COURSE DESCRIPTION FORM: CS-3001 Computer Networks

FAST School of Computing, National University of Computer and Emerging Sciences, Islamabad

BSCS – Fall-2024

PROGRAM TO BE EVALUATED

Course Description

Course Code	CS-3001
Course Title	Computer Networks
Credit Hours	3+1
Prerequisites by Course(s) and Topics	CS-2001 Data Structures
Grading Policy	Absolute grading
Policy about missed assessment items in the course	Retake of missed assessment items (other than sessional/ final exam) will not be held. For a missed sessional / final exam, an exam retake/ pretake application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee decides the exam retake/ pretake cases.
Course Plagiarism Policy	Plagiarism in project or sessional/ final exam may result in F grade in the course. Plagiarism in an assignment will result in zero marks in the whole assignments category.
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Assessment Items

Assessment Item	Number	Weight (%)
Assignments	4	10
Project (Lab)	1	10
Sessional Exams	2	30 (15 each)
Quizzes	4	10
Final Exam	1	40

Course Instructors	Dr. Ali Zeeshan, Dr. Danish Shehzad, Dr. Fehmida Usmani, Ms. Sana Razzaq
Lab Instructors (if any)	Ms. Hajira Uzair, Ms. Sundus Amir
Course Coordinator	Dr. Danish Shehzad
URL (if any)	
Current Catalog Description	Basic computer and communication networking technologies, concepts of layering, routing, congestion control, and medium access control. The course primarily aims to acquaint the student with basic computer and communication networking technologies and the layered approach that makes design, implementation and

	operation of computer and communication networks possible. The course explores in detail the concepts of layering, routing, congestion control, and medium access control. In keeping with the nature of the textbook, the course follows a top-down approach, commencing with networking applications to motivate the study of networking protocols, architectures and principles.
Textbook (or **Laboratory Manual** for Laboratory Courses)	James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson.
Reference Material	1. Behrouz A. Forouzan, "Data Communications and Networking" 5th Edition 2. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks" 5th Edition, Pearson. 3. William Stallings, "Data and Computer Communications" 8th Edition, Pearson.
Course Learning Outcomes	**A. Course Learning Outcomes (CLOs)** After completion of the course, the students shall be able to: 1. Define Internet, Network Edge/Core, Delay, Loss, and Throughput 2. Identify protocol layers, their service models, and different network security issues 3. Define network applications and Application Layer protocols, and identify application layer protocols e.g., HTTP, SMTP, POP3, IMAP, DNS, FTP, and DHCP 4. Implement Client Server communication using socket programming 5. Identify Transport Layer services, differentiate between reliable and unreliable services, and define flow control and congestion control 6. Classify, analyze, and design IPv4 addressing schemes, and differentiate between routing and forwarding on Network Layer 7. Identify and design: subnetting, CIDR. Design, calculate, and apply subnet masks and addresses to fulfill networking requirements 8. Describe VPN, NAT, ICMP 9. Identify Link Layer services, and define link layer addresses 10. Describe ARP, Ethernet, and differentiate between Link Layer Switch and Router

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Software Engineering Knowledge	To apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of Complex Software Engineering problems.	✔
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computational problems, reaching substantiated	✔

	conclusions using first principles of mathematics, natural sciences, computing, and software Engineering.	
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods.	✔
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern Computer-Aided software Engineering (CASE) tools, including prediction and modelling for complex computing problems.	✔
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of professional computing problems.	
7. Environment and Sustainability	Understand the impact of professional software solutions in societal and environmental contexts and demonstrate knowledge of, and need for, sustainable development.	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of Software Engineering practice.	
9. Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
10. Communication	Communicate effectively on complex Software Engineering processes and activities with the software Engineering community and with society at large.	✔
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcome

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔		✔							✔		
	2	✔		✔	✔	✔					✔		
	3	✔		✔	✔	✔					✔		
	4	✔	✔	✔	✔	✔				✔	✔		
	5	✔									✔		
	6	✔	✔	✔	✔	✔				✔	✔		
	7	✔	✔	✔	✔	✔				✔	✔		
	8	✔		✔	✔						✔		
	9	✔	✔	✔	✔						✔		
	10	✔	✔	✔	✔						✔		

Topics covered in the course with number of lectures on each topic (assume 15 weeks of instruction and 1.5 hour lecture duration)

Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO(s)
Internet and Protocols, Network Edge	**1**	**3**	**1**
Network Core, Delays and Service Models, Networks under attack	**1**	**3**	**2**
Application Layer Principals and Protocols ● Application Layer Principles ● Web & HTTP ● Web Caches & FTP ● Email & DNS ● Peer-to-Peer File Distribution	**3**	**9**	**3,4**

	Transport Layer Services ● Introduction to Transport Layer Services ● UDP ● Reliable Data Transfer protocol ● Pipelined Protocols, Go Back N, Selective Repeat ● TCP Segment Structure ● TCP RTT Estimation and Timeout ● TCP Flow Control ● TCP Connection Management ● Congestion Control ● Evolution of Transport-Layer Functionality	**4**	**12**	**5**
	Network Layer Protocols and Service Principles ● Network Layer Principles ● Internet Protocol Datagram ● IP Addressing ● IP Subnetting ● CIDR ● NAT, DHCP ● Generalized Forwarding and SDN ● Middleboxes ● Routing Algorithms ● Link State Routing ● Distance Vector Routing ● Count to Infinity, Hierarchical Routing ● RIP, OSPF ● BGP ● The SDN Control Plane (5.5) ● ICMP (5.6)	**5**	**15**	**6,7,8**
	Link Layer and LANs ● Introduction to the Link Layer ● Error-Detection and –Correction Techniques ● Multiple Access Links and Protocols ● Switched LANs (up o 6.4.3) ● Retrospective: A day in the life of a Web page request (6.7)	**1**	**3**	**9,10**
	Total	**15**	**45**	

Laboratory Projects/ Experiments Done in the Course	Lab outline is separately provided			
Class Time Spent (in percentage)	**Theory (%)**	**Problem Analysis (%)**	**Solution Design (%)**	**Social and Ethical Issues (%)**
	50	25	20	5

Oral and Written Communications	Every student is required to submit at least __4___ written reports of typically _5____ pages and to make __1___ oral presentation of typically ____10___ minutes' duration.

Lab/ Practical Component of the course

Weeks	Contents/Topics	Assessment Items (Case Study/ Exercise Assignment/ Quiz etc.)
Week-01	Course Introduction	
Week-02	Network Programming Overview + Transport Layer and Basic Socket Programming	Activity 1
Week-03	TCP Client/Server Architecture, UDP Sockets	Activity 2
Week-04	Introduction to Packet Tracer	Activity 3, Assignment 1
Week-05	Basic Topologies in Packet Tracer, Connection between devices, Introduction to routers	Activity 4
Week-06	Static routing Implementation, Introduction to Subnetting.	Activity 5
Week-07	Dynamic routing protocols, RIP, EIGRP, OSPF, VLSM.	Activity 6
Week-08	Configuring DHCP in Static and Dynamic routing Protocols	Assignment 2
Week-09	MIDS	
Week-10	Introduction to switches	Activity 7
Week-11	Configuring VLANS on different scenarios	Activity 8, Assignment 3
Week-12	Communications between VLAN	Activity 9
Week-13	InterVLANs	Project
Week-14	Introduction to IPV6	
Week-15	IPV6 Advanced	Activity 10

Practical/ Programming Work/ Tools: Packet Tracer, C++