RPI | SCHOOL OF SCIENCE

Computer Science Graduate Program Guide 2025-2026

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Graduate Program Director: *Prof. Stacy Patterson*
Graduate Program Administrator: *Tracy Hoffman*

TABLE OF CONTENTS

Co-Terminal Program

Rensselaer's Co-Terminal Program provides undergraduates the opportunity to pursue graduate degrees while maintaining their undergraduate Rensselaer funding. Most Rensselaer master's programs are available as part of the Co-Terminal Program, and participants follow the same curriculum as traditional master's students. Co-Terminal students can pursue a master's degree in the same academic discipline as their bachelor's or take an interdisciplinary approach, applying to a graduate program outside of their undergraduate department. Co-Terminal students are not eligible to receive departmental graduate funding (Teaching Assistantship or Research Assistantship).

Co-Term students are required to graduate with their bachelor's degree in up to eight semesters, with a minimum GPA of 3.0 (Computer Science has a minimum GPA requirement of 3.5 in order to apply). After graduating with their BS degree, they have up to two semesters to complete their master's degree.

Computer Science Application Deadlines:
April 15- for students graduating with their BS in December (last semester seniors: Oct 15th)
November 1- for students graduating with their BS in May (last semester seniors: March 1st)

Application Requirements:
   ★ Applicants must have at least 90 credits toward their BS degree. This includes AP credits, transfer credits, and courses in progress.
   ★ Have a minimum GPA of 3.5 upon applying.
   ★ One letter from the MS research advisor detailing your research project or thesis. This letter should be sent to gradops@rpi.edu directly from your advisor, once you have started your application. *Students without a graduate research advisor cannot apply.
   ★ Statement of Background and Goals
   ★ 4th and 5th Year Planner
   ★ Graduate Plan of Study (which must include Grad Skills, 1cr., first fall semester of Co-Term prog)
   ★ Updated Degree Works report
   ★ Most recent unofficial transcript
   ★ The online Co-Terminal application and other information/requirements can be found here: https://graduate.rpi.edu/co-terminal-program/application-process

How to Apply:
   1. **Schedule a meeting with Tracy Hoffman** (Click here to schedule a meeting) early in the semester that you're applying. She will walk you through all of the required steps and requirements.
   2. Meet with the Financial Aid Office to determine your financial aid package that may/may not continue throughout the Co-Terminal portion of your degree.
   3. Research Computer Science Faculty to find which one(s) meet your research interests. Reach out to them and schedule a meeting to discuss if they will agree to accept you into their research group and become your research advisor.
   4. Submit an online application
   5. Upload your Statement of Background and Goals, updated Degree Works report, current RPI unofficial transcript.
   6. Meet with Tracy periodically to create your Graduate Plan of Study and 4th and 5th Year Planner
   7. Ask your research advisor to send their letter to gradops@rpi.edu

M.S. Requirements

FUNCTIONAL PHILOSOPHY

The Master of Science degree in Computer Science at Rensselaer is a technical degree from which students may advance to positions of responsibility in the computing field with a solid foundation of knowledge. A number of students often continue into PhD study similarly well prepared.

The program requirements (below) provide a broad curriculum at a high level, yet permit a modest degree of specialization. A significant component of the program is a research Master's thesis (six-credits) based on original research. The Master's Thesis should demonstrate a student's skill in problem-solving and application of computing principles in areas such as algorithm and data-structure design, programming languages and software systems, program testing and debugging, and software documentation. In lieu of a Master's thesis, students can complete a 3-credit Master's project with significant conceptual depth, and earn the remaining three credits through additional course work.

ADMISSION

Students with significant prior computer science experience are encouraged to apply for admission to the program. To be considered, an applicant must have a bachelor's degree (or the US equivalent) in a technical field, preferably related to Computer Science. Applicants must know how to program in at least three higher-level languages, and must have a thorough working knowledge of computer organization and data structures. The applicant also must have a substantial mathematics background at the college level, including a year of calculus and knowledge of linear algebra and discrete mathematics.

Application materials are available from the [Rensselaer Admissions Office](#). A complete application file consists of the application itself, transcripts from all prior undergraduate and graduate work, a statement of background and goals, current resume/CV, and letters of recommendation. International applicants are also required to include official scores for the Test Of English as a Foreign Language (TOEFL) examination. Check the Graduate Admissions website for GRE requirements.

Applicants should clearly indicate, both in their personal statements and on the application form where requested, their main area or areas of interest in computer science, relating them if possible to the faculty research interests as listed in the document *Research Groups at Rensselaer Computer Science Department*. An important factor in the evaluation of applicants is the potential for conducting original research, so students who have already participated in a significant research project should emphasize their experience and achievements in the project. In most cases, admission and financial aid awards will be by research groups rather than by the department as a whole, so that students become associated with a research group and begin research immediately upon entering the program.

Check the Graduate Admissions website for MS application deadlines.

DEGREE REQUIREMENTS

In addition to meeting the degree requirements of the Office of Graduate Education, a candidate must:
- Complete a Plan of Study form by the second semester of study. This plan is drawn up with the advice and approval of the student's academic advisor and is to be a coherent, thoughtful plan reflecting the student's professional goals. If necessary, changes can be made to this plan at any time with the approval of the academic advisor and the graduate program director. All Plans of Study must

reflect your entire program's requirements until expected graduation. More details are available under the [Plan of Study](#).

- Complete 30 credits beyond the Bachelor's, at least 18 of which must be at the 6000 level.
- Full-time students must attend at least 50% of colloquia offered for each semester they are enrolled in the graduate program (up to a maximum of four semesters). More details are available under Colloquium Attendance Requirements (as listed in this document)..
- Complete the Graduate Skills course: every new MS/Co-Terminal student must register for the 1 credit Graduate Skills class: "CSCI 69xx Graduate Skills", which is only offered in the fall. This course should be listed on the graduate Plan of Study.
- Complete a Master's Thesis or a Master's Project. The thesis must be an original research contribution and typically takes multiple semesters to complete. This is especially appropriate for students continuing on with a PhD. A Master's project is a conceptually advanced work, going beyond course work or an undergraduate research project. The workload for completing a project is similar to the workload for a full semester graduate-level Computer Science course.
- The average of all grades used toward completion of an MS degree must be at least a B. If a student's grades fall below a B average, the Office of Graduate Education may request that the department conduct a formal review to determine whether continuation is warranted. The student's advisor, committee, or department may recommend to the Office of Graduate Education that the student whose performance is unsatisfactory be dropped from the graduate program. A student who has accumulated two failing grades will be dropped from the graduate program.
- Students may not count courses that were used to fulfill BS degree requirements towards their MS degree requirements.
- Students must complete the Core Foundation and Core Depth and Breadth requirements as listed below.

Core Foundation:

Students must demonstrate competence at the advanced undergraduate level in the core areas of CS.

1. Algorithms: Design and Analysis of Algorithms
2. Systems: Operating Systems**
3. Software/Programming: Programming Languages

*** Starting Fall 2025 students may alternatively take Computer Architecture or Advanced Operating Systems to fulfill this requirement.*

Students may fulfill the Core Foundation requirement by completing a BS degree in Computer Science at RPI. Students with an undergraduate degree in Computer Science from another university may fulfill the Core Foundation requirement by demonstrating competence in two of the three areas. All other students must demonstrate competence in all three areas.

Students **without** an undergraduate degree in Computer Science must (proactively) petition the Graduate Curriculum Committee (GCC) to fulfill the Core Foundation requirement by demonstrating competence in two of the three areas Algorithms, Systems, Software/Programming. Students without an approved petition are required to fulfill all three areas.

Students may demonstrate core competence in one of 3 ways.

- Take the course at the undergraduate level and get a B or better.

- Take the final exam of the course and get B or better on the final. Students should coordinate this option with the Graduate Program Administrator who will coordinate the final exam with the relevant instructor. If a student chooses this option to demonstrate a core area, it is recommended the student audit/sit-in the relevant course, perhaps even doing some of the assignments.
- Take an advanced graduate level course in the corresponding area (marked with *, **, *** in PhD Part II Core). **Students without an undergraduate degree in CS** must obtain pre-approval for this option. If such a student has taken an equivalent course at another institution (with B grade or better), they must submit the detailed course syllabus and official transcript to the GCC for approval.

Core Depth and Breadth:

The student must take (4) 6000 level courses (see the PhD Core and Core requirements for the buckets).

- Depth: Two courses must be in one bucket.
- Breadth: Two courses from two other buckets
- The student must receive at least a total of 12 quality points in these 4 courses. (A=4, A-=3.67, B+=3.33, B=3, B-=2.67, etc.)

MS Thesis Option:

The thesis option requires at least six, and no more than nine credits of CSCI-6990 Master's Thesis. If more credits are taken, at most nine credits can be put in the plan of study. The thesis is supervised by a member of the faculty, and evaluated by a committee of three faculty members that includes the research supervisor. It is graded on a satisfactory/unsatisfactory basis and submitted to the Office of Graduate Education. The committee membership must be approved by the Office of Graduate Education prior to submission of the thesis. The student may work with a research supervisor who is not a CS faculty member, but the work must also be overseen by an advisor who is a member of the Computer Science Department faculty. The thesis should present an original research contribution, which is also the subject of a paper submitted for publication with the advisor as co-author.

Students must register for CSCI-6990 Master's Thesis prior to completion of the thesis, but normally earlier (even in the first semester of the program) as they begin exploratory research for the thesis. It is not necessary to take all six of the required CSCI-6990 credits in the same term. The Office of Graduate Education regulations in the Rensselaer Catalog for Master's Theses apply, including the following. Theses are graded either S (satisfactory) or U (failed). Most students should be involved in research each semester, taking at least one CSCI-6990 Master's Thesis credit under the supervision of their faculty advisor.

The completed thesis must be presented to the candidate's advisor for review at least one week before the Office of Graduate Education's MS thesis submission deadline. The candidate must deposit a copy of the thesis, together with the advisor's written approval of both content and format, at the Office of Graduate Education by the MS thesis submission deadline. The Office of Graduate Education must certify that the approved document has been deposited before the degree is awarded. Only work meeting the highest standards of integrity will be accepted for degree requirements at Rensselaer. Academic integrity is a requirement of continued good academic standing and for the awarding of a graduate degree.

In conjunction with the completion of the thesis, each student must complete an oral presentation to their faculty committee. For students completing a thesis, details can be found on page two of the [Record of Master's Thesis](#).

MS Project Option:

The project option requires at least three, and no more than four credits of project credits. Students completing a Master's project must register for CSCI-6980 Master's Project. CSCI-6980 is graded S or U.

Master's projects are completed under the guidance of a project advisor. The project advisor must be someone who has a permanent teaching appointment (tenure track or teaching faculty) to the Department of Computer Science. Students may also collaborate with a research supervisor who does not fit this description, as long as there is also a project advisor who does meet the criteria and bears ultimate responsibility for supervising the project.

Before starting the project, the student, in consultation with the project advisor, will prepare a project proposal. Project proposals are typically 1-2 pages. It is strongly recommended that dates, when particular milestones will be completed, are included, along with grading criteria. The project scope will be agreed upon by both the advisor and the student. The workload for completing a project will be similar to the workload for a full semester ADVANCED 3-4 credit course.

- All Master's projects must be presented as posters at Computer Science Department poster sessions. Poster sessions will be held in November and April, early enough to allow students to incorporate feedback from the poster sessions into their final projects.

Elective Courses

The student must select additional courses to bring the total number of credits in the degree program up to 30. Course credits must be chosen with the advice and approval of the Computer Science advisor and must constitute a coherent plan of study reflecting the student's goals in obtaining a degree in Computer Science. At least half of the 30 credits required for the MS degree must be offered by the Computer Science Department (i.e., courses numbered CSCI-xxxx). These courses must be at the 4000 or 6000 level. No more than 12 credits of the 30 required for the degree may be at the undergraduate (4000) level. Students may apply 4000 level courses only if the course is not offered at the 6000 level.

MS Plan of Study

The Plan of Study is the list of all the courses the student has taken or plans to take to fulfill the requirements for the degree. The Department, the Office of Graduate Education, and the Registrar's Office refer to the *Plan of Study* when they check whether students are fulfilling the degree requirements. When it comes time for a student to graduate, the Registrar's Office will compare the student's Plan of Study with their transcript to be certain that the right courses were taken.

Students can print out the [PDF version](#) and fill it out. Students will probably have to revise the Plan of Study several times, so it will be easier to make revisions to complete the form electronically. Always use the Plan of Study version within the link above. Older/outdated versions will not be accepted.

Students are encouraged to meet with the Computer Science GPA to prepare a draft of their Plan of Study (POS) before meeting with their advisor.

For a MS:

- Complete the MS Core Foundation requirements
- Complete the MS Core Depth and Breadth requirements. (6000-level courses)
- Either 3-4 credits of a master's project (CSCI 6980) or 6-9 credits of a master's thesis (CSCI 6990)
- A total of exactly 30 credits
- Graduate Skills
- No more than 12 credits at the 4000 level
    - All courses must be taken at the 6000 level, unless the course is only offered at the 4000 level.
- No more than six independent study credits
- At least 24 credits must be at RPI
- It is the student's responsibility to make sure their Plan of Study and Registration match every semester (course title, course number, credit hours, etc..) by the posted Add/Drop deadlines. Late add/drop requests are not permitted.

When listing the depth buckets courses, students should place a check in the "Required" column. Any courses and credits that are above and beyond what is required must not be listed on the plan of study.

Ph.D. Requirements

Degree Requirements

The PhD in Computer Science is the highest professional degree awarded by the Rensselaer Department of Computer Science. With it students may advance to university teaching and research, and to careers in industrial research, with a solid foundation of knowledge and an ability to carry through original investigations in Computer Science.

The major milestones in the PhD program are:
- Core Qualifying Exam   by end of third and fourth semesters
- Research Qualifying Exam   by end of second year
- Candidacy Exam   by end of fourth year / one year before defense
- Thesis Defense   when ready

Part-time students may take up to twice the time to meet these milestones.

Students enrolled in the MS program concurrently with the PhD program are expected to work toward the above milestones from the time they enter the graduate program, rather than waiting until the MS is complete.

Most students should be involved in research each semester, taking at least one research credit under the supervision of their faculty advisor. PhD students register for CSCI-9990 Dissertation, which will only be allowed to count towards the PhD degree (not an MS degree).

If at any point the student and/or advisor recognizes that the student will not meet their milestones as outlined above, the advisor and student will need to request an extension. See GPA for more information.

Course and Credit Requirements

Course and research credits must be chosen with the advice and approval of the Computer Science advisor and must constitute a coherent plan of study reflecting the student's goals in obtaining a PhD in Computer Science.

Students must complete 72 credits of coursework and research beyond the undergraduate degree. Of these 72 credits, at least 36 must be course credits and at least 24 must be research credits. If the student has a prior MS, a total of 48 credits beyond the MS must be taken, including at least 12 course credits and at least 24 research credits. At least two-thirds of the course credits must be at the 6000 level. Up to one third of the course credits may be 4000 level. Students cannot count courses that were used to fulfill BS requirements on their PhD Plan of Study.

The minimum average of all grades used for credit toward a PhD degree must be B. If a student's grades fall below a B average, the Office of Graduate Education may request that the department conduct a formal review to determine whether continuation is warranted. The student's adviser, committee, or department may recommend to the Office of Graduate Education that the student whose performance is unsatisfactory be dropped from the graduate program. A student who has accumulated two failing grades will be dropped from the graduate program.

Students who complete the required credits before completing their thesis work will need to continue to register for research credits to maintain full-time status.

Additional Requirements

- PhD students benefit from experience in public speaking and presenting technical ideas. Thus, all PhD students are required to make a public lecture (such as a conference presentation) while in the PhD program.
- Students are expected to attend the Computer Science Colloquium series on a regular basis. Full-time students must attend at least 50% of Computer Science Department colloquia offered during their first two years. Part-time students are exempt from this requirement. More details are available under Colloquium Attendance Requirement.
- All PhD students must enroll in the Graduate Skills course: This is a 1 credit Graduate Skills class: "CSCI 69xx Graduate Skills", which is only offered in the fall. This course should be listed on the graduate Plan of Study, and must be taken in the first year of the PhD.

Students reading these requirements should also read the regulations laid down by the Graduate School, in the latest *Rensselaer Catalog.*

PhD Core Qualifying Exam

During the first few semesters, the student focuses on obtaining a breadth of knowledge in computer science. Full-time students must complete all requirements for the core qualifying examination by the end of their third and fourth semesters (see details below). Part-time students may take up to six semesters to complete the core qualifying exam requirements. The timing is measured from the student's semester of PhD program entry, regardless of whether the student is concurrently enrolled in another degree program

or entered from another degree program. The only exception is that students in the accelerated BS-PhD program may begin the timing when they complete 128 credits.

Students should consult with their faculty advisor regarding both the requirements of their research project(s) and their plans for preparation for the core qualifying exam. When ready, students will need to record their courses and grades using this [form](). Once completed and signed by both the student and advisor, it needs to be returned to the department's GPA for review and processing.

To pass the core qualifying exams, students must:

- Demonstrate competence in the core areas of Algorithms, Systems, and Software/Programming at the undergraduate level. Two of the three Core Foundation areas must be fulfilled by the end of the student's third semester. The third area must be met by the end of the student's fourth semester.

- Meet grading and distribution criteria in 5 graduate courses (at the 6000 evel). The distribution criteria are that three courses be in the students primary area and two courses outside the primary area. The grading criteria are that the student must receive 18.5 quality points (A=4, A-=3.67, B+=3.33, B=3.00) in the 5 courses (for example A,A,A-,A-,B+).

Core Qualifying Exam Details

Part I - Core Foundation: Students must demonstrate competence at the advanced undergraduate level in the core areas of CS.
1. Algorithms: Design and Analysis of Algorithms
2. Systems: Operating Systems **
3. Software/Programming: Programming Languages

*** Starting Fall 2025 students may alternatively take Computer Architecture or Advanced Operating Systems to fulfill this requirement.*

Students may demonstrate core competence in one of 3 ways.

- Take the course at the undergraduate level and get B or better.
- Take the final exam of the course and get B or better on the final. Students should coordinate this option with the Graduate Program Administrator who will coordinate the final exam with the relevant instructor. If a student chooses this option to demonstrate a core area, it is recommended the student audit/sit-in the relevant course, perhaps even doing some of the assignments.
- Students **with** an undergraduate degree in Computer Science are permitted to take a starred course (*,*,***) to demonstrate competence in the Core Foundation area without petitioning the GCC for approval.
- Students **without** an undergraduate degree in Computer Science: If a student has taken an equivalent course at another institution (with B grade or better), they must petition the GCC by submitting the detailed course syllabus and official transcript to the GCC for approval to take an advanced graduate level course in the corresponding depth bucket (marked with *, **, and *** in Part II Core). Pre-approval from GCC is required for this option. Students must provide an official transcript and course syllabus to the Graduate Program Administrator highlighting the course being used to demonstrate the background with a grade of B or better.

Part II - Core Depth and Breadth: Students must demonstrate advanced knowledge at the 6000 level. To satisfy this depth requirement, students must take 5 courses in designated buckets, with 3 courses in their primary research area bucket (depth) and two courses from two other buckets (breadth). The student must receive at least 18.5 quality points in the 5 courses to satisfy the depth requirement.

1. **Theory/Algorithms (T).** (Selected courses demonstrate Algorithms core.)
2. **Systems, Software and Security (SSS).** (Selected courses demonstrate Software/Programming core foundation and Systems core foundation.)
3. **AI/ML/Data (AMD)**
4. **Mathematics and Numerical Computing (MNC)**
5. **Robotics/Vision/Graphics (RVG)**

Note:
1. The Part I and Part II Core requirements may be fulfilled separately. For example, a student takes Design and Analysis of Algorithms with a B, 3 RVG courses with A, and 2 SSS courses with A. Assuming the student chose the SSS course appropriately.
   ○ Core Foundation is demonstrated by Design and Analysis of Algorithms and the 2 SSS courses.
   ○ Core Depth and Breadth is demonstrated by the 3 RVG + 2 SSS courses.

(The below lists may be updated periodically to reflect new(er) approved courses)

Theory/Algorithms (T):

- CSCI 6220   Randomized Algorithms*
- CSCI 6510   Distributed Systems and Algorithms*
- CSCI 6040   Approximation Algorithms*
- CSCI 6450   Principles of Program Analysis
- CSCI 6100   Machine Learning From Data
- CSCI 6230   Cryptography and Network Security I
- CSCI 6240   Cryptography and Network Security II
- CSCI 6250   Frontiers of Network Science
- CSCI 6560   Computational Geometry
- CSCI 6050   Theory of Computation*
- CSCI 6610   Computing and Quantum Computing
- ECSE 6530   Information Theory and Coding
- MATP 6620   Combinatorial Optimization and Integer Programming
  * course can be used to satisfy Part-I Core Foundation Algorithms.
  Note: students may petition special topics courses for this area with advisor support.

  Special topics courses that have already been approved to satisfy this area are:
  - Network Resilience (CSCI)
  - Economics and Computation (CSCI)
  - Algorithmic Game Theory (CSCI) *
  - Quantum Computer Programming (ECSE)
  - Network Flows (CSCI)
  - Algorithm Design & Modern ML (CSCI) *
  - Designing Economic Algorithms (CSCI)
  - Distributed Quantum Computing (CSCI)
  - Computational Aspects of Online Learning (CSCI)
  - Designing Economics Algorithms (CSCI)

Systems, Software and Security (SSS):

- CSCI 6190   Decentralized AI (AI & Blockchain)
- CSCI 6360   Parallel Computing**
- CSCI 6450   Principles of Program Analysis***
- CSCI 6460   Large-Scale Programming and Testing
- CSCI 6230   Cryptography and Network Security I
- CSCI 6240   Cryptography and Network Security II
- CSCI 6500   Distributed Computing Over the Internet***
- CSCI 6310   Networking in Linux Kernel
- CSCI 6280   Graph Mining
- CSCI 6510   Distributed Systems & Algo
- ECSE 6600   Internet Protocols
- ECSE 6730   Fault-Tolerant Digital Systems
  ** course can be used to satisfy Part-I Core Foundation Systems.
  *** course can be used to satisfy Part-I Core Foundation Software/Programming.
  Note: students may petition special topics courses for this area with advisor support.

  Special topics courses that have already been approved to satisfy this area are:
    - Software Verification (CSCI)
    - Security and Privacy of Machine Learning (CSCI)
    - Network Security and Defense (CSCI)
    - Programming in Haskell (CSCI)
    - Quantum Programming and Applications (CSCI)
    - Cloud Computing (CSC)
    - Quantum Computer Systems (CSCI)
    - Frontiers in Blockchain Research (CSCI)
    - Hardware Security (CSCI)

AI/ML/Data (AMD):

- CSCI 6100   Machine Learning From Data
- CSCI 6190   Decentralized AI (AI & Blockchain)
- CSCI 6390   Data Mining
- CSCI 6110   Computational Social Processes
- CSCI 6130   Natural Language Processing
- CSCI 6350   Data Science
- CSCI 6400   Xinformatics
- CSCI 6340   Ontologies
- CSCI 6250   Frontiers of Network Science
- CSCI 6140   Machine Learning and Optimization
- CSCI 6370   Data & Society
- CSCI 6120   Computational Finance
- CSCI 6270   Computational Vision
- CSCI 6160   Reinforcement Learning
- CSCI 6240   Time Series Analysis
- CSCI 6280   Graph Mining
- ECSE 6530   Information Theory and Coding
- ECSE 6610   Pattern Recognition
- ECSE 6850   Intro. To Deep Learning
- ISYE 6100   Time Series Analysis
  Note: students may petition special topics courses for this area with advisor support.

  Special topics courses that have already been approved to satisfy this area are:

- Information retrieval (COGS)
- Economics and Computation (CSCI)
- Trustworthy Machine Learning (CSCI)
- Machine Learning Bioinformatics (CSCI)
- Safe Autonomy (CSCI)
- Projects in Machine Learning (CSCI)
- Network Resilience (CSCI)
- AI for Conservation (CSCI)
- Machine Learning Seminar (CSCI)
- Deep Learning on Graphs (CSCI)
- Neurosymbolic Knowledge Graphs (CSCI)
- AI for Drug Discovery (CSCI)
- AI for Science (CSCI)
- Large Language Models (CSCI)
- Decision Making under Uncertainty (CSCI)
- Sense Making and Computation (CSCI)
- Deep Learning (CSCI)
- Computational Creativity (ECSE)
- Distributed Optimization and Learning (ECSE)
- Knowledge Graph-Powered Hybrid AI (CSCI)
- Stochastic Optimization and Reinforcement Learning (MATP)
- Frontiers in Blockchain Research (CSCI)
- Computational Aspects of Online Learning (CSCI)

Mathematics and Numerical Computing (MNC)
- CSCI 6800   Computational Linear Algebra
- CSCI 6820   Numerical Solution of Ordinary Differential Equations
- CSCI 6840   Numerical Solution of Partial Differential Equations
- CSCI 6860   Finite Element Analysis
- CSCI 6140   Machine Learning and Optimization
- CSCI 6120   Computational Finance
- MANE 6660   Fundamentals of Finite Elements
- MATP 6600   Intro. To Optimization
- MATP 6610   Computational Optimization
- MATP 6620   Combinatorial Optimization and Integer Programming
- MATP 6640   Linear and Conic Optimization
- MATH 6660   Stochastic Methods & Processes
  Note: students may petition special topics courses for this area with advisor support.

  Special topics courses that have already been approved to satisfy this area are:
  - Distributed Optimization and Learning (ECSE)

Robotics/Vision/Graphics (RVG)
- CSCI 6490   Robotics II
- CSCI 6270   Computational Vision
- CSCI 6530   Advanced Computer Graphics
- CSCI 6550   Interactive Visualization
- CSCI 6560   Computational Geometry
- ECSE 6470   Robotics I
- ECSE 6650   Computer Vision
- ECSE 6620   Computer Vision for Visual Effects
- ECSE 6630   Digital Image and Video Processing
- ECSE 6640   Digital Picture Processing
  Note: students may petition special topics courses for this area with advisor support

Special topics courses that have already been approved to satisfy this area are:
- Safe Autonomy (CSCI)
- AI for Conservation (CSCI)

PhD Research Qualifying Exam

Year 2 is devoted to further research exploration, selection of a doctoral committee, and the Research Area Qualifying Exam. The Research Qualifying Exam must be passed by the end of the second year in the PhD program.

A student's research is overseen by their research supervisor and/or CS advisor. Students may work with a research supervisor outside the CS Department; however, a CS faculty member must also oversee the work as the student's CS advisor. Both the research supervisor and CS advisor will serve on the student's doctoral committee. The chair of the doctoral committee is typically the research supervisor and/or CS advisor and must be a full-time, tenure-track faculty member with an appointment in the CS Department.

The research qualifying exam will be supervised by a preliminary committee consisting of the advisor and at least two other faculty members. The membership of the preliminary committee is informal and does not have to be approved by the Office of Graduate Education. The preliminary committee will be chosen based on who is likely to become a member of the doctoral committee, but when the time comes to choose the doctoral committee members, the choice need not be constrained by the membership of the preliminary committee. The preliminary committee will decide what a student must do for the research qualifying exam and whether the student passes or fails the exam. To pass the research qualifier the student must present a survey-style oral talk to the committee. The purpose of the talk is for the student to demonstrate a thorough understanding of the related research and general area in which their work sits, and to place their research in this larger context, including citations to all related work where relevant.

The basis for the survey-talk can be one of the following:

1. Approximately 12 papers selected by the student and approved by the committee. The student should discuss the broad research field, summarize the contributions that have been made in this field and the interesting open questions. If applicable, the student should relate various contributions in this field to their proposed research topic.

2. A conference paper or a journal paper that has been published or is under submission, in which the student is a main co-author. This paper should be pre-approved by the committee. The student will expand on and present the related work surrounding the paper. During the talk the student should discuss the related work in the context of their contribution and precisely articulate what is novel about their contribution in the context of this related work.

For students taking path (2), the presentation *should not be a presentation of the students' work and methods,* for evaluation by the committee. That will be the role of the candidacy exam. The purpose is for

the student to demonstrate a thorough understanding of the related research and area in which their work sits, and to place their research in this larger context. As a concrete example, if the student's paper is on a new mathematical model of network formation for a particular application X, the presentation could:

- Identify the general area: network modeling.
- Discuss a comprehensive collection of network modeling methods that exist and what kinds of networks they apply to.
- Explain why none of those methods apply to the student's application X.
- Summarize the paper's result explaining that it does apply to application X.

When the research qualifying exam has been completed, the committee members should complete and sign the Research Qualifying Exam Form and submit the form to Graduate Program Administrator at gpa@cs.rpi.edu or morizt@rpi.edu.

Full-time students who have not passed the Qualifying Exam within the specified number semesters of entering the Ph.D. program may face dismissal from the program. Extensions to this deadline must be requested from the Graduate Curriculum Committee prior to the end of the student's 4th semester.

Choosing a Doctoral Committee

The PhD thesis is supervised by a single faculty advisor and overseen by a doctoral committee with at least four members. Students may choose more than four members for their committee if they wish. At least three of the members, including the committee chair (the student's primary advisor) must be Computer Science Department (or affiliated) tenure or tenure track faculty. Clinical, research, and emeritus professors do not count for this purpose. One member must be an outside member.

Whenever possible, "outside" shall be "outside the university," but in all cases this person must come from outside the Computer Science Department (affiliated faculty are not considered outside members). The outside member is expected to be a recognized authority on the subject of the dissertation and cannot be a recently graduated student, previous advisor, or close collaborator of the student or the advisor.

After students have chosen the members of their committee, they must fill out a Nomination of Doctoral Committee form. Students must get all committee members to sign the form.

For any committee members who are not RPI faculty members, you also need:
1. The committee member's curriculum vitae. This must be included with the nomination of doctoral committee form.
2. The student's advisor must send a draft letter to the Graduate Program Administrator (gpa@cs.rpi.edu or morizt@rpi.edu) detailing the qualifications and suitability of the proposed committee member for your PhD research topic. The GPA will work with the Graduate Program Director on the letter and ask for clarifications as needed.

After the form is complete, including original signatures of the committee members, it must be delivered to the Graduate Program Administrator (gpa@cs.rpi.edu or morizt@rpi.edu). The GPA will have the GPD sign it. After the form has been signed, the GPA will put a copy in the student's file and send the original to the Office of Graduate Education. Digital or electronic signatures are acceptable, but must all be on the same form.

If a student needs to change their committee membership, the student may submit another *Nomination of Doctoral Committee* form or the student may prepare a memo to be submitted by the department chair to the Graduate School.

If a member of a student's committee retires or otherwise leaves Rensselaer before the student's graduation, the person may continue to count as one of the full-time committee members if
1. The student graduates no more than one year after the professor's departure.

and
2. The department head requests an extension from the Graduate School.

Candidacy Exam

Working with his or her advisor, the student develops a detailed understanding of the chosen research area and prepares a research proposal. A student should plan for their candidacy proposal in their 3rd or 4th year, and must be completed no later than at least one year before their planned defense.

Additional information about the candidacy exam can be found in the PhD requirements.

The Candidacy Exam is an oral exam focusing on a thesis proposal and administered by the student's doctoral committee. The student begins by presenting the thesis proposal and then is questioned by the committee. Other faculty may attend the exam, but do not vote on whether the student passes the exam.

The committee form must be signed and approved by the Office of Graduate Education **before** the exam is scheduled. If the committee membership is changed sometime between the candidacy and the defense, the new committee must be approved by the Graduate School, but the candidacy exam with the old committee will still be valid.

Prior to taking the exam, the student must have fulfilled the following requirements:
● Plan of Study approved by the Graduate School
● GPA of at least 3.0
● Doctoral Committee approved by the Graduate School

Before the candidacy exam, the student must prepare a [Record of Candidacy Examination Form](). After the candidacy exam, the advisor must check "Passed" or "Failed" and all members of the committee must sign the form. The completed form must be given to the Graduate Program Administrator (gpa@cs.rpi.edu or morizt@rpi.edu) after that, and the GPA will get the Graduate Program Director signature and send the form on to the Graduate School.

The Graduate School will issue a Candidacy Certificate when a student has passed the candidacy exam and met the requirements listed above. When some requirements have not been met, the Graduate School will send the student a letter indicating what remains to be done.

Students who wish to hold their exam in the department's conference room, can ask Shannon Carrothers to reserve it. Often rooms can be reserved online at: https://info.rpi.edu/room-reservations

Students should prepare a talk that will last 30-45 minutes without questions. The committee members may ask questions throughout the exam, so the exam may last up to two hours.

In addition to the oral exam, students must prepare a written candidacy proposal. This should include the following topics:
- The proposed research area, including what work has been done, what challenges exist, what the thesis contribution will be.
- What work the student has already completed. This may require several chapters.
- What additional work will be completed before graduation.

Some tips for preparing the proposal:
- Although there are no requirements for the format of the candidacy proposal, there are requirements for the final thesis, and students may want to use those guidelines. That way, material from the candidacy proposal may be used in the final thesis for reformatting. The thesis guidelines are published in the [Rensselaer Writing Manual for Dissertations and Theses](#). The document [Dissertation/Thesis Formatting Checklist](#) may also be helpful.
- Students should check with their advisor and other committee members throughout the preparation of the proposal to ensure that their expectations are being met.
- Students can ask committee members for copies of good candidacy proposals which have been submitted to them in the past.
- Students may find it helpful to write notes about papers while reading and record the bibliographic details as well as notes about the content. That way, when writing the literature review, the relevant information will already be collected.

PhD Dissertation and Defense

After the candidacy exam has been passed, the student must complete the proposed research, write the dissertation, and defend the dissertation, all under the supervision of the student's advisor. Throughout this time, the student should continue to discuss progress and results with committee members to reduce the possibility of "surprises" during the defense.

The dissertation defense is an oral examination that includes a presentation by the student of the major results in the dissertation. A student's doctoral committee establishes the specific format for this examination. The presentation of research results by the student is open to the public.

Evaluation of Student Progress
The progress toward the degree of each graduate student in the department is reviewed every year by their advisors and the Graduate Program Director to provide useful feedback to the student. At the end of each spring semester, all graduate students complete a Doctoral Student Yearly Review (DSYR) form that records their progress towards their degrees (e.g., milestones completed, courses taken, papers published, talks, major results, etc.) and sets goals for the next year. The faculty advisor meets with the student to review this form, make necessary changes, and evaluate whether the progress has been satisfactory or not. After the meeting, the form and an updated plan of study is sent to the Graduate Program Director for additional review. If a student's progress is deemed unsatisfactory for two years in a row, the student is subject to dismissal from the PhD program. Note that students who enter the PhD program with a prior MS degree are expected to make faster progress through the PhD program than students who enter the program with no prior MS.
The defense should take place at least one year after the candidacy exam, in order to allow time to incorporate feedback from the candidacy exam. Students who wish to take the defense less than one year after the candidacy must contact the Graduate Program Director for approval.

The student is responsible for making sure that the dissertation is prepared according to the Office of Graduate Education regulations. The [Thesis Writing Manual](#) defines these regulations.

PhD Plan of Study

The Plan of Study is the list of all the courses the student has taken or plans to take to fulfill the requirements for the degree. The Department, the Office of Graduate Education, and the Registrar's Office refer to the *Plan of Study* when they check whether students are fulfilling the degree requirements. When it comes time for a student to graduate, the Registrar's Office will compare the student's Plan of Study with their transcript to be certain that the right courses were taken.

Students can print out the [PDF version](#) and fill it out. Students will probably have to revise the Plan of Study several times, so it will be easier to make revisions if you complete the form electronically. Always use the Plan of Study version within the link above. Older/outdated versions will not be accepted.

Students are encouraged to meet with the Computer Science GPA to prepare a draft of their Plan of Study (POS) before meeting with their advisor.

For a PhD:
- A total of exactly 72 credits
- Complete the PhD Core Foundation requirements
- Complete the PhD Depth/Breadth requirements (All 6000 level)
- At least 36 credits of coursework
- At least 24 dissertation credits
- At least 2/3 of the credits for courses must be 6000 level
- No more than 15 credits at the 4000 level
    - All courses must be taken at the 6000 level, unless the course is only offered at the 4000 level.
- No more than nine independent study credits (no more than six for students counting a Master's from another school)
- At least 48 credits taken at RPI (not transfer credits)
- It is the student's responsibility to make sure their Plan of Study and Registration match every semester (course title, course number, credit hours, etc..) by the posted Add/Drop deadlines. Late add/drop requests are not permitted.

Any courses and credits that are above and beyond what is required must not be listed on the plan of study.

PhD Plan of Study for students with MS from another school
Students who earned a Master's from another school should list the MS on their Plan of Study, and list it as counting for 24 credits. An additional 48 credits must then be listed to bring the total to 72 for the PhD. The 24 for the Master's are considered course credits, so the additional 48 credits should include at least 12 course credits and at least 24 dissertation credits. The 24 credits will count towards your Plan of Study as credits only, not specific courses.

Pursuing MS and PhD degrees at RPI

Students pursuing both an M.S. and a Ph.D. should file separate Plan of Study forms for each degree. In this case, students may list all course credits from an RPI Master's on the PhD Plan of Study. MS thesis and project credits do not count as either course or dissertation credits for the PhD. See your GPA for a detailed process. A new Plan of Study and Change of Status form is required to be approved and on file before proceeding.

Plans of Study (MS & PhD)

Creating/Making Changes to your Plan of Study
Prior to creating or making changes to your Plan of Study (POS) you will need to meet with the department's GPA, then with your advisor.

Student Responsibility
It is the student's responsibility to make sure their Plan of Study and Registration match every semester (course title, course number, credit hours, etc..) by the posted Add/Drop deadlines. Late add/drop requests are not permitted.

Extra credits
The total number of credits listed should be 72 for the PhD and 30 for the MS. It is likely that a student will register for more than that number of credits while a student here, but these extra credits should not be listed here. Only the credits that are needed to count toward the degree should be listed. If needed to reach exactly 72 credits, fewer than the total number of courses may be listed. For example, it is okay to list only 2 credits of a 3-credit course. Courses may be counted for the core qualifying exam or research qualifying exam even if they are not listed on the Plan of Study.

Semester and Year
The semester section is divided into two columns. In the "Year" column, write the year, such as 2018. (Some students make the mistake of writing "1" for their first year.) In the "F, S, U" use one of the letters to indicate whether the credits will be taken in the Fall, Spring, or sUmmer.

Date of Graduation
Your expected date of graduation (with MS or PhD) must also be included on your Plan of Study.

Completing the form
Students must meet with the department's GPA first. On the Plan of Study form, the course number must be listed with subject prefix (e.g. CSCI) and course title. The form must be signed by the student, the advisor, and the Graduate Program Director. Signed forms must be left with the Graduate Program Administrator who will get the Graduate Program Director's signature. Once the GPD has signed the Plan of Study will then be sent to OGE. If the courses the student takes are different from those listed on the Plan of Study, a revised Plan of Study form must be filed. A revision is not needed every time a change is made, but the Plan of Study will need to be up to date any time a request is submitted to the Office of Graduate Education, and immediately prior to graduation. If the only change is the date of graduation, but the courses taken are unchanged, a new Plan of Study is not needed.

Colloquium Attendance Requirement

During their first two years in the graduate program, full-time Computer Science graduate students are required to attend at least 50% of those offered. After two years, attendance will no longer be tracked, but graduate students are encouraged to make colloquium attendance a habit throughout their time in the program.

The first two years will be counted based on the date the admission to the graduate program is effective, even if the student is enrolled in the undergraduate program at the time. There is one exception: students in the BS-PhD accelerated program will be counted starting after they complete 128 credits.
Students will be expected to attend at a rate of eight colloquia per semester, or 50% of those offered.

Students who attend fewer in a given semester will be warned during their annual review that they need to increase their attendance.

Students who are enrolled in the graduate program for less than two years will be expected to attend a total number of colloquia equal to eight times the number of semesters they are enrolled, or 50% of those offered during the time they are enrolled.

Only Computer Science Department colloquia, listed on the department's events page can be counted, this includes CS Candidacy and Dissertation defenses. Talks offered by other departments, talks specific to a research group, or department seminars do not count.

Students may sometimes have schedule conflicts which make it impossible to attend 8 per semester or 50%. If attendance is slightly below the requirement one semester, it can be made up through additional attendance during the following semester. If there are many conflicts, it may be possible to adjust the requirements. At the end of the semester, the student should contact the Graduate Program Administrator (gpa@cs.rpi.edu or morizt@rpi.edu) with the details of the conflicts.

Part-time students are not required to fulfill the colloquium requirement, but they are encouraged to attend talks on campus and/or at their workplace as much as they are able. Speak with your GPA on how to record attendance.

Registering for Independent Study

To register for an independent study, students do not register online, but instead, they should complete an Independent Study form. Signatures are needed from the independent study supervisor, the research advisor, and the computer Science Department's Graduate Program Director. After the form is completed, send it to the department's GPA. The GPA will process, retrieve the GPD's signature and send it over to the Registrar's Office for processing. The deadline is the same as the deadline to add classes.

Full-Time Status

Many students need to maintain full-time status. Full-time status is required for aid eligibility and for student visas. The minimum number of credits per semester to still maintain full-time status is 9 for

teaching assistants and research assistants, all others are 12 credits. The maximum number of credits without paying additional tuition is 16. These rules apply to the Fall and Spring semesters. Students are not required to take additional credits during the summer to maintain full-time status.

Many students take two or three classes per semester and then fill in the rest of the needed credits with research. For example, if a student needs to take at least 12 credits, they might take a 4-credit class, two 3-credit classes, and two research credits. The number of research credits taken during a given semester does not necessarily correspond to the amount of research that will be done during the semester. Students will receive a grade of IP (in progress) for all research credits until completing the degree, at which time these grades will be converted to S (satisfactory). Thus, what matters is not how much research is done in a particular semester, but that by the time the student is finished they have completed all the research and have registered for as many research credits as needed. Because it doesn't cost extra to take 15 credits, and because students don't have to do extra work if they register for extra research credits, students may want to register for 15 credits to get as many credits as possible out of the way.

Of course, the bigger challenge is getting the research done, and often students complete all their credits before they complete their research. In such a situation, students must continue to register for at least 12 credits per semester (or 9 for RA/TAs). Usually, students in this situation register for additional research credits rather than take classes. When they graduate, they will receive a grade of S (satisfactory) for those research credits used toward the degree. Any extra credits will remain with a grade of IP (in progress). The maximum number of research credits used toward an MS is MS Project 3-4 credits, MS Thesis 6-9 credits. The total number of credits used for the degree (courses plus research) will be 30 for the MS and 72 for the PhD (or 48 for students with a prior MS).

Students must either register for every Fall and Spring semester or apply for a leave of absence. Part-time students must register for at least one credit per semester and full-time students must register for at least 9 crs (TA/RA). Students who do not register for a semester will be removed from the program. See GPA for Leave of Absence procedure.

Residence and Time Limit

Refer to RPI Catalog: https://catalog.rpi.edu/content.php?catoid=33&navoid=885

Adding Computer Science to current non-CS program

If you are currently in a non-Computer Science program and planning to add Computer Science to your current program, you must provide the below documents to Tracy Hoffman (morizt@rpi.edu). Your documents will then be reviewed by our Admissions Committee. Before submitting materials you are required to have a Computer Science Research Advisor.

- ➢ Change of Status form
- ➢ Current Resume
- ➢ Statement of Purpose
- ➢ Transcripts

➢ Valid GRE test scores (if required)
➢ (2) letters of recommendation that will speak to your abilities as a Computer Scientist
  ○ One letter from your current non-CS advisor
  ○ One letter from your CS advisor. This letter must also include project/thesis milestones.
➢ Plan of Study: to be created between you and your CS Research Advisor. See the GPA for current Plan of Study versions.

If you are a current MS non-CS major, looking to add a PhD then you MUST apply through the traditional application system (SLATE, Graduate Admissions). Also, if you're looking to drop your current program to become a full-time CS student then you must apply through SLATE as well.

Submitting Your Thesis

Rensselaer's Office of Graduate Education (OGE) and the Rensselaer Libraries have transitioned to an electronic-only submission process for theses and dissertations for all graduate students. This process now streamlines many of the former paper submission steps including being eco- and student-friendly!

For step-by-process: https://graduate.rpi.edu/academic-progress/submit-your-thesis-dissertation

Ph.D. Thesis Defense

When your thesis is complete, you must defend it in a public exam conducted by your committee. You will need to:

● Schedule the defense for a time when all committee members can be present.
  ○ Reserve a room using this reservations link
  ○ To reserve a Computer Science conference room, contact a department staff member.
  ○ For questions about department room reservations, contact Shannon Carrothers (bornts@rpi.edu) or Tracy (morizt@rpi.edu)
● Send a copy of your abstract to Tracy Hoffman (morizt@rpi.edu) so that she can forward it to the department faculty and grad students. Include date/time/location of defense.
● Fill out a Record of Dissertation Exam form. After your defense, have your committee members sign the form.
● Have your committee members sign your thesis cover pages.

The defense should occur at least one year after the candidacy exam. Students who wish to defend less than one year after the candidacy must contact the Graduate Program Director for approval.

Graduate Dismissal Policy

Graduate Academic Suspension and Dismissal Policy: https://catalog.rpi.edu/

Graduate Tuition Policy

Funding Information: https://graduate.rpi.edu/funding-and-fellowships/internal-funding

Teaching Assistants

TA Handbook: https://rpi.app.box.com/s/zgv3kzzgnysuf5vqtnpqq9j4rmqgev7k

Guidelines for TA Appointments: https://rpi.app.box.com/s/y49mpuf02u60j032bzxbdcf1byf74gnc

Travel Reimbursement for Conferences

If you are presenting a paper or poster at a conference, your expenses can usually be reimbursed partially by your advisor and partially by the Office of Graduate Education (OGE). The Computer Science Department and the School of Science do not offer travel funding except in rare special circumstances.

To request OGE funding, complete a Graduate Student Professional Meeting Travel Request. You'll need to include a copy of your invitation letter from the conference, as well as an abstract of the paper or poster you will be presenting.

After you have completed the form, attached the required documents, received your advisor's signature, bring the form to Tracy Hoffman as she will process and send it to the department's Business Administrator. The Office of Graduate Education will fund no more than one conference per student per academic year. The maximum amount the Office of Graduate Education may contribute is $250.

This policy is subject to change based on availability.

Prior to making any travel arrangements, including conference registrations, hotel reservations, etc... you must request a Concur profile. Reach out to Shannon Carrothers (bornts@rpi.edu) to create your Concur Profile.

After you have attended the conference, submit your receipts in Concur for your reimbursement. All travelers must abide by RPI's Travel Policy & Procedures.

Childbirth Accommodation, Parental Accommodation, and Family Leave Policy for Graduate Students

For the most current and detailed information:
https://rpi.app.box.com/s/4vjgowzt8t1zsf8mcf186e22w2jpyufr

USEFUL LINKS