

Fall 2017

PHYS 7335: Dynamical Processes on complex Networks

Instructor: Prof. Alessandro Vespignani

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Lecture hours: Wed. and Friday 11.45am-1.25pm

Classroom: 177 Huntington, 2nd Floor, Large Meeting Room

Office hours: Directly following the lectures. Appointments will be scheduled for those students who cannot make the official hours.

Textbook:

Dynamical processes on complex Networks, A. Barrat, M. Barthelemy and A. Vespignani, Cambridge University Press.

Course description and objectives: The advances obtained in the understanding of large complex networks have generated an increased attention towards the potential implication of their structure with respect to the most important questions concerning the various physical and dynamical processes occurring on top of them. This class aims at reviewing in a systematic way the impact of the various network characteristics on the basic features of equilibrium and non-equilibrium dynamical processes. The class will introduce the basic techniques used to analyze dynamical, equilibrium, and non-equilibrium systems. We will make a special effort in defining for each phenomenon or system under study the appropriate language used in the field and offer to the reader a mapping between languages and techniques used in the different disciplines. The material discussed in the class will include

- Introduction to the basic theoretical concepts and tools needed for the analysis of dynamical processes taking place on networks.
- Equilibrium processes and the behaviors of basic equilibrium physical models such as the Ising model in complex networks.
- Analysis of damage and attack processes in complex networks by mapping those processes into percolation phase transitions.
- Synchronization in coupled systems with complex connectivity patterns
- Navigation, and exploration processes of complex networks
- Epidemic spreading
- Emergence of collective behavior (social and Bio Systems)
- Traffic avalanche and congestion

Course Organization

Lectures will be given by Prof. Vespignani. Occasionally a guest lecturer may be invited to talk about specific topics.

Homework:

The homework includes -

Written take home assignment 1

Written in class assignment 2

Final take home assignment

Examinations: None

Grading

Grade distribution

Written assignment 1 – 25 %

Written assignment 2 – 25 %

Final assignment – 35 %

Attendance – 5%

Teacher evaluation – 10 %

Class policy

- Use of laptops in class is allowed only to take notes. In this case please sit in the front rows of the classroom. No email, facebook, games, or other distractions, please.
- Students are responsible for making backups of all of their work! This includes any assignment and other materials you produce.
- Students are responsible for the safe and ethical use of class accounts on shared servers, according to university policy and copyright law, and for the sole purpose of carrying out class assignments. Accounts will be monitored and any abuse will be reflected in the grades.
- Students are responsible for assigned readings PRIOR to class discussions.
- Students are required to attend class.
- If you miss class, it is your responsibility to find out about any announcements or assignments you may have missed.
- Late assignments will incur a penalty of 50% within 24 hours of the deadline, and no partial or make-up credit will be available after that.
- Extenuating circumstances will normally include only serious emergencies or illnesses documented with a doctor's note.

Help: If you have trouble with the homework, seek help immediately - do not fall behind in the course. You have several places to go for help: your lecturer (after class, during office hours, or anytime by arrangement

Academic misconduct: Appropriate disciplinary action, potentially including failing the student, will be taken in the event of cheating, plagiarism, dishonesty, or other academic misconduct. The Northeastern University Policy on Academic Integrity can be found at:

<http://www.northeastern.edu/osccr/academichonesty.html>)

Since students in this course are often encouraged to work in teams, some specific remarks are in order:

It is not considered cheating if you:

- Work together on homework assignments, as long as you each work out and submit your own final answers
- Get help from professors, physics workshop, tutors, etc. on the homework assignments
- Work together on preparing for quizzes and exams

It is considered cheating if you:

- Submit work done by others (without your participation) as your own
- Copy work on quizzes and exams

Statement of Non-Discrimination: Northeastern University is committed to social justice. As the instructor of the course, I expect to maintain a positive learning environment based upon communication and mutual respect. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. The university does not discriminate on the basis of race, sex, age, disability, religion, sexual orientation, color, or national origin. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangement with Disability Resource Center (617) 373-4428.

The instructor reserves the right to modify this syllabus as deemed necessary any time during the semester. Emendations to the syllabus will be discussed with students during a class period. Students are responsible for information given in class.

There may be also details about the class uncovered in this syllabus. Do not assume something just because it is not specified in the syllabus. If you are unsure about anything related to the rules guiding this course, consult with your instructor.