

Department of Computer Science and Engineering

National Institute of Technology Jamshedpur

B. Tech. 2020-21
FIFTH SEMESTER
Course Handout

August 12, 2020

Course No. : CS1502
Course Title : Computer Networks
Course Instructor : Dr. Vinay Kumar (Email: vkumar.cse@nitjsr.ac.in)

- 1. Objective and Scope of the Course:** *This first course on Computer Networks aims at providing a sound conceptual foundation with emphasis on the design aspects while adopting combination of the systems and top-down approaches. The course attempts to provide a balanced treatment of the fundamental concepts as well the relevant state-of-the-art in the area. At the end of this course, students should be able to analyze, design and build simple networks and internetworks apart from acquiring due conceptual understanding of the popular TCP/IP Network Architecture.*
- 2. Learning Outcomes:** After completing this course the student must demonstrate the knowledge and ability to:
 1. Independently understand basic computer network technology.
 2. Understand and explain Data Communications System and its components.
 3. Identify the different types of network topologies and protocols.
 4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
 5. Identify the different types of network devices and their functions within a network
 6. Understand and building the skills of subnetting and routing mechanisms.
 7. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

3. Course Material:

Text Books:

1. *Larry L. Peterson & Bruce S. Davie: Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann / Elsevier, New Delhi, 2012, reprint 2016. <To be used as per need.>*
2. *James F. Kurose & Keith W. Ross: Computer Networking: A Top-Down Approach, 7th Edition, Pearson Education Inc. Boston, 2016. <To be used as per need.>*

Reference Books:

1. *Mohamed G. Gouda: Elements of Network Protocol Design, John Wiley & Sons, Singapore, 2004.*
2. *Andrew S. Tanenbaum & David J. Wetherall: Computer Networks, 5th Edition, Pearson, New Delhi, 2014.*

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3. Douglas E. Comer: Hands-on Networking, Pearson, New Delhi, 2015.
4. Jorg Liebeherr & Magda El Zarki: Mastering Networks: An Internet Lab Manual, Pearson, New Delhi, 2004.

3. Course Plan:

Lecture Nos.	Topic(s) to be discussed	Sections of the Text-Book-1	Sections of the Text-Book-2
1-3	<i>What is a Computer Network? Need for a computer network. What is the Internet? How shall the course be conducted? History of Networks and that of the Internet</i>	1.1	1.7
	<i>Application-driven approach of designing computer networks, From Edge to the Core of the Networks and Internetworks: Focus: Edge</i>	1.1, 1.2	1.1, 1.2, 1.3
	<i>From Edge to the Core of the Networks and Internetworks: Focus: Core</i>	1.3	1.2, 1.3
	<i>Network services, Network Protocols, Network Architectures: Concept and examples, Architecture of the Internet revisited</i>	1.3	1.1, 1.2, 1.3
	<i>Introduction to Network Architecture, Protocols, Services, Protocol-Layering, Service Access Points, Service Models</i>	1.3	1.5
	<i>Performance Aspects: Delay, Loss, Throughput, Bandwidth, Delay-Bandwidth Product etc.</i>	1.5	1.4 1.6, 1.8
4-6	<i>Top-Down versus Bottom-Up Approaches to Computer Networking: A brief comparison of respective merits and demerits, Network Applications: First Principles, Architectural perspectives, Service Requirements, Dependencies including type of basic transport support required at the lower levels / layers</i>	9.1	2.1: 2.1.1, 2.1.2, 2.1.3
	<i>An Introduction to common Transport Services: TCP, UDP</i>	5.1, 5.2	2.1.4
7-9	<i>An Overview of Application-Layer Protocols and corresponding application classes, The WWW and the Protocol that enables it: HTTP</i>	9.1, 9.2	2.1.5, 2.1.6, 2.2.1
	<i>More on HTTP, Persistence, Messaging, Formats, Cookies, Web-Caching etc., HTTP over SSL/TLS: A brief overview</i>	9.1	2.2.2-2.2.6
10-11	<i>Designing, verifying and Implementing a New Network Protocol</i>	NA	NA
12-14	<i>An Overview of the Ubiquitous E-mail and supporting Application Layer Protocols: SMTP, IMAP, POP</i>	9.1	2.4
15-17	<i>Naming in the Internet, Finding Internet Addresses corresponding to the Node Names and Vice-Versa: The DNS, Initial discussion on Stateful IP Address Assignment via</i>	9.3	2.5, 4.4

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	<i>DHCP</i>		
	<i>Client-Server and Peer-to-Peer Application Paradigms: A brief overview, Peer-to-Peer Application Types, Select example cases</i>	9.4	2.6
18.	<i>Introduction to Preliminary Network Programming via Socket API route</i>	1.4	2.7, 2.8
19-22	<i>Understanding the Transport Layer: Need for Transport Services, Types of Transport</i>	5.1,5.2, 5.3	3.1, 3.2, 3.3
	<i>Services: Connection-Oriented versus Connectionless, Requirements from the Adjacent Layers (Application and Network Layers) and their Impact on the Transport Layer Design, Service Access Points, Multiplexing, Demultiplexing, More about the Connectionless Unreliable Transport Mechanism-based Protocol: UDP</i>		
	<i>The Reliable Transport Mechanisms: First Principles, Requirements, Protocol Design, A few Simple Reliable Transport Protocols</i>	5.2	3.4
	<i>A Connection-Oriented Reliable Transport Mechanism-based Protocol: TCP</i>	5.2	3.5
23-25	<i>More on TCP and its internal mechanisms (including flow-control, error control)</i>	5.2	3.5
	<i>Congestion Control versus Congestion Avoidance: An Overview, Basics of Congestion Control, Congestion Control in TCP</i>	6.1, 6.3, 6.4	3.6, 3.7
26	<i>Understanding UDP, Comparing alternatives</i>	5.1	3.7
27-29	<i>Understanding the Network Layer: Need for Network Services, Types of Network Services, Service Models, Requirements from the Adjacent Layers (Transport and Link Layers) and their Impact on the Network Layer Design, Service Access Points, Packet Forwarding / Routing / Switching</i>	3.1, 3.2	4.1,
	<i>Connectionless Datagram Networks, Connection-Oriented Virtual Circuit Networks, Principles, Applications, Examples</i>	3.2	4.2
30-32.	<i>Principles of Working of a Simple Datagram Network Router, Router Architectures, Ports, Switching Techniques and Mechanisms, Switching Fabric, Queue Management, Packet Scheduling</i>	3.3	4.3
	<i>Routing Protocols and Routed Protocols: The Basic Differences, Packet Forwarding and Addressing in Internetworks: IP (versions 4 and 6), Formats, Addressing Schemes, Stateless versus Stateful IP Address Allocation, ICMP, IGMP</i>	3.3, 3.4	4.4
	<i>Roles of Other Protocols at Various Levels: DHCP, and more, Brief overview of ARP, RARP and BOOTP</i>	3.3	4.4
33-35	<i>Routing: Needs, Desires and Ways, Types of Routing: Unicast & Multicast Routing, Unicast Routing Principles, Simple Routing Algorithms</i>	3.3, 3.4	4.5

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	<i>The Distance Routing Algorithm and its basic variants (RIP included)</i>	3.3, 3.4	4.5.2, 4.6.2
	<i>The Link-State Routing Algorithm and its basic variants (OSPF included)</i>	3.3, 3.4	4.5.1, 4.6.1
	<i>Hierarchical Routing Techniques and Algorithms</i>	4.1	4.5.3
	<i>Routing within and Intranet versus Routing in the Internet: Basic Differences, Routing in the Internet: Requirements, Constraints and Techniques, Concept of the Autonomous Systems</i>	4.1,	4.6
	<i>A Common Inter-AS Routing Protocol: BGP</i>	4.1,	4.6.3
	<i>A Brief Overview of Broadcast and Multicast Routing</i>	4.2	4.7
	<i>MPLS, Mobile Device based Routing</i>	4.3, 4.4	NA
36-39	<i>Providing Foundation at the Bottom of the Network: The Link Layer and Physical Layer, Need for Link and Physical Layer Services, Types of Link Layer Services, Requirements from the Adjacent Layers (Network and Physical Layers) and their Impact on the Link Layer Design, Frame Forwarding / Switching, Error Detection / Correction basics</i>	2.1, 2.2, 2.3, 2.4, 2.5	5.1, 5.2
	<i>Multiple Access Techniques to Access Media and Select Protocols: CSMA, CSMA/CD and more, Addressing Formats and Techniques, A Popular Wireline LAN Protocol: Ethernet / IEEE 802.3,</i>	2.6	5.3, 5.4, 5.5, 5.9
	<i>Ethernet Bridges and Switches, Point-to-Point Link Layer Communication Protocol: PPP, Link Virtualization, MPLS, Virtual LANs (VLANs)</i>	2.6	5.6, 5.7, 5.8
40	<i>An Overview of Select Wireless and Mobile Networking Technologies: Principles, WLANs: IEEE 802.11, WPANs: IEEE 802.15 family, Cellular Networks, Issues in Seamless Mobility,</i>	2.7	6.1, 6.2, 6.3, 6.7, 6.8

4. Evaluation Scheme

S No.	Component	Duration	Weight age
1	Mid-Semester Test	2 Hours	30%
2	Team Project and Assignments	As per the Project	20%
4	End Semester Exam	3 Hours	50%

5. Team Project: A complete project is to be done by a team of students using the best practices of software engineering. Evaluation will be done continuously, on the basis of the quality of work products delivered according to the project plan and schedule, as well as process compliance.

6. Team Project Grading: Grades assigned to individual students are determined using periodic presentations, design and other documents, teamwork, quality of the prototype and the product, and technological innovation.

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7. Make-up Policy: No makeup will be given for Team Project and Assignments. However, for Mid-Semester Test, makeup may be granted only on genuine grounds, if prior permission is sought from the HoD (CSE).

Course Instructor

CS502