

Network Science II

NETS 6116, Spring 2021

Instructor: Prof. Dima Krioukov, 177 Huntington Ave, 2nd floor, Rm. 227, x2934, dima@northeastern.edu

Office Hours: By appointment

Credits: 4

Course Schedule: WF 11:45am-1:25pm, Jan 19 – May 1, 2021

Course Location: Online/hybrid

Course Description: The second half of the foundational graduate course in network science. Provides in-depth coverage of the core concepts in network science dealing with network properties and network models. Assumes familiarity with basic concepts in networks science and hands-on experience working with network data.

Course Prerequisites: PHYS 5116, *Network Science I* (currently *Complex Networks and Applications*)

Textbooks:

M. Newman, *Networks*, 2nd ed., Oxford University Press, 2018.

R. van der Hofstad, *Random Graphs and Complex Networks*, Cambridge University Press, 2017.

Course Objectives and Learning Outcomes: The main learning objective of the course is to gain in-depth knowledge of the core concepts, methods, and computational techniques in network science, necessary in hands-on work with real data on complex systems. The course consists of two unequal parts. The first shorter part revisits the most basic properties of networks introduced in the prerequisite course *NetScil* (PHYS 5116). The focus is on addressing common misunderstanding and confusion points. The second part considers a collection of best-studied models in network science, and teaches the analytical and computational methods to analyze networks using these models and the properties considered in the first part. The focus is on deepening and broadening the foundational knowledge and skills acquired in *NetScil*.

Course Organization: The first part of the course utilizes the flipped classroom methodology, except the selected students teach not new but old material they already know from *NetScil* concerning foundational concepts in network science, such as network sparsity, small worldness, scale freeness, etc. The instructor and other students question the teachers trying to fix common misconceptions, misunderstanding and confusion points concerning the presented concepts. The second part of the course follows a more traditional teaching methodology, covering core concepts in network science omitted in *NetScil*, such as the stochastic block model, configuration model, exponential random graphs, multilayer/multiplex networks, etc., yet the presentation is discussion-based, and the students earn points aggressively for participating in the discussion.

Homework: There will be several homework assignments of either analytic-calculation or computer-simulation types, or mixture thereof. The assignments will be of different levels of difficulty, and either individual or group-based. Their grades will be weighted proportionally.

Final examination is a miniproject at the level of a very difficult homework, either individual or group-based, due within about ten days from the assignment.

Grading: Final course grades will be determined as follows:

- **20%** Teaching presentation at the first part of the course
- **20%** Attendance and participation
- **30%** Homework
- **20%** Final project
- **10%** Teacher evaluation

Grade	Score
A	93-100
A-	90-93
B+	85-90
B	75-85
B-	70-75
C+	65-70
C	55-65
C-	50-55
F	0-50

Policies: Be sure to review and follow the Northeastern University Academic Integrity Policy available at <http://www.northeastern.edu/osccr/academic-integrity-policy/>

Disclaimers: Announcements in the class that in conflict with the material in this syllabus override the syllabus.