

**CS 5651: COMPUTER NETWORKS (4)****Catalog Description:**

Introduction to computer networking, network programming, networking hardware and associated network protocols. Layered network architecture, network services, and implementation of computer networking software.

**Textbook:** J. Kurose and K. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, 4<sup>th</sup> Ed., Morgan Kaufmann, 2007.

**Course Goals:**

The goals of this course are: (1) to provide students with a solid understanding of computer network hardware and software; and (2) to provide students with a practical and theoretical knowledge of network architecture and network performance analysis.

**Prerequisites by Course & Topic**

CS 2511: Software Analysis and Design – data abstraction, algorithm analysis, group implementation

CS 2521: Computer Organization and Architecture – computer organization and introduction to computer architecture, hardware performance analysis and measurements.

**Major Topics Covered in the Course**

- Layering of Internet architecture
- Requirements for building computer networks
- Application layer, security in networks
- Unix socket programming
- Network performance characteristics and analysis
- Packet switching
- The Transport Layer - End-to-end protocols, reliable transmission
- Congestion avoidance and resource allocation
- The Network Layer - Internetworking
- The Data Link Layer
- Wireless Networks
- Wireless Security

**Class/Laboratory Schedule:** Lecture: 3 hours per week, Laboratory: 1

**Course Outcomes**

Students who finish this course satisfactorily will be able to:

1. Familiarity with networking fundamentals.
  - a. Understand layering and protocol principles.
  - b. Understand the distribution of network services among layers.
  - c. Describe Internet architecture.
  - d. Describe general communication performance.
2. Familiarity with Ethernet and wireless networks.
  - a. Describe standard mechanisms of media access control.
  - b. Describe the principles of reliable transmission.
  - c. Plan a local area network with different users, hosts and services.
3. Ability to recognize and evaluate different communication services.
  - a. Establish the differences between data grams and virtual circuits.
  - b. Describe ATM networks and their possible use in the Internet.
4. Ability to comprehend routing mechanisms.
  - a. Describe the elements of addressing and routing.
  - b. Describe hierarchical addressing and its implementation in the Internet.
5. Ability to design and modify end-to-end protocols.

- a. Develop software to establish and tear out a connection.
- b. Handle TCP transmission rules.
- c. Develop code for remote procedure calls.
- 6. Ability to apply network congestion reduction mechanisms.
  - a. Understand the principles of queuing.
  - b. Apply the mechanisms of congestion avoidance to specific scenarios.
- 7. Familiarity with end-to-end data standards.
  - a. Write scripts using XML markup language.
  - b. Write code to handle multimedia data in original and compressed formats.
- 8. Ability to apply network security mechanisms.
  - a. Analyze and design cryptographic algorithms.
  - b. Plan for the use of firewalls.

**Relationship to Program Outcomes**

Prerequisites to CS 5651 include systems analysis and design and computer organization and architecture. This course contributes to meeting the following program outcomes:

2. *Students can design, develop, and analyze significant software systems.*

Software and its implementation play an important role in a systems approach to understanding computer networks. Students gain depth in the field of software analysis, design and testing, while programming communication protocols and modifying existing code. All course outcomes map to this program outcome.

3. *Students understand the fundamentals of computer organization and architecture, data structures and related algorithms, and programming languages*

Students gain experience in data structures and algorithms while studying communication protocols. Also, students apply computer organization concepts while studying an application-specific computer: the router, and network interface cards. All course outcomes map to this program outcome.

4. *Students can apply computer science principles and practices to a variety of problems.*

Students have the opportunity to apply graph theory, queuing, probabilities and combinational theory to several networking problems such as addressing, routing and congestion control. All course outcomes map to this program outcome.

**Assessment Plan for Course:**

This course is assessed every third year by the instructor and a course assessment document covering all of the course outcomes and their effect on the program outcomes is prepared.

**Estimate CSAB Category Content**

	CORE	ADVANCED		CORE	ADVANCED
Data Structures			Computer Organization and Architecture		2
Algorithms			Concept of Programming Languages		
Software Design		2			

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