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.

Activity: Use a **scenario worksheet** with different environments (e.g., office LAN, rural broadband, mobile network). Students choose appropriate transmission media (e.g., fiber, coaxial, wireless) and justify their choices.

Evaluation Method: Peer-reviewed worksheet with rubric:

- Correct media selection
- Justification clarity
- Understanding of bandwidth, cost, and distance factors

Outcome: Apply error control and flow protocols (e.g., sliding window, ALOHA) to optimize link-layer communication.

Activity: Simulate **sliding window and ALOHA protocols** using tokens or cards to represent frames. Students act as sender/receiver and demonstrate retransmission, acknowledgments, and flow control.

Evaluation Method: Evaluate students on a 10-point scale based on:

- Correct protocol steps
- Handling of errors and retransmissions
- Flow control logic

Plus a brief reflection sheet explaining what they learned

Outcome: Evaluate routing strategies and congestion control algorithms within network environments, including Internet-based systems.

Activity: Use a **network simulation tool** (e.g., Cisco Packet Tracer or NetSim) to compare routing algorithms (e.g., Dijkstra, Distance Vector). Introduce congestion and observe how algorithms respond.

Evaluation Method: Evaluate students on a 10-point scale based on Lab report submitted by students with:

- Routing table snapshots
- Congestion response analysis
- Efficiency comparison

Include a rubric for clarity, accuracy, and insight

Outcome: Implement basic application-layer protocols and illustrate how services like email, web browsing, and streaming are supported on networks.

Activity: Set up a **mini-network** or use simulation to demonstrate:

- Email (SMTP/POP3)
- Web browsing (HTTP/HTTPS)

Evaluation Method: Practical demo + oral explanation on a 10-point scale:

- Protocol identification
- Service flow (client-server interaction)

SEMESTER-IV

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