



# EM/ISE 451

## Analysis of Networks & Strategies

*School of Systems & Enterprises*  
Spring 2024

Instructor: Dr. Teresa Zigh  
Canvas Course Address: <https://sit.instructure.com/courses/70494>  
Course Schedule: Tuesday, Thursday 8:00am-9:15am  
Contact Info: [tzigh@stevens.edu](mailto:tzigh@stevens.edu)  
Office Hours: by appointment  
Prerequisite(s): ISE 224, EM 365 or equivalent  
Corequisite(s): N/A  
Cross-listed with: N/A

### COURSE DESCRIPTION

This course is designed to help students understand the complexity, structure, and dynamics of a highly connected world. The course is comprised of two basic parts: complex network analysis and the social and economic factors that affect decision-making in networked systems. It takes a mathematically rigorous and interdisciplinary look at economics, sociology, information science and applied mathematics to discuss some of the fundamental features of networks and their behavior. Topics such as diffusion and cascading, voting, emergence and evolving networks, and economic and market implications will be explored.

### STUDENT LEARNING OUTCOMES

- 1B You can use network analysis to represent industrial and system engineering management problems
- 1A You can adapt networks to model problems in manufacturing, service, and supply areas
- 2A You can design functioning networks to solve industrial and systems engineering management problems
- 6 You can identify variables that impact network structures and analyze performance using quantitative software packages and languages

## COURSE FORMAT AND STRUCTURE

This course is a combination of lectures, exercises, and discussions about the topics and current research

Tuesday – lecture, exploration, discussion

Thursday – lectures and exercises in class

## TENTATIVE COURSE SCHEDULE

	Topic(s)	Reading(s)	Class & Project work
Week 1	Introduction to Networks	Network Science Chap. 1	Personal networks
Week 2	Graph Theory	Network Science Chap. 2	Review classic network problems
Week 3 - 4	Random Networks	Network Science Chap. 3	Random network examples
Week 5	Scale-Free Property	Network Science Chap. 4	Examples of Scaling, Bipartite networks,
Week 6 - 7	Barabási-Albert Model	Network Science Chap. 5	B-A model examples
Week 8 - 10	Evolving Networks	Network Science Chap. 6	Develop recovery models for networks, identify declining networks
Week 11 - 12	Degree Correlation	Network Science Chap. 7	Degrees of separation
Week 13 - 14	Network Robustness	Network Science Chap. 8	Review resilience factors for networks

## COURSE MATERIALS

### Recommended Textbook(s):

**“Network Science”**, D A. Barabási, 2016, Cambridge University Press, ISBN: 978-1-107-07626-6

**“Social and Economic Networks”**, M.O. Jackson, 2008, Princeton University Press, ISBN: 978-0-691-14820-5

**“Networks, Crowds, and Markets: Reasoning about a Highly Connected World”**, David Easley and Jon Kleinberg, Cambridge University Press, ISBN 978-0-521-19533-1.

**“Introduction to Agent-Based Modeling”**, U. Wilensky, W. Rand, 2015, The MIT Press, ISBN: 9780262328111

**“Flows in Networks”**, L.R. Ford, Jr., D.R. Fulkerson, 1962, Princeton University Press, L.C. Card 62-7401.

### Software:

Excel, Gephi, R, Python, as needed.

All the software specified for this class are either free or ubiquitous for undergraduates at Stevens.

*You will be expected to use the tools specified in this class. It is your responsibility to make sure your machines are configured properly and are in good working order.*

## COURSE REQUIREMENTS

**Attendance/Participation: required for Class Participation Grade**

**Homework/Presentations: weekly exercises when scheduled**

**Quizzes N/A**

**Exams: N/A**

## GRADING PROCEDURES

Grades will be based on:

Class Participation (20%)

Scheduled Exercises (80%)

Late Policy: Don't be late to class!

## ACADEMIC INTEGRITY

### Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at <http://web.stevens.edu/honor/>

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

*“I pledge my honor that I have abided by the Stevens Honor System.”*

### Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at [www.stevens.edu/honor](http://www.stevens.edu/honor).

### **Graduate Student Code of Academic Integrity**

*All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.*

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at [www.stevens.edu/provost/graduate-academics](http://www.stevens.edu/provost/graduate-academics).

### **Special Provisions for Undergraduate Students in 500-level Courses**

The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Dean of Graduate Academics or to the Honor Board, who will refer the report to the Dean. The Honor Board Chairman will give the Dean of Graduate Academics weekly updates on the progress of any casework relating to 500-level courses. For more information about the scope, penalties, and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the Bylaws of the Honor System document, located on the Honor Board website.

### **EXAM ROOM CONDITIONS**

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the quiz or exam.

1. Students may use the following devices during quizzes and/or exams. Any electronic devices that are not mentioned in the list below are not permitted.

Device	Permitted?	
	Yes	No
Laptops (determined by instructor)	x	
Cell Phones		x
Tablets		x
Smart Watches		x
Google Glass		x
Other		x

2. Students may use the following materials during quizzes and/or exams. Any materials that are not mentioned in the list below are not permitted.

Material	Permitted ?	
	Yes	No
Handwritten Notes	x	
Typed Notes	x	
Textbooks	x	
Readings	x	
Other		x

3. Students are not allowed to work with or talk to other students during quizzes and/or exams.

**Specific Parameters: Collaboration with other students during take-home exams (if they are given) is not allowed**

## LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

### *Disability Services Confidentiality Policy*

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit <https://www.stevens.edu/office-disability-services>. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at [pgehman@stevens.edu](mailto:pgehman@stevens.edu) or by phone (201) 216-3748.

## INCLUSIVITY

### *Name and Pronoun Usage*

As this course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

### *Inclusion Statement*

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

## MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments are strongly encouraged and can be made by phone (201-216-5177) or in-person (on the 7th floor of the Howe Center). CAPS is open from 9:00 am – 5:00 pm Mondays, Wednesdays, Thursdays and Fridays and from 9:00 am – 7:00 pm on Tuesdays during the Fall and Spring semesters.

## EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. Other 24/7 resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at [care@stevens.edu](mailto:care@stevens.edu). A member of the CARE Team will respond to your concern as soon as possible.