



**FIRST SEMESTER 2022-2023**

Course Handout Part II

Date: 19-08-2022

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 G525*

*Course Title : Advanced Computer Networks*

*Instructor-in-Charge :Dr.Pragati Shrivastava (pragati.shrivastava@hyderabad.bits-pilani.ac.in)*

**Course Description :** Topics in advanced networking – Quality of Service in IP networks, IPv6, Wireless and Mobile Networks, Carrier Technologies (Frame Relay, FDDI, ISDN, ATM), Peer-to-Peer Networks and Overlays, Routing and QoS Issues in Optical Networks.

**Scope of the Course:**

This course is an advanced computer networking course focusing on the relevant and state-of-the-art networking protocols and architectures. The focus is on the protocols used in modern networked systems including wireless and mobile networks. The goals of the course are to build on basic networking course material in providing a deep understanding of existing technology with concrete experience of the challenges through a series of lab exercises. The course is divided into four parts where the first two parts aim to provide deep understanding of protocols, architectures and segment structures at different layers of the protocol stack specifically transport and network and link layers. The third part will focus on the application layer and services/applications. The final part is designed to provide a comprehensive understanding and evolution of wireless networks.

**Objectives of the Course:**

- To understand the state-of-the-art networking protocols at different layers of the protocol stack.
- To develop a strong understanding of the core concepts of computer networks.
- To gain experience in research-oriented activities where the lab is designed for students to gain practice of reading research papers, designing experiments, performing analysis, and presentation of results.
- To gain hands-on experience with the networking protocols.

**Textbooks:**

[T1] James F. Kurose and Ross, Computer networking: a top-down approach featuring the Internet, 7th Ed., Pearson, 2017.

**Reference Books:**

[R1] L. L. Peterson B.S. Davie, “Computer Networks: A Systems Approach”, 5th Ed., Morgan Kaufmann, Elsevier, 2012.

[R2] A S Tanenbaum, Computer Networks, 5th Ed, Pearson, 2013.

[R3] W. Richard Stevens, “TCP/IP Illustrated Volume 1, The protocol”, 2nd Ed. Addison-Wesley, 2011.

**Course Plan:**

S. No.	No. of Lectures	Learning objectives	Topics to be covered	Chapter in the TextBook
1	1	To understand the course components and structure.	A basic introduction to the course, explanation of exams and evaluations, overview.	Class Notes
<b>PART A: TRANSPORT LAYER</b>				
2	1	To understand the basics of User Datagram Protocol (UDP)	UDP protocol, UDP segment structure, UDP checksum.	T1: Chapter 3, Class Notes
3	1	To learn reliable data transfer protocols	Go-Back-N and Selective Repeat protocols	T1: Chapter 3, Class Notes
4	6	To understand the basics of TCP and TCP variants	TCP connection, TCP segment structure, round trip time, understanding congestion, congestion control algorithms, TCP variants, Fairness	T1: Chapter 3, Class Notes, Congestion Avoidance and Control [Jacobson 1988], Analysis of Increase and Decrease Algorithms for Congestion Avoidance in Computer Networks [Raj Jain 1989]
5	3	To learn modern transport layer protocols	QUIC, Multipath TCP (MPTCP) and Multipath QUIC (MPQUIC), Data Center TCP, DCTCP	Class Notes, Data Center TCP (DCTCP), [ACM Sigcomm 2010]
<b>PART B: NETWORK LAYER</b>				
6	3	To introduce network layer and network service models	Network service model, routers, queueing.	T1: Chapter 4, Class Notes
7	5	To understand the Internet Protocol (IP)	IP datagram, IPv4 addressing, NAT, IPv6, Quality of service (QoS) in IP networks.	T1: Chapter 4, Class Notes
8	5	To understand routing Algorithms and routing protocols.	Link-State (LS), Distance-Vector (DV), Hierarchical routing, RIP, OSPF, BGP, Broadcast routing algorithms, multicast routing algorithms, other advanced routing algorithms.	T1: Chapter 5, Class Notes, Traffic Engineering with Traditional IP Routing Protocols [Bernard 2002], Making Intra-Domain Routing Robust to Changing and Uncertain Traffic Demands: Understanding Fundamental Tradeoffs [David 2003]
<b>PART C: APPLICATION LAYER</b>				
9	3	To gain an understanding of applications, QoS	Multimedia applications, Peer-to-peer applications, QoS	Class Notes
10	4	To know about the service specific networks and their characteristics. Performance and implementation-related challenges and their solutions.	DNS and Naming System, DNS and CDN, HTTP and CDN, Coral CDN DNS Caching and Performance.	Class Notes, Democratizing content publication with Coral [Freedman 2004], DNS Performance and the Effectiveness of Caching [Jung

				2002]
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11	4	Introduction to sockets , socket Programming, client/server architecture	UDP/TCP sockets, Deadlocks, Half-open Connections	T1:Chapter 2, Class Notes
<b>PART D: SOFTWARE-DEFINED NETWORKING</b>				
12	6	- To understand about SDN, OpenFlow and the way it changes the communication networks.	Software-Defined Networking (SDN) Data plane, Control plane and control platforms, SDN use cases.	T1:Chapter 4, Chapter 5, The Road to SDN: An Intellectual History of Programmable Networks [ACM Sigcomm CCR 2014] ONOS: towards an open, distributed SDN OS [ACM HOTSDN 2014]

#### Evaluation Scheme:

EC No.	Evaluation Component	Duration (Mins)	Weightage (%)	Date & Time	Nature of Component
1.	Mid Semester	90	30	02/11 1.30 - 3.00PM	Close Book
2.	Research paper presentation	Take Home	10	TBA	Open Book
3.	Lab/Term project	Take Home	30	TBA	Open Book
4.	Comprehensive Examination	180	30	23/12 FN	Open Book

Note: minimum 40% of the evaluation to be completed by midsem grading.

**Make-Up:** May be given on prior permission and to only genuine cases.

**Chamber Consultation Hour:** To be announced in the class

**Notice:** Notices concerning this course will be displayed on the Google Classroom only.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**  
**CS G525**