

# Network Science, PhD

Website (<http://www.networkscienceinstitute.org>)

The PhD program in network science aims to enhance our understanding of networks arising from the interplay of human behavior, sociotechnical infrastructures, information diffusion, and biological agents. This is an intrinsically multidisciplinary activity, with members of the network science community representing a wide range of fields including computer science, information science, complexity, physics, sociology, communication, organizational behavior, political science, and epidemiology. This is an interdisciplinary doctoral program focused on training students in network science across several colleges—including the College of Social Sciences and Humanities, the College of Science, the Khoury College of Computer Sciences, and Bouvé College of Health Sciences—with several research areas, including computational sciences, information sciences, health and life sciences, social sciences, and theoretical physics. See other collaborating colleges' catalog sections for possible elective courses.

Coursework is dependent on a student's area of research and subject to prior approval by their faculty advisor. Required coursework includes 20 semester hours of core courses in network science, plus an additional 20 semester hours of courses relevant to the students' area of research.

A minimum of 40 credit hours of coursework is required, though the graduate program committee may recommend additional coursework based on student research interests.

Satisfactory progress in the program will be ongoing and formally evaluated at the end of both the first and second years of the program. Students are expected to maintain a cumulative GPA of 3.000 or better in all coursework. Students are not allowed to retake courses. A student who does not maintain the 3.000 GPA, or is not making satisfactory progress on their dissertation research, may be recommended for termination by the graduate program committee.

Each student will have one primary research advisor from the network science doctoral program faculty.

Students will be expected to select their research advisor by the end of the spring semester of their second year in the program.

The dissertation committee consists of at least four members: the dissertation advisor, one additional network science doctoral program faculty member, one member expert in the specific topic of research (can be from outside the university), and one additional tenured/tenure-track faculty member from the concentration department/conferring college. The dissertation advisor must be a full-time tenured or tenure-track member of the Northeastern University faculty. Students may repeat the comprehensive examination once if they are unsuccessful.

## Degree Candidacy

A student is considered a PhD candidate upon completion of all required coursework with a minimum cumulative GPA of 3.000, satisfactory completion of the qualification exam, and satisfactory completion of the comprehensive exam.

## Qualifying Examination

The qualification exam will be an oral examination of the material during the students' coursework. The exam will be an hour in length and consist of questions selected by network science faculty who comprise the qualifying examination and dissertation committee. Students will receive 50 to 80 potential questions, which they must be prepared to answer,

one month before the exam. The exam will consist of a subset of these questions. The qualifying exam will be offered twice annually, in the fall and spring term. All students are required to initially sit for the exam in the fall, typically in their third year of the PhD program. Students who do not pass the qualifying exam on their first attempt are expected to retake the exam in the spring term. Students may sit for the qualifying exam no more than twice.

Students who fail to complete the qualifying examination but who have completed all the PhD program's required coursework with a cumulative GPA of 3.000 or better will be awarded a terminal Master of Science in Network Science degree. Note that no students will be admitted directly into the network science program for receipt of a master's degree.

## Comprehensive Examination

Students must submit a written dissertation proposal to the Dissertation Committee. The proposal (with the aid and approval of their dissertation advisor) will outline a plan to carry out new and original research. The proposal should identify relevant literature, the research problem, the research plan, and the potential impact on the field. An oral presentation of the proposal will be made in an open forum before a public audience and the Dissertation Committee, followed by questions from non-committee members. The written proposal must be given to committee member at least two weeks prior to the oral presentation. After the presentation, the student will meet with the dissertation committee to address any concerns raised in either the written proposal or the presentation. The Comprehensive Exam must precede the final dissertation defense by at least one year.

## Dissertation Defense

A PhD student must complete and defend a dissertation that involves original research in network science. The dissertation defense must adhere to Northeastern University academic policies.

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*Students who do not qualify for the doctoral degree, but who have completed required coursework with a cumulative GPA of 3.000 or better, may be eligible to receive a terminal MS Network Science (<http://catalog.northeastern.edu/graduate/social-sciences-humanities/interdisciplinary/network-science-ms/>) degree. Note that no students will be admitted directly into the Network Science program to pursue a master's degree.*

## Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

### Milestones

Annual review  
Qualifying exam  
Dissertation committee  
Dissertation proposal  
Dissertation defense

### Core Requirements

Code	Title	Hours
PHYS 5116	Complex Networks and Applications	4
NETS 6116	Complex Networks and Applications 2	4
PHYS 7332	Network Science Data 2	4

or NETS 7332	Machine Learning with Graphs	
POLS 7334	Social Networks (NETS )	4
PHYS 7335	Dynamical Processes in Complex Networks	4

### Specializations

Choose one of the following specializations or 20 semester hours of elective coursework from the electives course list:

- Computer Science (p. )
- Social Science (p. )
- Epidemiology (p. 2)
- Physics/Theory (p. 2)
- Math (p. 2)
- Coursework (p. )

### COMPUTER SCIENCE

Code	Title	Hours
CS 5800	Algorithms	4
CS 6140	Machine Learning	4
or CS 6220	Data Mining Techniques	

Complete 12 semester hours of elective courses from the elective list below. Students who wish to take courses outside of the electives list below must do so in consultation with their adviser. 12

### SOCIAL SCIENCE

Code	Title	Hours
NETS 7350	Bayesian and Network Statistics	4
NETS 7360	Research Design for Social Networks	4

Complete 12 semester hours of elective courses from the elective list below. Students who wish to take courses outside of the electives list below must do so in consultation with their adviser. 12

### EPIDEMIOLOGY

Code	Title	Hours
PHTH 5202	Introduction to Epidemiology	3
PHTH 6202	Intermediate Epidemiology	3

Complete 14 semester hours of elective courses from the elective list below. Students who wish to take courses outside of the electives list below must do so in consultation with their adviser. 14

### PHYSICS/THEORY

Code	Title	Hours
MATH 7233	Graph Theory	4
PHYS 7337	Statistical Physics of Complex Networks	4

Complete 12 semester hours of elective courses from the elective list below. Students who wish to take courses outside of the electives list below must do so in consultation with their adviser. 12

### MATH

Code	Title	Hours
CS 5800	Algorithms	4
MATH 7233	Graph Theory	4

Complete 12 semester hours of elective courses from the elective list below. Students who wish to take courses outside of the electives list below must do so in consultation with their adviser. 12

### COURSEWORK

Code	Title	Hours
	Complete 20 semester hours of elective courses from the elective list below. Students who wish to take courses outside of the electives list below must do so in consultation with their adviser.	20

### ELECTIVES LIST

Common electives include the following:

Code	Title	Hours
CS 5800	Algorithms	
CS 6120	Natural Language Processing	
CS 6140	Machine Learning	
CS 6220	Data Mining Techniques	
CS 7180	Special Topics in Artificial Intelligence	
CS 7260	Visualization for Network Science	
CS 7295	Special Topics in Data Visualization	
NETS 7341	Network Economics	
NETS 7350	Bayesian and Network Statistics	
NETS 7976	Directed Study	
NETS 7983	Topics	
MATH 7233	Graph Theory	
MATH 7243	Machine Learning and Statistical Learning Theory	
PHYS 7305	Statistical Physics	
PHYS 7321	Computational Physics	
PHYS 7337	Statistical Physics of Complex Networks	

### Dissertation

Code	Title	Hours
NETS 9990	Dissertation Term 1	
NETS 9991	Dissertation Term 2	

### Program Credit/GPA Requirements

40 total semester hours required  
Minimum 3.000 GPA required

### Plan of Study

Year 1			
Fall	Hours	Spring	Hours
PHYS 5116		4 PHYS 7332	4
PHYS 7331 or INSH 5301 ( If required, may be substituted with an elective)		4 NETS 6116	4
		POLS 7334	4
	8		12
Year 2			
Fall	Hours	Spring	Hours
PHYS 7335		4 Two Elective Courses	8

Two Elective Courses		8	
		12	8
<b>Year 3</b>			
<b>Fall</b>	<b>Hours</b>	<b>Spring</b>	<b>Hours</b>
NETS 9990		0 NETS 9991	0
		0	0
<b>Year 4</b>			
<b>Fall</b>	<b>Hours</b>		
NETS 9996		0	
		0	

Total Hours: 40