

SEMESTER-IV

COURSE 9: COMPUTER NETWORKS

Theory

Credits: 3

3 hrs/week

Course Objectives

1. **Introduce foundational concepts** and architecture of computer networks, including OSI and TCP/IP models.
2. **Explain the functionalities of network layers**, from physical to application, highlighting their roles in communication systems.
3. **Explore data transmission technologies**, including guided and wireless media, and assess their real-world applications.
4. **Develop understanding of core protocols**, error handling mechanisms, and routing algorithms used in modern networks.
5. **Demonstrate how network services operate**, focusing on protocols like TCP, UDP, HTTP, DNS, and their relevance in global connectivity.

Course Outcomes

These define what students should be able to do after successful completion, At the End of the Course, The Students will be able to:

1. **Describe network models** (OSI, TCP/IP) and differentiate between network hardware and software components.
2. **Analyze data transmission techniques** and select appropriate media for specific networking scenarios.
3. **Apply error control and flow protocols** (e.g., sliding window, ALOHA) to optimize link-layer communication.
4. **Evaluate routing strategies and congestion control algorithms** within network environments, including Internet-based systems.
5. **Implement basic application-layer protocols** and illustrate how services like email, web browsing, and streaming are supported on networks.

Unit 1. Introduction to Computer Networks:

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

Unit 2. Data link layer:

Design issues, framing, Error detection and correction. Elementary data link protocols, Sliding Window protocols.

Medium Access sub layer: The channel allocation problem.

Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols.

Wireless LANs, Data link layer switching.

Unit 3. Network Layer:

Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

Unit 4. Transport Layer:

Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

Unit 5. Application Layer:

Domain name system, SNMP, Electronic Mail, SMTP, World Wide Web, HTTP and HTTPS.

Textbooks:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

Reference Books:

1. An Introduction to Computer Networks- Peter Lars Dordal,; Loyola University Chicago (2022); eBook (Creative Commons Licensed)
2. The TCP/IP Guide: A comprehensive, Illustrated Internet Protocols reference, Charles M. Kozierok

Activities:

Outcome: Describe Network Models (OSI, TCP/IP) and Differentiate Hardware vs. Software Components

Activity: Create a **layered diagram** of OSI and TCP/IP models using colored cards or digital tools. Label each layer with its function and examples of hardware (e.g., router, switch) and software (e.g., protocols, applications).

Evaluation Method: Short quiz with:

- Matching layers to functions
- Identifying hardware/software roles
- One scenario-based question (e.g., Which layer handles routing?)

Outcome: Analyze data transmission techniques and select appropriate media for specific networking scenarios.

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COURSE 9: COMPUTER NETWORKS

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Understanding various network tools in Windows and Linux
2. Study different types of Network devices and Cables
3. Building a Local Area Network.
4. Concept of Network IP Address
5. Introduction to Network Simulator – Packet Tracer (PT)
6. Configuration of a Router using Packet Tracer
7. Implementation of a Network using Packet Tracer
8. Implementation of Static Routing using Packet Tracer
9. Implementation of RIP using Packet Tracer
10. Implementation of OSPF using Packet Tracer
11. Implement DNS using packet tracer
12. Implementation of a VLAN using Packet Tracer