



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/AGSR Division

SECOND SEMESTER 2020-2021

Course Handout (Part II)

Date: 18 Jan 2021

In addition to Part-I (General handout for all courses appended to the timetable) this portion gives further specific details regarding the course:

COURSE NO. : CS F303
COURSE TITLE : COMPUTER NETWORKS
INSTRUCTOR-In-Charge : VIRENDRA SINGH SHEKHAWAT
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Course page: <http://nalanda-aws.bits-pilani.ac.in> and Microsoft Teams

Scope and Objectives

This course will give you a breakdown of the applications, communications protocols, and network services that make a computer network work. We will closely follow the top down approach to computer networking as given in the textbook, which will enable you to understand the most visible part i.e. the applications, and then seeing, progressively, how each layer is supported by the next layer down. Most of the time our example network will be the Internet. Also, a chapter on wireless and mobile networks will be covered as currently users access the Internet from offices, from homes, while on move, and from public places wirelessly. There will be laboratory sessions to provide practical skills using a network simulator (NS-2), a network protocol analyzer tool (Wireshark) and TCP/IP socket programming.

TEXT BOOK

[T1] James F. Kurose, and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, India, 2017. (Fifth Edition is also fine)

[T2] L. Peterson and B. Davie, Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2012

REFERENCE BOOKS

[R1] Andrew S. Tanenbaum & David J. Wetherall: Computer Networks, 5th Edition, Pearson, New Delhi, 2014.

[R2] Douglas E. Comer: Hands-on Networking, Pearson, New Delhi, 2015.

[R3] W. R. Stevens, UNIX Network Programming, Vol I, Networking APIs: Sockets and XTI, Pearson Education, 3rd Edition.



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Module No.	Topics	Learning Objectives
M1	Internet Architecture and Computer Network Primitives: Overview of computer network building blocks, Internet architecture, protocol layers	<ul style="list-style-type: none"> ✓ To know about elements of computer network design ✓ To understand the Internet Design Philosophy and layered architecture
M2	Network Applications (Application Layer): Principles of network applications (e.g., HTTP, FTP, e-mail, P2P, DNS etc.), Creating network applications using socket programming	<ul style="list-style-type: none"> ✓ To understand working of various network applications ✓ To learn network application creation process using socket programming.
M3	End to End Data Transfer (Transport Layer): Data transport services: Connectionless (UDP), Connection oriented (TCP), Reliable data transfer protocol design, Congestion control and resource allocation principles, TCP congestion control and performance measurement	<ul style="list-style-type: none"> ✓ To understand end-to-end data transfer mechanism used in the Internet. ✓ To understand congestion control and resource allocation principles used in the Internet on end-to-end basis
M4	Data Routing and Forwarding (Network Layer): IP addressing (IPv4 and IPv6) for host and network devices, Network segmentation using subnets, IP Routing algorithms and protocols to move datagrams in the Internet (One to one, One to all, One to many)	<ul style="list-style-type: none"> ✓ To understand how to assign addresses to the communicating nodes in the IP network ✓ To understand IP addressing mechanism to segregate a network into multiple subnetworks for scalability ✓ To understand data routing and forwarding mechanisms used in the Internet
M5	Access Networks & LANs (Link Layer): Hop by Hop data transmission using link layer frames, Multiple access links and protocols: Point-to-Point and Broadcast link (LANs), Node addressing in switched LANs (Ethernet), Link Virtualization (MPLS)	<ul style="list-style-type: none"> ✓ To understand how data moves from one hop to another hop between two end points. ✓ To learn about local area network design and performance issues ✓ To understand different channel access protocols
M6	Wireless and Mobile Networks: Wireless links and network characteristics, Wi-Fi (802.11) networks, Node mobility management in wireless networks (Mobile IP)	<ul style="list-style-type: none"> ✓ To understand the challenges faced by IP network due to mobile communicating nodes ✓ To understand wireless network access in IP networks.





PLAN OF STUDY

Lect. No.	Topics	References
M1: Internet Architecture and Computer Network Primitives		
1-3	Internet Architecture, Network Hardware: The Network Edge, The Network Core, ISPs and Internet Backbones, Delay, Loss and Throughput in Packet Switched Networks, Protocol Layers and their Service Models (TCP/IP)	T1: 1.1 – 1.5
M2: Network Applications (Application Layer)		
4-5	Principles of Network Applications, Hypertext Transfer Protocol (HTTP): Persistent vs. Non-persistent connections, Cookies, Web Caching, File Transfer Protocol: FTP	T1: 2.1 – 2.3
6-7	Mail Transfer Protocols (SMTP, POP3, IMAP), HTTP 1.0 and HTTP 2.0, The Internet Directory: Domain Name Systems (DNS), DNS services,	T1: 2.4 – 2.5
8-9	Peer to Peer (P2P) File distribution: BitTorrent, Distributed Hash Tables (DHTs)	T1: 2.6
M3: End to End Data Transfer (Transport Layer)		
10-12	Transport layer services: Connection oriented vs. Connectionless, Multiplexing, Demultiplexing, UDP, Principles of Reliable Data Transfer (Go-Back-N, and Selective Repeat).	T1: 3.1 – 3.4
13-14	Introduction to Socket Programming; TCP, UDP, Creating simple Client Server Applications	T1: 2.7
15-18	Connection oriented transport using TCP: TCP connection management, RTT Estimation and Retransmission Timeout, TCP Flow Control. TCP Error Control and Congestion control algorithms (Slow start, Congestion avoidance, Fast Recovery, Fast Retransmit), TCP Fairness	T1: 3.5 – 3.7
M4: Data Routing and Forwarding (Network Layer)		
19-21	Virtual Circuits Networks vs. Datagram Networks, Inside a Router, Forwarding and Addressing in the Internet (IP). IPv4 Addressing, Internet Control Management Protocol (ICMP), IPv6 Addressing	T1: 4.1 – 4.4
22-24	Routing Algorithms: Shortest Path Routing, Flooding, Link State, Distance Vector, and Hierarchical Routing	T1: 4.5
25-27	Routing in the Internet: Intra-domain routing (RIP, OSPF), Inter-domain routing (BGP): BGP policy and attributes, Multicast routing algorithms: Source based multicast tree vs. group based multicast tree, IP Multicast routing (DVMRP, IGMP)	T1: 4.6 – 4.7
M5: Access Networks & LANs (Link Layer)		
28-29	Services, Error Detection and Correction Techniques (Parity Checks, Checksums, CRC).	T1: 5.1 – 5.2
30-31	Multiple Access Protocol: TDM, FDM, Slotted ALOHA, Pure ALOHA, CSMA,	T1: 5.3





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	CSMA/CD	
32-34	Local Area Networks, Link Layer addressing: MAC addresses, Address Resolution Protocol (ARP), Domain Host Control Protocol (DHCP), Ethernet, Link Layer switches, Virtual Local Area Networks (VLANs)	T1: 5.4
35	Link Virtualization: Multi-Protocol Label Switching (MPLS)	T1: 5.5
36-37	The theoretical basis for data communication (Bandwidth Limited Signals, Maximum Data Rate of a Channel), Guided physical media. Line coding Schemes: NRZ, RZ, Manchester, Differential Manchester.	R1: 2.1, Class Notes
M6: Wireless and Mobile Networks		
38-40	Wireless Links and Network Characteristics, Wi-Fi: 802.11 Wireless LAN Architecture and Protocol, Cellular Internet access: Architecture and Standards.	T1: 6.2 – 6.4
41	Mobility management: addressing and routing, Mobile IP	T1: 6.5 – 6.6

EVALUATION SCHEME

S. No.	Component	Duration	Weightage	Date and Time	Nature of component
1.	Quiz (2 nos)	TBA	20%	TBA	Online
2.	Mid Semester Test	1.5 hrs	30%	TBA	Online
3.	Lab Test	TBA	15%	TBA	Online
4.	Comprehensive Exam	2 hrs	35%	08-05-2021	Online

Notices: All course notices will be displayed on the **NALANDA LMS/Microsoft Teams**

Make-up Policy: Only in genuine cases, on a case-by-case basis, make-ups shall be allowed. Prior permission from I/C is must.

Chamber Consultation Hour: Monday, Wednesday @ 5:00 PM – 6:00 PM

Instructor-In-Charge
CS F303



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