

## **ECE581B8 - Network Centric Systems**

**3-credits (2 hrs of lectures and 3 hrs of lab)**

**Spring 2020 (Also offered as an on-line course)**

**Prerequisites: MATH 369 or ECE/STAT 303 or ECE421 or ECE 456,  
and Programming expertise (in any language, e.g., CS165)**

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### **Objectives:**

Networks are central to many natural systems and are at the core of complex man-made systems. What are the features of different network types? How can the networks be represented? How do underlying characteristics influence network-based systems? How do communities arise in social networks? What parameters influence the growth and characteristics of networks? What are the principles of network based system design? How to extract network topology from limited measurements? These are some of the questions we plan to address. This course provides an overview of principles of network centric systems, and introduces techniques for modeling and analysis of large-scale networks as well as processes that evolve on such networks. Case studies ranging from social networks to communications networks will be used to illustrate network modeling, controlling the evolution of network structures, influence propagation and network analytics. Also considered will be policy and societal implications of modern network centric systems.

### **Topics:**

#### Network Science

- Network representation and modeling
- Centrality measures and network decomposition
- Network types (small-world, scale-free, multilayer, etc.)
- Influence spread and diffusion over networks
- Distributed pattern detection
- Tools (e.g., graph databases, visualization)

#### Network System Case Studies

- End-to-end vs. centralized designs
- IoT and the Internet
- Network attacks, defense mechanisms and resilience
- Peer-to-peer networks & distributed hash tables
- Distributed ledgers and Blockchain
- Mining social networks
- Selected examples (from Biology, Ecology, Economics, Epidemiology, etc.)

As this is an experimental course offered for the first time, we will select a subset of the topics listed above depending on time and student interest.

**Text:** There is no required text book for the course. Online reference material available via Canvas includes: Selected conference and journal papers, and Network Science by A.L. Barabasi. You also have access multiple sources such as IEEE Xplore and ACM Digital Library using your CSU login

**Grading:**

Labs and Assignments	– 25%
Project	– 25%
Class Presentation	– 25%
Minute Papers	– 15%
Participation	– 10%

- Active participation in class and contributing to discussions will be rewarded. Read the pre-assigned material prior to the lecture and come prepared.
- The lectures will be a mix of instructor led and student led presentations on selected topics. Each student is required to make one 70-minute or two 35-minute presentation on a pre-approved course-related topic.
- There will be several homework and reading assignments. Only selected assignments and problems will be graded. Graded problems may vary from student to student

**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.

**Do not text, check e-mail, browse web, etc., during the lecture unless it is directly related to the lecture.**