Birla Institute of Technology & Science, Pilani (Rajasthan) India

Instruction Division

Department of Computer Science & Information Systems

Second Semester: 2015-2016

Course Handout: Part-II

Date: 01/01/2016

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 F 303 / IS F 303
Course Title: Computer Networks
Instructor-in-Charge: RAHUL BANERJEE
Co-Instructor: Shyamapada Mukerjee

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. **Course Material:** *<Being a senior-level undergraduate course, no single book shall be exact fit the bill. However, Text Books listed as well as companion materials supplied are good enough for self-study.>*

A> Text Books:

1. *James F. Kurose & Keith W. Ross*: Computer Networking: A Top-Down Approach, 6th Edition, Pearson Education Inc. Boston, 2013.
2. *Larry L. Peterson & Bruce S. Davie*: Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann / Elsevier, New Delhi, 2012. *<To be used as per need.>*

B> 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.*
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.*

C> Additional support material:

- *Course page on BITS Pilani's Open edX-based Any-Learn MOOC Environment is: http://any-learn.bits-pilani.ac.in. This platform shall be used for weekly self-assessment quizzes to be taken by you online for getting a feel of how well you are able to understand the topics discussed in lecture sessions. This platform would also host all Lab-Sheets and Lecture Material.*

- *Notices, Marks, Indicative Solutions to Papers and Grades shall be uploaded at BITS Pilani's LMS: http://nalanda.bits-pilani.ac.in.*

3. Course Plan: *< Lecture Days: M/W/F, Lecture Timing: (1200-1250) Hrs., Venue: 5101> <Lab. Sessions: As per Time Table, No. of Lab. Sections: 05 >*

Lecture No.	Topic(s) to be discussed	Sections of the Text-Book-1
1.	*What is a Computer Network? Need for a computer network. What is the Internet? How shall the course be conducted?*	*1.1*
2.	*Application-driven approach of designing computer networks, From Edge to the Core of the Networks and Internetworks: Focus: Edge*	*1.1, 1.2, 1.3*
	From Edge to the Core of the Networks and Internetworks: Focus: Core	*1.2, 1.3*
3.	*Network services, Network Protocols, Network Architectures: Concept and examples, Architecture of the Internet revisited*	*1.1, 1.2, 1.3*
	Introduction to Network Architecture, Protocols, Services, Protocol-Layering, Service Access Points, Service Models	*1.5*
4.	*Performance Aspects: Delay, Loss, Throughput, Bandwidth, Delay-Bandwidth Product etc.*	*1.4 1.6*
Self Study	*History of Networks and that of the Internet*	*1.7*
***Any-Learn MOOC Module-1**: Concept Summarization, part-1*		*1.8*
5.	*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*	*2.1: 2.1.1, 2.1.2, 2.1.3*
6.	*An Introduction to common Transport Services: TCP, UDP* (Details to be covered in L 12-18)	*2.1.4*
	An Overview of Application-Layer Protocols and corresponding application classes, The WWW and the Protocol that enables it: HTTP (HTTP 2 shall be taught from the RFC since text book does not cover it.)	*2.1.5, 2.1.6, 2.2.1*
7.	*More on HTTP, Persistence, Messaging, Formats, Cookies, Web-Caching etc., HTTP over SSL/TLS: A brief overview*	*2.2.2-2.2.6*
8.	*Transferring Large Files reliably: The FTP*	*2.3*
9.	*Designing a New Network Protocol*	
Self-Study	*An Overview of the Ubiquitous E-mail and supporting Application Layer Protocols: SMTP, IMAP, POP and more*	*2.4*
10.	*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 DHCP*	*2.5, 4.4*
Self-study:	*Client-Server and Peer-to-Peer Application Paradigms: A brief overview, Peer-to-Peer Application Types, Select example cases*	*2.6*
11.	*Introduction to Preliminary Network Programming via Socket API route*	*2.7, 2.8*
***Any-Learn MOOC Module-2:** Concept Summarization and discussions,* part-2		

Lecture No.	Topic(s) to be discussed	Sections of the Text-Book-1
12.	*Understanding the Transport Layer: Need for Transport Services, Types of Transport 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*	*3.1, 3.2, 3.3*
13.	*The Reliable Transport Mechanisms: First Principles, Requirements, Protocol Design, A few Simple Reliable Transport Protocols*	*3.4*
14.	*A Connection-Oriented Reliable Transport Mechanism-based Protocol: TCP*	*3.5*
15.	*More on TCP and its internal mechanisms (including flow-control, error control)*	*3.5*
16.	*Congestion Control versus Congestion Avoidance: An Overview, Basics of Congestion Control, Congestion Control in TCP*	*3.6, 3.7*
17-18	*Understanding UDP, Comparing alternatives*	*3.7*
	Any-Learn MOOC Module-3: *Concept Summarization and discussions,* part-3	
19.	*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*	*4.1,*
20.	*Connectionless Datagram Networks, Connection-Oriented Virtual Circuit Networks, Principles, Applications, Examples*	*4.2*
21-23.	*Principles of Working of a Simple Datagram Network Router, Router Architectures, Ports, Switching Techniques and Mechanisms, Switching Fabric, Queue Management, Packet Scheduling*	*4.3*
24-28.	*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*	*4.4*
29.	*Roles of Other Protocols at Various Levels: DHCP, and more, Brief overview of ARP, RARP and BOOTP*	*4.4*
30.	*Routing: Needs, Desires and Ways, Types of Routing: Unicast & Multicast Routing, Unicast Routing Principles, Simple Routing Algorithms*	*4.5*
31.	*The Distance Routing Algorithm and its basic variants (RIP included)*	*4.5.2, 4.6.2*
32.	*The Link-State Routing Algorithm and its basic variants (OSPF included)*	*4.5.1, 4.6.1*
Self-study	*Hierarchical Routing Techniques and Algorithms*	*4.5.3*
Self-Study	*Routing within and Intranet versus Routing in the Internet: Basic Differences, Routing in the Internet: Requirements, Constraints and Techniques, Concept of the Autonomous Systems*	*4.6*
33.	*Designing a New Network Layer Protocol*	*-NA-*
34.	*A Common Inter-AS Routing Protocol: BGP*	*4.6.3*
35.	*A Brief Overview of Broadcast and Multicast Routing*	*4.7*

Lecture No.	Topic(s) to be discussed	Sections of the Text-Book-1
36	*Introduction to Virtual Private Networks (IP VPNs)*	
	Any-Learn MOOC Module-4: *Concept Summarization and discussions,* part-4	
37.	*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*	*5.1, 5.2*
38	*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,*	*5.3, 5.4, 5.5, 5.9*
39.	*Ethernet Bridges and Switches, Point-to-Point Link Layer Communication Protocol: PPP, Link Virtualization, MPLS, Virtual LANs (VLANs)*	*5.6, 5.7, 5.8*
Self-study	*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,*	*Extracts from 6: 6.1, 6.2, 6.3, 6.7, 6.8*
40.	*Summary of major concepts learnt, Reading Advisory for the Aspects of Networking not explicitly covered through lectures / experiments*	
	Any-Learn MOOC Module-5: *Concept summarization, part-5*	

4. Evaluation Scheme: *<All evaluation components are MANDATORY. Any failure to participate in one or more evaluation component may lead to an 'NC' report.>*

Evaluation Component	Type	Duration & Other Details	Weight	Date
EC-1: Mid-Semester Test	*Open Book: 15%* *Closed Book: 15%*	*Two Hrs.*	*30%*	17/3 2:00 -3:30 PM
EC-2: Laboratory Experiments	*Laboratory-based (Handouts shall be provided at the laboratory and uploaded at the Any-Learn page of the course.)*	*Two Hours Hrs. per week*	*20%*	*To be started with effect from January 16,, 2015 (All laboratory experiments shall be evaluated on spot and may later lead to an additional Lab-Test, if time permits.)*
EC-3: End-Semester Lab-Test	*Design / Laboratory-based*	*Not Applicable*	*10%*	*To be announced latest by February third week via Any-Learn and in the Classroom. (In case of the Group Project option, if enabled, each project idea must be discussed with the Instructor after first week of classwork and there must be at least one monthly*

				interaction per project until submission.)
EC-4: Comprehensive Exam.	*Open Book: 15%* *Closed Book: 25%*	*Three Hours*	*40%*	11/5 FN

5. Honor Code: *Each student shall have to agree to the* ***Honor Code*** *at the Any-Learn portal, prior to use.*

6. Anti-Plagiarism Policy: *In the context of any test, quiz, assignment, project, report or laboratory work etc. no form of plagiarism shall be tolerated.* ***In the event of discovery of any form of plagiarism, the student shall be awarded ZERO marks against the relevant evaluation component and in case of repeated instance of such an occurrence, the case may be reported to the appropriate committee of the Institute for appropriate action.***

7. Pull-up Policy: *There would be a self-assessment quiz via the Any-Learn portal each week. This has NO direct weightage in the evaluation scheme. However, it is strongly recommended that students take all these quizzes for helping themselves know the quality and extent of their own learning. These quiz-results shall be closely monitored by the Instructor-in-Charge since they would give him an idea of any mid-course correction or fine-tuning of the course delivery for improving learning experience of the students.* ***In case of border-line cases who may miss a higher grade by ONE mark, the quiz-data (what percentage of these quizzes were taken by a given student) shall be used for deciding a possible pull up to the next higher grade.***

8. Notices: All notices shall be electronically displayed only on the Departmental Notice Board and Course Home Page at the ***Any-Learn MOOC*** portal only.

9. Make-up Policy: Only in genuine cases, on a case-by-case basis, Make-ups shall be allowed.

10. Chamber Consultation Hours: Tuesday: 4:00 PM to 5:00 PM.

Instructor-in-Charge