Assignments (4)	10	25
Mid Term Exam	25	25
Terminal Exam	50	50
Total	100	100
Total =T+L	**T=(T/100)*67**	**L=(L/100)*33**

Major Topics Covered in the Course:

Unit	Topic	No of teaching hours
1.	Introduction, Organization of the Internet, Switching Techniques (Packet, Circuit), Physical Components of a Network (Hosts, Routers, Switches, ISPs, Wireless, LAN Access Points, and Firewalls).	3
2.	Layering Principles, OSI Reference Model (Encapsulation, Multiplexing, Roles of Different Layers).	1
3.	Networked Applications: Naming and Address Schemes (DNS, IP Addresses, Uniform Resource Identifiers), Distributed Applications, HTTP, FTP Protocols Multiplexing with TCP and UDP, Sockets APIs, SMTP, IMAP, POP3, Peer to peer architecture.	5
4.	Reliable Data Delivery: Error Control, Flow Control, Performance Issues (Pipelining), TCP: End to End versus Network Assisted Approach, Fairness, Principle of reliable data transfer (RTD 1.0, RTD 2.0, RTD 3.0): Stop-and-wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ. TCP Connection Establishment Mechanism, SYN Flooding Attack. Principles of Congestion Control, Approaches to Congestion, TCP, Tahoe, TCP Reno, TCP New Reno, TCP Selective ACK, TCP timers; Retransmission Time-out time (RTO), ACK ambiguity problem, RTTS spread too wide, Karn's Algorithm, Jacobson's Algorithms, TCP Flow-Control Mechanism, Silly-window Syndrome, Nagle's Algorithm, QoS: Congestion Control and Resource Allocation, Issues in Resource Allocation, Effective and Fair resource allocation, Queuing Discipline, FIFO. Active Queue Management, DECbit, Random Early Detection (RED), Quality of Services, Taxonomy of Real-time Applications, Approaches to QoS Support, Integrated Service (RSVP), Differentiated Services.	5
5.	Routing and Forwarding: Routing versus Forwarding, Static Routing, Internet Protocol, Scalability (Hierarchical Addressing). IP v4.0 and IPv6.0 header, ICMPv4.0, ICMPv6.0, Subnetting (VLSM, FLSM), IP Addressing, Network Address Translation (NAT), Datagram Segmentation and Reassembly, Transition strategy for IPv4.0 to IPv6.0. RPF, Multicast Routing Protocols (DVMRP, PIM), Count-to-infinity problem, Bellman Ford Algorithm, Dijkstra's Algorithm, RIP, OSPF,	4
6.	Local Area Networks: Multiple Access Problems, Common Approaches to Multiple Access Problems, Local Area Networks, Ethernet, Switching.	3

7.	Resource Allocation: Need for Resource Allocation, Fixed Allocation. WiFi, Ethernet, Pure ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA, Checksum, CRC, Parity Checking	3
8.	Physical Layer: Analog and Digital Data, Analog and Digital Signals, Periodic and non-periodic Signals, Attenuation, Distortion, Noise, NyQuist Bit Rate, Shannon Capacity, Line coding, Line coding schemes, Block coding, Scrambling, Pulse Code Modulation, Delta Modulation, Parallel Transmission, Serial Transmission.	3
9.	Introduction to Mobility: Wireless and Mobile Networks, 802.11 networks, Threats to Networks.	3
Total Contact Hours		**30**

Course Learning Outcomes:

Upon completion of the course, students will be able to:

C1	Describe the basic network components, services, technologies, and layered network architecture.
C2	Demonstrate the functionality of each layer using networking tools.
C3	Develop simple network applications.
C4	Describe the basic issues in Mobile Networks and Network Security.

Relationship between Course Learning Outcomes and Program Learning Outcomes:

Course Learning Outcomes	**Unit of the syllabus**	**Possible artifacts**	**Level**	**Program Learning Outcomes**
C1	1-2	Quizzes, Assignments, Sessional Exams, Terminal Exam	L	a-1
C2, C3	3 -8	Quizzes, Assignments, Sessional Exams, Terminal Exam, LAB, Project	M , H	i-2, c-2
C4	9-10	Quizzes, Assignments, Terminal Exam	L	e-2

Prepared by:

Reviewed by: