CpE 138 Computer Networks and Internets **Required Course**

2000 -2002 Catalog Description: An overview of the fundamentals of computer networks and connections between networks, from the physical layer up through peer-to-peer communications at the application level. Lower layer characteristics including serial vs. parallel, capacity issues, high-speed connections, LAN framing and error handling. LAN vs. WAN characteristics, network architecture and the ISO network model. Internetworking components including LANs repeaters, routers, bridges, and gateways. Internet addresses, TCP/IP, and the Domain Name System. Common Internet client/server application protocols including SMTP and FTP. Client/Server programming involving sockets. World Wide Web characteristics including CGI and HTTP protocol, Web pages, Web browsers, Web servers, and Applets. Introduction to advanced Web issues such as Web security, search engine operations, and Web database operations. Prerequisite: CSc 35, 60, 130, 3 units.

Prerequisites: Knowledge of assembly language, data structures, and algorithms.

Text: Computer Networks and Internets, Third Edition, Douglas Comer, Prentice Hall, 2001;
Additional Support Material Perl How To Program, Deitel, Deitel, Nieto, McPhie, Prentice Hall, 2001; CCNA: Cisco Certified Network Associate, Second Edition, Lammle, Todd, Sybex, 2000

Course Objectives:
1. Introduce electrical engineering, computer engineering, and computer science students to fundamental network architecture concepts and to their application in the network of networks
2. Provide a solid foundation of networking that can lead to study of advanced topics and detailed network architectures

Topics Covered:

1. Programming design tools such as logic flow-charting, high level pseudo code or machine state diagrams.
2. Specifications, design, implementation, testing and debugging a large complex program.
3. Advanced data structures used in file descriptor tables and complex network structures.
4. High level programming language techniques to manipulate bits and bytes.
5. Application programming interface (API).
6. Asynchronous and synchronous timings.
7. UNIX command line interface.
8. UNIX X-windows interactive development environment (IDE).
9. Error detection.
10. Big-endian and little-endian order of bytes and words.
11. Hardware interrupt programming.

Class Schedule:

1. Introduction to information communications. (3 hours)
2. Encoding, Modulation, Transmission Media. (3 hours)
3. Long-Distance Digital Technologies and Multiplexing. (5 hours)
4. Transmission impairments, error detection and correction. Introduction to layered network architectures (ISO, IEEE 802, TCP/IP) finite state machine. (6 hours)
5. Asynchronous and synchronous communications. RS-232 and related standards. Modems. (2.75 hours)
6. Data Link Protocols: ARP, DNS, UDP, TCP and ATM. (6 hours)
7. Local Area Networks: Ethernet, Token Ring, and *WAN* Networks. (6 hours)
8. Fiber Optic and Satellite technologies. PBX. (3 hours)
9. Introduction to higher layer protocols: SMTP, RIP, OSPF, BGP-4 and IPV6. (6 hours)
10. World Wide Web protocols (HTTP) and document technologies. Network security and privacy in electronic communications. (3 hours)
11. Exams (1.25 hours)

Laboratory Schedule:
1. Research RFC for Computing the Internet Checksum (IP, UDP, TCP). (.5 week)
2. Network diagnostic tool “ping”. (.5 week)
3. Network diagnostic tool “traceroute”. (.5 week)
4. Configure two Cisco network routers. (1 week)

5. Perform analysis of 3 compression utilities. (.5 week)
6. Configure four Cisco network routers. (1 week)
7. Write research paper on a topic from a list of suitable topics. (1 week)
8. Design code to send a message between two workstations using a RS-232 LAN or RS-232 Token Ring. (6 weeks)
9. Use the HP 4972A protocol analyzer to determine packet header information. (.5 week)
10. Write a Perl TCP client program to send information to a server and receive a confirmation message. (.5 week)
11. Write a 3 tier client/server application prototype for an on-line voting system. (1 week)
12. Create a HTML form with one input text and the CGI program to process the data. (.5 week)
13. Create a Guest book Web application with form entry. (1 week)
14. Write a UDP Java client program that sends a username and password to a server for authentication. (.5 week)

Contribution of Course to Meeting the Professional Component:

1. ABET category content as estimated by faculty member who prepared this course description:
   Engineering science: 3 units or 100 %, Engineering design: 0 units or 0 %
2. This course covers the basics of network architecture, protocols, and terminology.

Course Outcomes:

CpE 138 CO_1 Students will understand terminology common to 'networks and internet'
CpE 138 CO_2 Students will design software to exercise data transfers on various networks; socket protocols
CpE 138 CO_3 Students will acquire hands-on laboratory skills in observing data transfers
CpE 138 CO_4 Students will understand the design of hardware network equipment
CpE 138 CO_5 Students will write a technical, grammatically term paper

Relationship of Course to Program Outcomes: ABET designations, "a" through "k"

a. ability to apply knowledge of mathematics, science, and engineering – **CpE 138 CO_1, CO_2, CO_4, CO_5 The bulk of the material in this course is mathematical (transfer rates, probability of collision avoidance, noise, etc) and is related to engineering limitations (maximum rate of data flow, noise generation).**
b. an ability to design and conduct experiments, as well as to analyze and interpret data – **CpE 138 CO_3 The lab related exercises require students to observe and understand various types of data transfers.**
c. an ability to design a system, a component, or process to meet desired needs – **Not applicable.**
d. an ability to function on multi-disciplinary teams **– CpE 138 CO_2, CO_3 Students work on teams on the LAN project assignment. This course is cross-listed with CSc 138 and the teams have both computer engineering and computer science majors.**
e. an ability to identify, formulate, and solve engineering problems – **CpE 138 CO_2, CO_4 Two of the lab project assignments are extensive and open ended (such as interrupt handlers) engineering problems.**
f. an understanding of professional and ethical responsibility **- Not applicable.**
g. an ability to communicate effectively – **CpE 138 CO_5 The research term paper is read, graded and marked for grammar and spelling errors. Students have a list of topics to choose from.**
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context – **CpE 138 CO_1 Much of the informational material on networks and internet is concerned with issues of today; secrecy, security, identification, etc.).**
i. a recognition of the need for, and an ability to engage in life long learning – **CpE 138 CO_1 A basic thread of the course is that networking and internets is a process that is constantly being improved and modified; students are instructed on the value of keeping current in this area.**
j. a knowledge of contemporary issues - **CpE 138 CO_1 Instructors include lecture material on issues such as data security, safety, monitoring.**
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice **–CpE 138 CO_ 2 CO_3 This course uses the most recent tools, equipment, and devices from industry (students use protocol analyzers and modern switchers and routers; student use industry software design tools, etc).**

Course Coordinator and Preparer of this Course Description: Professor Dick Smith, December 2, 2002