Polytechnic University of Puerto Rico
Department of Electrical & Computer Engineering and Computer Science (ECECS)
Master in Electrical Engineering

Course Syllabus

Note : This is a major revision, the original syllabus appears at the end.

Course Title: Data Communication Networks

Course Code : EE 6130

Credits **:** Three (3) Credits

Duration : One academic quarter

Pre-requisites:

Course Description:
The course covers the fundamentals of data communication networks, including architecture, principles of operations, and performance analyses. It provides a rationale from the engineering standpoint that justifies the way networks are currently structured, and facilitate understanding the issues and tradeoffs faced by designers of future networks. Strong emphasis is provided to understanding algorithms used in networking and their performance impact. An engineering mathematics background including probability is assumed. Some of the topics included are: multilayered network architecture, data link layer protocols, high-speed packet switching, queuing theory, LANs, and WANs issues.

Justification:
Computer Networks are an essential infrastructure component of any modern society. The course emphasizes the theory behind data networks. The students will learn about mathematical models used in data communication networks, that will enable them to develop their own models and to implement these networks in hardware and software.

Textbook:
Lecture Notes

Objectives:
- Provide insight into the rationale of why networks are structured the way they are today and to understand the issues facing the designers of next-generation data networks.
- Be able to create realistic models of computer networks with good predictive power.

- Learn to analyze networks using both discrete event simulations and closed form models.
- Be able to understand research literature on computer networks.
- Motivate students to pursue the research of contemporary problems in computer networks

Topics Covered:

1. Data Networks
2. The Data Link Layer: Framing and Error Detection
3. The Data Link Layer: ARQ Protocols
4. Introduction to Queueing Theory
5. Burke's Theorem and Networks of Queues
6. M/G/1 Queues
7. Reservations Systems M/G/1 Queues with Priority
8. Packet Multiple Access: The Aloha Protocol
9. Local Area Networks
10. Fast Packet Switching
11. Broadcast Routing
12. Routing in Data Networks
13. Optimal Routing
14. Flow and Congestion Control
15. Higher Layer Protocols: TCP/IP and ATM

Evaluation Criteria:
Final grade will be determined based on the following scale:

100 – 90 A
89 – 80 B
79 – 79 C
69 – 60 D
59 – 0 F

Course History:
April, 2004; prepared by Kay Berkling, PhD, Armin Zundel, PhD

Bibliography:
Computer Networks: A Systems Approach, 3rd Edition
by Larry Peterson, Bruce Davie
Morgan Kaufmann; 3 edition (May 2003) ISBN 155860832X

Computer Network (1996)
by Andrew S. Tanenbaum
Prentice Hall, ISBN 0133499456

TCP/IP Illustrated, Vol I (1995)
By W. Richard Stevens.

Addison Wesley, ISBN 0-201-63346-9

The Internet Book:Everything You Need to Know about Computer Networking and how the Internet Works 3rd Edition (2000)
Douglas E. Comer
Prentice Hall, ISBN: 0130308528

Previous Version:

Course Title : Data Communication and Computer Networks

Code : EE 6130

Credits : Three (3) Credits

Duration : Forty-five credit-hours per course

Prerequisites : None

Description

Recent advances and new applications in the expanding field of computer networks and distributed systems are examined. The technical fundamentals, architecture, and design of computer networks and distributed systems are described. Strategies, tools, and techniques for network planning, implementation, management, maintenance, and security are delineated. Topics include ISDN, ATM, the OSI Model, transmission media, network operating systems, topologies, configuration protocols, and performance characteristics. Trends in standardization, internetworking, downsizing, and the development of local-networks (LANs), wide-area networks (WANs), metropolitan-area networks (MANs), and enterprise-wide networks are explored.

Justification

With the reduction of hardware costs and increasing sophistication of control software, the inevitable trend toward distribution of heterogeneous processors will accelerate. Systems analysts and their management need to be aware of the data communications technology and its related regulatory environment.

Objectives

1. Understand the concepts and terminology of data communications.

2. Understand equipment, protocols, architectures and transmission alternatives.

3. Understand the communications environment, regulatory issues and network pricing and management.

Course Outline

1. Introduction to Computer Networking

2. Transmission Media
3. Local Asynchronous Communication (RS-232)
4. Long-Distance Communication (Carriers and Modems)
5. Packets, Frames, and Error Detection
6. LAN technologies and Network Topology
7. Hardware Addressing and Frame Type Identification
8. LAN Wiring, Physical Topology, and Interface Hardware
9. Extending LANs: Fiber Modems, Repeaters, Bridges, and Switches
10. WAN Technologies and Routing
11. Network Ownership, Service Paradigm, and Performance
12. Protocols and Layering
13. Internetworking: Concepts, Architecture, and Protocols
14. IP: Internet Protocol Addresses
15. Binding Protocol Addresses (ARP)
16. IP Datagrams and Datagram Forwarding
17. IP Encapsulation, Fragmentation, and Reassembly
18. The Future IP (Ipv6)
19. An Error Reporting Mechanism (ICMP)
20. TCP: Reliable Transport Service
21. Client-Server Interaction
22. The Socket Interface
23. Domain Name System
24. Electronic Mail Representation and Transfer

25. File Transfer and Remote File Access

26. WWW Pages and Browsing

27. CGI Technology for Dynamic Web Documents

28. Java Technology for Active Web Documents

29. Network Management (SNMP)

30. Network Security

Required Textbook

Computer Networks and Internet 2ND BK&CDR (1998)
By Comer, D., Droms, Ralph E
Prentice Hall, Incorporated
ISBN: 0130836176

Grading Criteria

Final course grade in the course will be determined based on the following scale:

100-90	A
89-80	B
79-70	C
69-60	D
59- 0	F

Revision History

May, 2002; Alexander López
May, 2002; Alfredo Cruz, PhD

Bibliography

Computer Communications and Networking Technologies (2001)
M. Gallo Hancock/Thomson Learning
ISBN: 0534377807

Computer Networking: A Top-Down Approach Featuring the Internet Package (2000)
Kurose, James F/Keith W. Ross

Addison Wesley Longman, Inc.
ISBN: 0201477114

Computer Networks (2000)
Research & Education Association
ISBN: 0878910840

The Internet Book: Everything You Need to Know about Computer Networking and how the Internet Works 3rd Edition (2000)
Douglas E. Comer
Prentice Hall
ISBN: 0130308528

Business Data Communications 7th edition *(1997)*
By Stalling, William
Macmillan Publishing Company

Applied Data Communications: A Business-Oriented Approach (1997)
By James E. Goldman
John Wiley & Sons
ISBN 0471170674

Computer Networking Concepts (1996)
Ramos, Emilio / Shroeder, Al and Beheler
Prentice Hall

Business Data Communications and Networking (1996)
By Jerry Fitzgerald, Alan Dennis
5th Edition
John Wiley & Sons

Data Communication (1996)
By D. C. Green
Addison Wesley
ISBN 0582245206

Computer Network (1996)
By Andrew S. Tanenbaum
Prentice Hall
ISBN 0133499456