

## EEE 459 Communication Networks (3) [S]

### Course (Catalog) Description:

Fundamentals of communication networks. Study of Five-Layer Internet model. Focus on functionality and performance of protocols used in communication networks.  
Lecture. Technical Elective.

**Prerequisite:** EEE 203

**Prerequisite or Co-requisite:** EEE 350.

**Textbook:** James F. Kurose and Keith W. Ross, *Computer Networking, A Top-Down Approach*, 5<sup>th</sup> Edition 2010, Addison-Wesley ISBN: 0-13-607967-9.

### Supplemental Materials:

- Behrouz A. Forouzan, *Data Communications and Networking*, 5<sup>th</sup> Edition, McGraw-Hill, 2013.
- Andrew S. Tanenbaum, *Computer Networks*, 5<sup>th</sup> Edition, Prentice Hall, 2010.
- Dimitri Bertsekas and Robert Gallager, *Data Networks*, 2<sup>nd</sup> Edition, Prentice Hall, 1992.

**Coordinator:** Martin Reisslein, Professor

### Prerequisites by Topic:

1. Basic knowledge of electrical circuits and systems. Elementary probability and random variables

### Course Objective:

1. Students will be able to identify and relate the fundamental components of a communication network

### Course Outcomes:

1. Students are conversant with the requirements and the protocols employed in the fundamental components in a communication network.
2. Students can analyze the impact of functional parameters in protocol design.

### Course Topics:

1. Overview of Computer Networks and the Internet.
  - ISPs and Internet Backbones
  - Delay and Loss in Packet Switched Networks
  - Protocol Layers and Their Service Models
  - Networks under Attack
  - Internet History
2. Application Layer Protocols
  - Basic Principles
  - The Web and HTTP
  - FTP
  - SMTP
  - DNS
  - Overview of Socket Programming
  - Content Distribution and Peer-to-Peer Networking
3. Overview of Transport Layer Services
  - Multiplexing and Demultiplexing
  - Connectionless Transport: UDP
  - Principles of Reliable Data Transfer

- Connection-Oriented Transport: TCP
- Principles of Congestion Control
- TCP Congestion Control
- 4. Overview of Network Layer and Routing
  - Routing Principles
  - Hierarchical Routing
  - IP
  - Routing in the Internet
  - Router Architecture
- 5. Overview of Link Layer
  - Overview of Error Detection and Correction
  - MAC
  - LAN Addresses, ARP
  - Ethernet
  - Hubs, Switches
- 6. Wireless and Mobile Networks
  - Wireless Links and Network Characteristics
  - WiFi: 802.11 Wireless LANs

**Computer Usage:** Students review and practice key course concepts through web-based applets, e.g., the applets provided as supplementary materials with the course texts. Students also engage with online tools to explore Internet behaviors, e.g., with online traceroute interfaces for investigating delays in the Internet.

**Laboratory Experiments:** None.

**Course Contribution to Engineering Science and Design:**

This course teaches engineering science and design by providing students with a basic understanding of the building blocks and mechanisms that make the Internet work. Students gain the opportunity to design small components of the networking protocol stack, such as a reliable packet transfer protocol and evaluate its performance through mathematical analysis. This course affords students also the opportunity to practice the modeling of networking mechanisms. For example, students need to make sensible approximations and simplifications to obtain performance results for otherwise mathematically intractable networking configurations and protocols. Students have also the opportunity to design local area networks, for instance the layout of a campus network. This design problem involves choosing the appropriate networking technology subject to user requirements and cost constraints.

**Course Relationship to Program Outcomes:**

**a,e:** Engineering and math background and problem solving abilities. Students can define a networking problem with appropriate consideration of context and constraints, and can recognize appropriate solutions. Students can develop models appropriate to a given networking problem using assumptions, estimates, and approximations guided by good engineering judgement.

**c:** Analysis of properties of communication systems

**k:** Our graduates are capable of using contemporary methods and tools for the design and evaluation of communication networks.

People preparing this description and date of preparation: Martin Reisslein, February 2015.