Fall 2023

# ECE 422 - COMPUTER COMM NETWORKS

Mohammed Feknous

**Department of Electrical and Computer Engineering**
**ECE 422: Computer Communication Networks**

**ECE 422 - Computer Communications Networks (3-0-3)**

**Instructor:** M. Feknous; email: feknous@njit.edu; Tel: 973-596-6460

**Textbook:** A. Leon-Garcia I. Widjaja, *Communication Networks*, McGraw-Hill, 2nd edition, ISBN-13 978-0-07-246352-1 (main text)

**Course Description:**
Introduction to the fundamental concepts of computer communication networks. Topics include the OSI reference model, the physical, data link, network, and transport layers, TCP/IP, LANs (including token ring, token bus, and ethernet), ALOHA, routing and flow control.

**Prerequisites:** ECE 321 or Math 333 **Corequisite:** none

**Computer Usage in course:**
Various freeware software packages needed in the class projects, in addition to personal computers and microcontrollers. Matlab

**Specific Course Learning Outcomes (CLO):** The student will be able to

1. define and recognize the basic elements of networks, and the different topologies
2. know how to select the cabling format optimum for a specific case
3. know and understand layering, the reasons for that concept, and the utilization of some interfacing devices such as bridges, switches and routers
4. be versed in TCP/IP, the original source for the layering concept
5. recognize the characteristics of larger networks and their inherent requirements
6. distinguish between all the sources of threat to networking, and how to circumvent them when possible
7. discuss the need and formats of wireless communications in networking
8. define and select among the many encoding techniques used to minimize errors in networking
9. evaluate the merits of various routing algorithms
10. Present in front of peers a practical implementation of the knowledge acquired in the course (implementation of servers, programming of routers suitable for a given application, and other topics of networking)

**Relevant Student Outcomes:**

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics (CLOs 2, 4, 7, 8, 9, 10).
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs (CLOs 2, 5, 10).

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately. (CLOs 3, 6, 7, 8, 9, 10)
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty. (CLO 10).

**Topics:**

| Topic | Week |
|---|---|
| **Communication Network and Services**<br>• Evolution of network architecture and services<br>• Key factors in communication network evolution | 1 |
| **Applications and Layered Architectures**<br>• Examples of protocols, services, and layering: HTTP, DNS, SMTP, TCP, UDP<br>• OSI reference model<br>• TCP/IP architecture | 2-3 |
| **Digital Transmission Fundamentals**<br>• Digital communications<br>• Communication channels<br>• Line Coding<br>• Modems and digital modulations<br>• Properties of media and digital transmission systems<br>• Error detection and correction | 3-4 |
| **TCP/IP**<br>• TCP/IP Architecture<br>• The internet protocol<br>• User datagram protocol<br>• Transmission control protocol<br>• Internet routing protocol<br>• Multicast routing<br>• DHCP, NAT, and Mobile IP | 5-7 |
| **Mid-term exam** | 7 |
| **Medium Access Control Protocols and Local Area Networks**<br>• ALOHA<br>• Scheduling approaches to MAC<br>• Channelization<br>• Delay Performance of MAC and Channelization Schemes<br>• LAN Protocols<br>• Wireless LANs and IEEE 802.11 Standard<br>• LAN bridges and Ethernet switches | 8-9 |
| **Packet-Switching Networks**<br>• Packet network topology<br>• Datagrams and virtual circuits<br>• Routing in packet networks | 10-11 |

| | |
|---|---|
| • Shortest-path routing<br>• ATM Networks<br>• Firewalls | |
| **Peer-to-Peer Protocols and Data Link Layer**<br>• ARQ protocols<br>• Sliding-window flow control<br>• Framing<br>• Point-to-point protocol<br>• HDLC Data link control | 12 |
| **Group project presentation, Review** | 13-14 |
| **Final exam** | 15 |

**Grading**: Class participation, Homework, Pop quizzes 10%; project including demonstration 20%; Mid-term 35%; Final exam 35%.

**Updates and Assignments** to be distributed via email

**Honor Code**: The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

**Office:** ECEC 311
**Office hours:** T 1:00 PM – 1:45 PM
T 3:00 PM – 3:45 PM
R 12:00 PM – 12:45 PM
Other times can be arranged through appointments;
Set up appointment for any office hour (regular or extraordinary) meeting through email stating the suitable meeting day and time

**Prepared by:** M. Feknous