ECE 545
Modern Internet Technologies

- **Course Description:**
  - This course covers the key technologies that enable the modern Internet with a top-down approach. The main topics include multimedia application and protocols, content distribution networks, edge computing, methodologies for reliable communications, next generation network architecture based on software defined networking, resource virtualization, and key techniques for mobile Internet. This course also deals with the concept of layer based design, strategy for quality of service provisioning, performance analysis based on mathematical modeling, and performance evaluation via practical simulations.
- **Teaching Materials:**
  - ***Main textbook:*** "Computer Networking: A Top-Down Approach Featuring the Internet", James F. Kurose and Keith W. Ross, 7th/8th Edition
  - ***Reference:*** "Data Networks", Dimitri Bertsekas and Robert Gallager (math oriented)
- **Background:**
  - Probability and random variables
- **Office Hour:**
  - Siegel Hall 320, cheng@iit.edu 3:30pm-4:30pm, Teu./Thr., or by appointment
  - Siegel Hall 307B, TA

- Do you need to this course? Check yourself
  - Do you know how Netflix or Youtube enables smooth multimedia streaming?
  - Give you a new non-TCP/IP communication network, can you design a reliable communication protocol over it?
  - Do you know how the modern software-defined networking (SDN) enables a versatile network layer (routing, load balancing, service differentiation, security)?
  - Do you know how WiFi protocol is designed and why it is designed in that way?
- Advanced features
  - Advanced topics covered: CDN, SDN, wireless, multimedia, QoS
  - General principles for design Internet protocols at a certain layer
  - Some mathematical analysis (P2P, caching deployment, TCP, playback)
  - Research-oriented course projects

How and Why

Class Schedule

3 classes:	Internet Structure and Service Models
3 classes:	Traditional Internet Applications (Application Layer)
2 classes:	P2P, CDN, Socket Programming
2 classes:	Generic Reliable Communication Protocol (Transport Layer)
3 classes:	TCP, congestion control and flow control
3 classes:	IP addressing, Router Design, NAT (Network Layer)

Midterm Examination

4 classes:	Software Defined Networking based Control Plane, Routing Algorithms
2 classes:	Medium Access Control, Ethernet (Link Layer)
2 classes:	Virtual LAN, Data Center Networking
2 classes:	Mobile Internet
2 classes:	Multimedia Networking

Final Examination

- **Project 1: Academic Investigation of a Selected Topic**
  - **Objective:** Help you learn the strategies and skills for conducting the academic research and writing a technical paper.
  - **Description:**
    - You need to select a technical topic related to computer networks and carry on some academic study.
    - You need to summarize your investigations into a technical report, in the style as an academic paper.
    - In your report, you need to give a proper literature survey, formulate the problem that you are going to study, summarize and classify the existing solutions to the problem, identify the open issues, and give some investigation to the possible solutions.
    - Some mathematical analysis is expected
    - Editing paragraphs from other papers will receive a low or zero score

- **Project 2: In-depth Investigation of TCP via NS Simulation**
  - **Objective:**
    - Help you learn the network simulator NS, and help you to gain the in-depth understanding of TCP through simulation.
  - **Description:**
    - NS is a widely used discrete event simulator for network analysis. You will study the implementation of the TCP protocol using ns3 simulation.
    - You may need to find and read related literature to learn the implementation details of the TCP protocols.
    - You need to submit one project report, along with your codes for your experiments and the generated data and graphs. We should be able to execute your codes.
    - Your project should be written with good readability, clearly describing the problem, your codes for the simulation, the generated trace files and the associated graphs, and your analysis.

- **Grading Scheme:**
  - Homework (15%)
  - 2 Projects (15%+20%),
  - Mid-Term Exam (25%),
  - Final Exam (25%)
  - Engagement bonus (based on quiz): 5 points

  A student will directly receive an “E” score, if the student
  - does not submit at least 50% of the homework assignments (e.g., at least 3 submissions in 6 assignments)
  - does not do the course project
  - does not take the midterm exam
  - does not take the final exam
  - use a published or submitted paper as course project (“Cheating”)
  - use a similar project report from a previous or other course (“Cheating”)

- **Some general things**
  - Meeting during the office hours, otherwise with appointment
  - Stick to the deadlines. Grading policies will be strictly applied
  - Copy, plagiarism, or cheating will directly result in the “E” grade and will be reported to related university office
  - Arguments for score upgrading with personal reasons (not based on performance), after exam or submission due date, will not be considered

- How to achieve good grades?
  - Regularly attend the classes and take notes
  - Refresh timely after each lecture
  - Details and big picture
  - Independently work on the homework problems
  - Improve capability for numerical analysis
  - Seriously deal with the course projects

Future Networking Research Lab (FunLab)

- Wireless network performance analysis and protocol design
- Machine learning, cloud computing and big data
- Internet and wireless network security
- Next-generation Internet architecture, protocols, and management

- Graduated thesis students joined AT&T, Juniper, InterDigital, Google, Qualcomm, United Technologies Research Center, Shanghai Jiaotong University, Southeastern University

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http://www.ece.iit.edu/~yucheng/