ECE456 **Computer Networks** **Spring 2024**

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Objectives: Introduce communication networking principles, architectures and technologies that make the current complex global information infrastructure possible.   This infrastructure consists of diverse devices, systems and users interconnected via diverse networking technologies such as cellular networks (e.g., 4G, 5G, 6G), optical backbones and other wired and wireless networks that seamlessly integrate. Internet is a dynamically evolving system held together by a set of protocols, in contrast to many other complex systems (e.g., microprocessors, automobiles and skyscrapers) that are designed by a close-knit group of designers. Where information resides has become less important compared to ubiquitous and quick availability of information. The quality of service experienced by a user or an application depends on the underlying network hardware (e.g., links, routers), protocols (e.g., TCP/IP) and   characteristics (e.g., network traffic, access times and interference), while the quality of service expected by a user depends on the application and the device. Internet of Things (IoT) and of Everything together with emerging 6G technologies will dramatically change our interaction with the physical and virtual landscapes.   This course will provide the fundamental expertise in networking necessary for understanding and developing modern networked systems and applications.

Outcomes: Upon successfully finishing this course, students will have acquired a comprehensive knowledge of various communication technologies that are employed in the global information infrastructure. They will have a firm grasp of how the Internet functions and its ability to adapt to disruptions and technological changes while expanding in terms of size, speed, and complexity. Students will be able to design and implement networking protocols and Internet-based distributed applications using network programming concepts.

Prerequisites: ECE251, ECE303, and programming (ex.CS160 or 155, CS156,CS157)

Topics:
1. Circuit Switching, Packet Switching, and Layered Architectures (TCP/IP)
2. Physical Layer – Link Technologies, Modulation, Encoding, Radio Spectrum, MIMO
3. Logical Link Control (LLC) –Framing, Error Detection & Correction, Flow Control
4. Medium Access Control (MAC) - Sonet/SDH, IEEE 802.X Standards
5. Cellular Communication Networks (1G to 6G)
6. Internet Protocol (IP) – Addressing, Service Model, Routing
7. Transport Protocols – TCP/UDP
8. Network Programming - Socket Systems Calls, Client-Server
9. Internet of Things
10. Future Trends in Networking

Texts and Reading Material:
The recommended text for the course is *"Data Communication and Networking," B.* A.Forouzan (McGraw Hill). Sixth edition is preferred but fourth or fifth edition is acceptable. Two other excellent texts are *Computer Networking, Kurose & Ross*, (5th ed. or later) and *Computer Networks, Peterson & Davie* (Morgan Kaufman 6th ed. or later).   Links to a few free books are available off Canvas.

Grading:

Homework & Quizzes	15%
Participation & Minute Papers	15%
Presentation	15%
Exam	20%
Lab Assignments	35%

+/- Grading will be used.

Homework & Quizzes: You are expected to turn in solutions to all the homework and quiz problems. However, only a subset of problems in each assignment will be graded; the subset may vary by assignment and by student. The on-line and in-class quizzes will require familiarity with recent lectures.

Minute paper: A minute paper is a short write-up about each lecture, e.g., what are the most significant things you learned in the lecture? why is it significant? what question is uppermost in your mind at the end of the lecture? Be creative!! A typical minute paper would be ~150 to 250 words. As each minute paper is based on a lecture, *you must not submit one for a lecture that you did not attend*. The minute paper must be submitted prior to the next lecture. Follow the links on Canvas to submit minute papers. Up to 20% of the minute papers may be skipped without a penalty.

Presentation: A presentation is expected covering a pre-approved topic or a project. Grade for the presentation will be based on the technical content, quality of slides, quality of presentation, and the understanding of the topic as conveyed by the presentation.

Exams: Exam will cover a subset of lecture objectives announced in advance. You will be allowed to bring a single 2-sided page of notes to the exam.

Labs: The lab assignments are an important part of this course. You must pass each lab assignment with a score of 60% or better to pass the course. Discussions with colleagues are encouraged on different approaches to solving the assignments and to overcome difficulties. You are expected to use emerging AI based software development tools to develop the programs. However, you should have a thorough understanding of the code you developed and be able to demonstrate it. The lab will run on an open-hour basis. Submit a well commented source code for the program and demonstrate the lab by the due date. The TA will help you with the concepts associated with the labs, but the TA is not responsible for debugging your programs.

Inclusivity: ECE456 classroom is a place where you will be treated with respect. We welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Academic Integrity: This course will adhere to the CSU Academic Integrity Policy in the General Catalog (http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity) and the Student Conduct Code (https://resolutioncenter.colostate.edu/conduct-code/). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

No web browsing, checking email, texting, etc., during the lectures please!!