**CS5470: Advanced Computer Networks**

**Time and Location:**

Fri., 9:00am-11:30am, KH B4017

**Instructor:**

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Office hours: Mon. and Weds. 9:30am-11:50am, or by appointment

**Course Description:**

This course introduces cutting-edge research topics in advanced computer networks, including Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT), Future Internet Architecture, Cloud Computing, Mobile and Wireless Networking, Cyber Physical Systems, Optical Networking, Network Survivability, Data Center Networking, Online Social Networking, Network Security and Privacy. The course covers the design principles, the research challenges, the real-world applications and the economic benefits of the above mentioned advanced computer networks. The course explores various simulations and experiments for the performance evaluation of proposed research ideas in those advanced computer networks.

**Pre-requisites:**

Students need to have some basic knowledge of operating systems, computer networks, data structure, algorithms, and object-oriented programming. In addition, students should be *proficient* in Java or C/C++ programming skills.

**Course goals:**

At the end of this course, each student should be able to:

* Recognize and describe various advanced computer networks topics.
* Criticize existing computer network systems and identify their limitations.
* Design and implement new and effective architectures and solutions for future advanced computer networks.
* Assess the performance of a new computer network design through simulations and experiments.
* Prepare for studying advanced topics in network and computer systems, and a career in the field of computer network systems.

**Learning objectives:**

* Identify various advanced computer networks topics and discuss the pros and cons in their design.
* Practice with various network simulation tools, such as Mininet, NS3, OPNET, OMNet++.
* Explain the Wavelength-Division Multiplexing (WDM) and Orthogonal Frequency-Division Multiplexing (OFDM) technologies.
* Describe the Routing, Wavelength Assignment (RWA) problem.
* Explain the wavelength continuity constraint, the transmission reach constraint in optical communications.
* Calculate the spectrum efficiency for different modulation formats.
* Categorize different network failures that affects a computer network system.
* Assess different protection schemes and restoration schemes for network survivability design.
* Develop novel solutions to maximize the service availability of computer network systems.
* Define and describe Software-Defined Networking (SDN) and Network Function Virtualization (NFV).
* Implement various virtual network mapping solutions.
* Describe the design principles of Named Data Networking (NDN) and implement NDN applications on simulators.
* Define 5G networks and identify the research challenges of 5G networks.
* Model and assess the energy consumption for various mobile and wireless communications.
* Analyze and predict user behaviors through crowdsourcing mobile users' data.
* Identify and evaluate various applications of cyber physical systems.
* Develop solutions that maximize the availability of interdependent power and communication networks.
* Formulate electrical vehicle charging system model and develop efficient solutions to solve the model.
* Describe and assess various Internet of Things (IoT) applications.
* Explore new research topics in IoT security and privacy.
* Implement virtual machine placement solutions in cloud computing.
* Identify research challenges in cloud computing security and privacy.
* Practice and assess the design of data center networking architectures and solutions through simulations.
* Collect and measure user's data of various online social networks.
* Analyze and interpret online social network data using big data analytics tools.
* Implement machine learning based tools for network intrusion detection.
* Propose and implement new solutions for addressing DDoS attacks from IoT devices.

**Class schedule:**

* Week 1: Syllabus and overview of advanced computer networks topics
* Week 2: Optical Networking
* Week 3: Network Survivability
* Week 4: Software-Defined Networking (SDN) and Network Function Virtualization (NFV)
* Week 5: Future Internet Architecture - Named Data Networking
* Week 6: Cloud Computing and Data Center Networking
* Week 7: Mobile and Wireless Networking
* Week 8: Midterm Exam
* Week 9: Internet of Things (IoT)
* Week 10: Spring Break
* Week 11: Cyber Physical Systems
* Week 12: Online Social Networking
* Week 13: Network Security and Privacy
* Week 14: Project Presentation
* Week 15: Project Presentation
* Week 16: Final Exam

**Required textbook:**

James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet," 6th edition, Addison Wesley.

**Classroom protocol:**

All the lectures will be recorded and published on CSNS for the purpose of a second view online.

**Dropping/Adding policy:**

* **Feb. 6th, 2017** is the deadline for adding and no record drop.
* **April 26th, 2017** is the withdraw deadline.

**Grading policy:**

* Project proposal: 10%
* Final project code and demo: 10%
* Final project presentation: 10%
* Final project report: 10%
* Midterm: 25%
* Final: 30%
* Attendance: 5%

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| --- | --- |
| A | [90, 100] |
| A- | [85, 90) |
| B+ | [80, 85) |
| B | [75, 80) |
| B- | [70, 75) |
| C+ | [65, 70) |
| C | [60, 65) |
| C- | [55, 60) |
| F | <55 |

(Tentative and may be subject to changes)

**Course policy:**

**Late policy:** All assignments are due on the date and time posted. Assignments may be submitted up to 1 day late, and late submission will be scored out of 90 instead of 100. No homework/report will be accepted more than 1 day after the assigned due date, unless medically impossible (a doctor's note stating that you were medically incapable of doing the homework during the entire period between the due date and your submission date of the homework is needed).

**Exam:**If you miss an exam because of sickness or similar reasons, visit a physician and obtain a note detailing the period during which you were medically incapable of taking the exam. Notify the instructor immediately via e-mail or telephone (voice mail) if you are going to miss an exam, before the exam takes place unless medically impossible. See your instructor as soon as you return to class. If you miss an exam without a valid excuse, you will receive a zero grade for that exam. No make-up exam will be available without a valid excuse.

**Americans with Disabilities Act (ADA)                                                                            \_\_\_\_\_\_**

Reasonable accommodation will be provided to any student who is registered with the Office of Students with Disabilities and requests needed accommodation. For more information visit the [Office for Students with Disabilities](http://www.calstatela.edu/osd)home page.

**Academic honesty:**

**No tolerance on cheating! FAIL the course on the FIRST attempt!**

All work you submit must be your own scholarly and creative efforts.  Any act of using ideas, words, or work of another person or persons as if they were one’s own is considered as cheating. Cheating will not be tolerated. Cheating on any assignment or exam will be taken seriously.  All parties involved will receive a grade of F for the course and be reported to the University Official. Check [Appendix E - Student Conduct / Student Conduct Procedures](http://ecatalog.calstatela.edu/content.php?catoid=12&navoid=843) to see student code of conduct in Cal State LA.

**Student Handbook:**

Information on student rights and responsibilities, academic honesty, standards of conduct, etc., can be found in Schedule of Classes for the current quarter visit the Cal State LA [Schedule of Classes Information](http://web.calstatela.edu/classschedule/) under Policies and Procedures.

**Dropping and adding:**

Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. Students should be aware of the current deadlines and penalties for adding and dropping classes by visiting the [GET home page](https://get.calstatela.edu/Registrar.htm). (Registrar news and information)