COMPUTER SCIENCE (PHD)

NYSED: 85150 **HEGIS:** 0701.00 **CIP:** 11.0101

Program Description

We have a thriving PhD program with approximately 80 full-time PhD students hailing from all corners of the world. Most full-time PhD students have scholarships that cover tuition and provide a monthly stipend. Admission is highly competitive. We seek creative, articulate students with undergraduate and master's degrees from top universities worldwide. Our current research strengths (https://engineering.nyu.edu/academics/departments/computer-science-and-engineering/research-computer-science/) include data management and analysis, cybersecurity, computer games, visualization, web search, graphics, vision and image processing, and theoretical computer science.

This degree program offers interested students opportunities to do their research abroad, under the supervision of faculty at NYU Shanghai (https://shanghai.nyu.edu/academics/graduate/computer-science-phd-program/) or NYU Abu Dhabi (https://nyuad.nyu.edu/en/academics/graduate/global-phd-student-fellowships/global-phd-student-fellowship-in-computer-science.html).

Admissions

Admission to graduate programs in the Tandon School of Engineering requires the following minimum components:

- Résumé/CV
- Statement of Purpose
- Letters of Recommendation
- Transcripts
- Proficiency in English

See NYU Tandon Graduate Admissions (https://engineering.nyu.edu/admissions/graduate/apply/requirements/) for additional information on school-wide admission.

Program Requirements

The program requires the completion of 75 credits, comprised of the following:

Course	Title	Credits
Major Requirements		
Theory Course 1		3
Systems & Applications Course 1		3
Systems & Applications Course 2		3
Theory Course 2 **or** Systems & Applications Course 3		3
Free Choice Course 1 [1]		3
Free Choice Course 2 [1]		3
Qualifying Exam		
RE-GY 9990	PHD QUALIFYING EXAM	0
Dissertation		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE (repeated throughout the program for a combined total of 21 credits)	21
Electives		
Other Elective Credits		36
Total Credits		**75**

[1]

Students are free to and encouraged to explore courses from within the CSE department as well as other departments within Tandon and other schools at NYU. Once courses of interest have been identified, students should discuss them with their adviser for approval. Alternatively, students may choose more courses from the Theory course list or Application & Security course list: courses from these lists require no further approval from the adviser. The following courses cannot be used to meet this requirement:

- CS-GY 9963 ADVANCED PROJECT IN COMPUTER SCIENCE
- CS-GY 9413 Readings in Computer Science I
- CS-GY 9423 Readings in Computer Science II
- CS-GY 999X PHD DISSERTATION IN COMPUTER SCIENCE

Program Summary

To receive a PhD in Computer Science at the NYU Tandon School of Engineering, a student must:

- satisfy a breadth course requirement, intended to ensure broad knowledge of computer science,
- satisfy a depth requirement, consisting of an oral qualifying exam presentation with a written report, to ensure the student's ability to do research,
- submit a written thesis proposal and make an oral presentation about the proposal,
- write a PhD thesis that must be approved by a dissertation guidance committee and present an oral thesis defense, and
- satisfy all requirements for the PhD degree, as described in the NYU Tandon School of Engineering bulletin, including credit points, GPA, and time-to-degree requirements.

Upon entering the program, each student will be assigned a faculty advisor who will guide them in formulating an individual study plan directing their course choice for the first two years. The department will hold an annual PhD Student Assessment Meeting, in which all PhD students will be formally reviewed.

Breadth Requirement

Each PhD student must complete a breadth requirement consisting of 6 courses. To remain in good academic standing, students must fulfill the breadth requirement within 24 months of entering the PhD program.

Students who do not fulfill the breadth requirement within 24 months will be dismissed from the program, unless an exception is granted by the PHDC. The PHDC will consult with the student's research advisor to decide whether an exception is granted and to determine the conditions the student needs to meet.

Details of Breadth Requirement

The breadth requirement consists of 6 courses: 4 approved list courses, and 2 free choice courses.

The courses used to fulfill the breadth requirement must satisfy the following:

1. **Approved list courses:** Four of the courses must be taken from the approved list of courses given in the appendix. The 4 courses must satisfy the following two requirements:

a. **Theory requirement:** At least one of the 4 courses must be taken in the Theory area.

b. **Systems & Applications Requirement:** At least two of the 4 courses must be taken in Systems & Applications.
   Exemptions from approved list courses: With the approval of the PhD Committee, students who have previously received a grade of A or A- in a course that is on the approved list, while enrolled in another NYU graduate program, can use that course towards the breadth requirement in lieu of taking it while in the PhD program. Also, students who have previously received a grade of A or A- in a graduate course similar to one on the approved list, while enrolled in a graduate program at NYU or at another university with standards comparable to those at NYU, can use that course in lieu of taking the course on the approved list. The determination of whether a previously taken course, not on the approved list, can be used in this way, will be made by the PHDC. However, any student who uses courses taken prior to entering the CS PhD program to fulfill one or both of the Systems & Applications course requirements must work on a medium-sized or larger software project while in the CS PhD program. This project can be part of coursework or the student's research. A brief report on the project must be produced and approved by the PHDC.
   Approved Course List: The list of approved courses will be reviewed regularly by the PHDC and is subject to change. Any changes must be approved by the CSE Department. In order for a course to be considered for inclusion in the list, the course must be rigorous and the students in it must be evaluated individually. Examples of inappropriate courses include those in which students are traditionally not differentially evaluated (e.g., all students receive A's or "pass") and courses in which grades are based on attendance or making a presentation of someone else's work, rather than on tests and assignments.
   Students, under their advisors' guidance, should select their courses from the approved list so that they are exposed to a broad set of topics in computer science.

2. **Free choice courses:** Students must take 2 free choice courses in addition to the 4 required courses from the approved list. Students can use any graduate course at NYU as free choice courses, but must obtain advisor approval to use a course not on the approved list. Students cannot use independent study courses (such as CS-GY 9963 ADVANCED PROJECT IN COMPUTER SCIENCE or CS-GY 9413 Readings in Computer Science I and CS-GY 9423 Readings in Computer Science II) or dissertation. Both free choice courses must be taken while in the CS PhD program. No exemptions are available for free choice courses.

3. **GPA requirement:** Students must receive a grade of at least B in each of the six courses used to fulfill the breadth requirement. The average in the 4 approved list courses used to fulfill the breadth requirement must be at least 3.5. Students who take more than 4 approved list courses can choose which ones to apply towards the breadth requirement, and the average will be calculated using just those courses. (For students who receive exemptions allowing them to take fewer than 4 approved list courses while in the CS PhD program, the average will be calculated over the approved list courses that were taken while in the CS PhD program. Students may choose not to use all exemptions which have been granted to them, and may instead take additional approved list courses to be used to satisfy the breadth requirement.) The average in the 2 free choice courses must also be at least 3.5.

4. **Requirement for Students who have never taken an Algorithms Course:** Any student who has not taken a course in Algorithms prior to entering the PhD program, at either the undergraduate or the graduate level, must take a graduate course in algorithms while in the PhD program. Students may take CS-GY 6033 Design and Analysis of Algorithms I, CS-GY 6043 Design and Analysis of Algorithms II, or CSCI-GA 3520 Honors Analy of Algo to fulfill this requirement. The department may revise this list in the future depending on course offerings. Alternatively, students may petition the PHDC to use another course. The grade received in the course must be at least B.

Appendix for Breadth Requirement

The following courses at NYU Tandon School of Engineering can be used to satisfy the breadth requirements:

Course	Title	Credits
Theory		
CS-GY 6043	Design and Analysis of Algorithms II	3
CS-GY 6703	Computational Geometry	3
CS-GY 6753	Theory of Computation	3
CS-GY 6763	ALGORITHMIC MACHINE LEARNING AND DATA SCIENCE	3
Systems & Applications		
CS-GY 6083	Principles of Database Systems	3
CS-GY 6093	Advanced Database Systems	3
CS-GY 6143	Computer Architecture II	3
CS-GY 6243	Operating Systems II	3
CS-GY 6253	Distributed Operating Systems	3
CS-GY 6313	INFORMATION VISUALIZATION	3
CS-GY 6413	Compiler Design and Construction	3
CS-GY 6513	Big Data	3
CS-GY 6533	Interactive Computer Graphics	3
CS-GY 6543	Human Computer Interaction	3
CS-GY 6553	Game Design	3
CS-GY 6613	Artificial Intelligence I	3
CS-GY 6643	COMPUTER VISION	3
CS-GY 6823	Network Security	3
CS-GY 6843	Computer Networking	3
CS-GY 6913	Web Search Engines	3
CS-GY 6923	Machine Learning	3
CS-GY 6943	Artificial Intelligence for Games	3
CS-GY 9163	Application Security	3

The following courses, offered by the Computer Science Department at the Courant Institute of Mathematical Sciences at NYU (http://cs.nyu.edu/webapps/courses/), can also be used to satisfy the breadth requirements:

Course	Title	Credits
Theory		
CSCI-GA 3520	Honors Analy of Algo	4
Systems & Applications		
CSCI-GA 2243	High Performance Computer Arch	3
CSCI-GA 2270	Computer Graphics	3
CSCI-GA 2271	Computer Vision	3
CSCI-GA 2434	Advanced Topics Database Systems	3

CSCI-GA 2560	Artificial Intelligence	3
CSCI-GA 2565	Machine Learning	3
CSCI-GA 2566	Foundations of Machine Learning	3
CSCI-GA 2590	Natural Lang Processing	3
CSCI-GA 2620	Networks and Mobile Systems	3
CSCI-GA 3110	Honors Programming Lang	4
CSCI-GA 3130	Honors Compilers	4
CSCI-GA 3250	Honors Operating Systems	4

Depth Requirement

By the end of a student's third semester in the program, at the latest, the student must be involved in a research project under the guidance of a faculty research advisor. It is the responsibility of each student to find a faculty advisor and a research project, and to inform the PHDC Chair about their choice of advisor. Students must inform the PHDC chair if they change their research advisor.

To satisfy the depth requirement, students must take a qualifying exam (QE) based on their research. The QE must be passed before the start of the student's fifth semester in the program. Students are required to form a QE committee, select an exam topic, and a tentative date approved by the advisor and committee, by the end of their third semester.

Scheduling the QE less than two months before the start of the fifth semester is strongly discouraged. If a student does not pass the QE before the fifth semester, the student will not be allowed to continue the PhD in the fifth semester, unless an exception is granted by the PHDC and the Office of Graduate Academics.

Students must register for RE-GY 9990 PHD QUALIFYING EXAM CS01, a 0-credit course, at the start of the semester in which they will take the QE.

The QE committee must consist of the advisor and at least two other members. The committee must be approved by the advisor and the PHDC. The advisor is the designated chair of the committee. All members of the QE committee must be CSE faculty, faculty from other departments at NYU, or individuals of like standing from outside the university. At least two of the QE committee members must be tenured or tenure-track members of the CSE department, unless permission is obtained from the PHDC to include only one such member.

For the QE, the student must give an oral presentation of their research accomplishments to the QE committee and write a detailed document describing those accomplishments. The document must be submitted to the QE committee and the PHDC no later than one week before the oral presentation. A student is expected to have conducted original research by the time of the exam. This research may have been carried out independently or in collaboration with faculty, research staff, or other students. Students are encouraged, but not required, to have publication-worthy results by the time of the exam. It is not sufficient for a student to present a survey of previous work in an area or a reimplementation of algorithms, techniques, or systems developed by others.

The committee, by majority vote, gives a grade for the QE as either "Pass" or "Fail". The chair of the QE committee will send this grade in writing to the student and to the PHDC chair, together with a written evaluation of the student's performance, approved by the QE committee members. A student who does not receive a "Pass" may request permission from the PHDC to retake the exam. The PHDC will consult with the QE committee, review the case and make the final decision as to whether a retake is allowed or not. A student may petition the PHDC to change one or more

members of the QE committee, but approval of the request will be at the PHDC's discretion.

If the request for a retake is approved, the QE committee will determine the date for the second attempt. If the student is not allowed to retake the exam, the student will not be allowed to continue in the PhD program in the following semester. If the student does not pass the qualifying exam on the second attempt, or otherwise does not satisfy the conditions given to them upon failing the exam the first time, the student will not be allowed to continue in the PhD program in the following semester.

If a student has passed the QE and then changes their area of research, the student need not retake the QE.

Thesis Proposal and Presentation

Within 6 months of passing the QE, each student is required to form a dissertation guidance committee. This committee must be approved by the student's research advisor and by the PHDC. The committee must include at least four members, including the research advisor. The committee members can be CSE faculty, faculty from other departments at NYU, or individuals of like standing from outside the university. At least one member of the dissertation guidance committee must be a tenured or tenure-track CSE faculty member, and at least one member of the committee must be from outside the CSE department. The committee chairperson may or may not be the research advisor, but must be a tenured or tenure-track faculty member in Tandon or have a cross-appointment of at least Associate level.

By the end of the student's fifth semester in the program, the student and committee must set a tentative date for the thesis proposal presentation. The presentation must be done prior to the start of the student's seventh semester in the program.

Before finalizing the date of the presentation, the student must submit a written thesis proposal to the dissertation guidance committee which should include:

- a description of the research topic
- an explanation of how the research will advance the state of the art, and
- a tentative research plan

After the dissertation guidance committee has approved the thesis proposal, the student should schedule the thesis proposal presentation and notify the PHDC chair once this has been finalized. The presentation should be announced to the faculty by the PHDC chair at least one week before it occurs. The presentation is open to all faculty. It may also be open to others at the discretion of the research advisor.

Substantial subsequent changes to the thesis topic must be approved by the dissertation guidance committee.

Thesis and Thesis Defense

The last, and most substantial, aspect of the PhD program is the dissertation. The research for the dissertation should be conducted in close consultation with the research advisor. When the advisor determines that the student is ready to defend the thesis, a dissertation defense will be scheduled. For the defense, the student will give an oral presentation describing the thesis research, which is open to the public. Following the oral presentation and an initial question and answer session, the dissertation committee and CSE faculty may ask the student further questions in closed session.

Other requirements for the PhD dissertation and defense can be obtained from the Office of the Associate Dean for Graduate Academics in the NYU Tandon School of Engineering.

Note: Students who began the program before Fall 2015 have the option of completing the requirements that were in effect at the time they began the program.

Students who began the program before Fall 2017 may count CS-GY 6903 Applied Cryptography as a breadth course in the Theory category, and CS-GY 6063 Software Engineering I as a breadth course in the Systems and Applications category.

Sample Plan of Study

Course	Title	Credits
1st Semester/Term		
CS-GY 9963	ADVANCED PROJECT IN COMPUTER SCIENCE	3
Systems & Applications Course		3
Theory Course		3
	Credits	**9**
2nd Semester/Term		
CS-GY 9963	ADVANCED PROJECT IN COMPUTER SCIENCE	3
Systems & Applications Course		3
Elective		3
	Credits	**9**
3rd Semester/Term		
CS-GY 9963	ADVANCED PROJECT IN COMPUTER SCIENCE	3
Systems & Applications Course		3
Elective		3
	Credits	**9**
4th Semester/Term		
CS-GY 9963	ADVANCED PROJECT IN COMPUTER SCIENCE	3
CS-GY 9413	Readings in Computer Science I	3
RE-GY 9990	PHD QUALIFYING EXAM	0
Elective		3
	Credits	**9**
5th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	6
	Credits	**6**
6th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	6
	Credits	**6**
7th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	6
	Credits	**6**
8th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	6
	Credits	**6**
9th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	6
	Credits	**6**
10th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	3
	Credits	**3**
11th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	3
	Credits	**3**
12th Semester/Term		
CS-GY 999X	PHD DISSERTATION IN COMPUTER SCIENCE	3
	Credits	**3**
	Total Credits	**75**

Learning Outcomes

Upon successful completion of the program, graduates will have:

1. A broad knowledge of computer science.
2. The ability to conduct original research in computer science.
3. The ability to present their research in written papers and oral presentations.

Policies
NYU Policies

University-wide policies can be found on the New York University Policy pages (https://bulletins.nyu.edu/nyu/policies/).

Tandon Policies

Additional academic policies can be found on the Tandon academic policy page (https://bulletins.nyu.edu/graduate/engineering/academic-policies/).