CSC 315A  Principles of Data Communications  4 cr.

Catalog description:
This course examines the basics of data communications. Modulation techniques, multiplexing, transmission media, error control techniques, message formatting, and packet-switching techniques are discussed. Various communication protocols, switching techniques, private branch exchange, networking and internetworking are covered. Three lecture hours and three hours of scheduled laboratory per week, plus programming work outside of class.

Prerequisite: CSC 260 with grade of C+ or higher.

Goals:
The purposes of this course are to:
CG01: provide an introduction to the basic requirements of and the techniques used in data communications networks;
CG02: develop students’ understanding of the basic principles of the technology and architecture of data and computer communications.

Objectives:
Upon successful completion of this course the student will have:

CO01: mastered terminology and basic concepts of general characteristics of LAN and WAN systems
CO02: established a unified and fundamental view of the broad field of data communications networks
CO03: gained hands-on experience in setting up a peer-to-peer and a client-server network models
CO04: chosen a topic in an up-to-date area of data communications, read and synopsized three journal/magazine articles relating to the topic, and given a formal presentation of a completed term paper

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Topics:
- Data transmission
  - transmission media
  - history of data communications
  - frequency
  - spectrum
  - bandwidth
  - signal strength
  - analog and digital data transmission
  - transmission impairments
  - signal-to-noise ratio
  - twisted pair
  - coaxial cable
  - optical fiber
  - satellites
  - microwave
  - infrared
  - low earth orbit satellites
  - low earth orbit satellite arrays
  - Local asynchronous communications (RS232)
    - The Need For Asynchronous Communication
    - Standards For Communication
    - Baud Rate, Framing, And Errors
    - Full Duplex Asynchronous Communication
    - Limitations Of Real Hardware

NC1(1), NC2(2), NC2(1)
• Hardware Bandwidth And The Transmission Of Bits
  • The Effect Of Noise On Communication
• Long-Distance Communication (Carrier, Modulation, And Modems) NC2(2.5)
  • Sending Signals Across Long Distances
  • Modem Hardware Used For Modulation And Demodulation
  • Leased Analog Data Circuits
  • Optical, Radio Frequency, And Dialup Modems
  • Carrier Frequencies And Multiplexing
  • Baseband And Broadband Technologies
  • Wave Division Multiplexing
  • Spread Spectrum
  • Time Division Multiplexing
• Packet Transmission NC2(1)
• Packets, Frames, And Error Detection NC2(6.5)
  • The Concept Of Packets
  • Packets And Time-Division Multiplexing
  • Packets And Hardware Frames
  • Byte Stuffing
  • Transmission Errors
  • Parity Bits And Parity Checking
  • Probability, Mathematics, And Error Detection
  • Detecting Errors With Checksums
  • Detecting Errors With Cyclic Redundancy Checks
  • Combining Building Blocks
  • Burst Errors
  • Frame Format And Error Detection Mechanisms
• LAN Technologies And Network Topology NC2(6)
  • Direct Point-to-Point Communication
  • Shared Communication Channels
  • Significance Of LANs And Locality Of Reference
  • LAN Topologies
  • Example Bus Network: Ethernet
  • Carrier Sense On Multi-Access Networks (CSMA)
  • Collision Detection And Backoff With CSMA/CD
• Hardware Addressing And Frame Type Identification NC2(2)
  • Specifying A Recipient
  • How LAN Hardware Uses Addresses To Filter Packets
  • Format Of A Physical Address
  • Broadcasting
  • Multicasting
  • Multicast Addressing
  • Identifying Packet Contents
  • Frame Headers And Frame Format
• LAN Wiring, Physical Topology, And Interface Hardware
  • Speeds Of LANs And Computers
  • Network Interface Hardware
  • The Connection Between A NIC And A Network
  • Original Thick Ethernet Wiring
  • Connection Multiplexing
• Extending LANs: Fiber Modems, Repeaters, Bridges, and Switches NC2(1)
• Long-Distance Digital Connection Technologies: repeater/bridge/router/gateway NC2(0.5)
• WAN Technologies And Routing NC2(0.5)
• Connection-Oriented Networking And ATM
• Network Characteristics: Ownership, Service Paradigm, And Performance NC6(1)
• Protocols And Layering NC2(1)
• Internetworking NC1(1), NC2(6)
• Internetworking: Concepts, Architecture, and Protocols
• IP: Internet Protocol Addresses
• Binding Protocol Addresses (ARP)
• IP Encapsulation, Fragmentation, And Reassembly
• The Future IP (IPv6)
• An Error Reporting Mechanism (ICMP)
• TCP: Reliable Transport Service
• Internet Routing

• Network Applications NC3(2), NC4(5)
  • Client-Server Interaction
  • The Socket Interface
  • Example Of A Client And A Server
  • Naming With The Domain Name System
  • Electronic Mail Representation And Transfer
  • File Transfer And Remote File Access
  • World Wide Web Pages And Browsing
  • Dynamic Web Document Technologies (CGI, ASP, JSP, PHP, ColdFusion)
  • Technology For Active Web Documents (Java, JavaScript)
  • RPC and Middleware
  • Network Security

The course grade will be determined using the following approximate weights: 30% final examination, 25% midterm examination, 15% written homework, 20% labs and programming assignments, 10% term paper and oral presentation

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<th>Homework Assignments</th>
<th>Programming Projects</th>
<th>Lab Exercises</th>
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Bibliography:

Tanenbaum, Andrew S. Computer Networks third ed, Prentice-Hall, 1996