

# Carnegie Mellon University

## The Robotics Institute

THE ROBOTICS DOCTORAL PROGRAM  
<http://www.ri.cmu.edu/>

HANDBOOK  
2018-2019

Robotics Institute  
Carnegie Mellon University  
Pittsburgh, PA 15213



*last revised August 22, 2018*

**Note: The information contained in this graduate handbook focuses on the resources and locations available at the Carnegie Mellon Pittsburgh Campus.**

## Table of Contents

<b>Welcome</b>	pg. 5
<b>Mission or Philosophy</b>	pg. 6
<b>Degrees Offered</b>	pg. 7
<b>Graduate Student Handbook</b>	
University Policies & Expectations	pg. 8
Carnegie Mellon Statement of Assurance	pg. 8
The Carnegie Mellon Code	pg. 9
<b>Departmental Resources</b>	
Departmental Personnel	pg. 10
Departmental Information	pg. 11
Department Directory	
Mail	
Graduate Student Travel	
Copy, Printing, Scanning	
Conference & Classrooms	
Conference & Classrooms Audio/Video Support	
Creative Media	
Emergency Situations	
Phone Usage & Information	
RoboOrg	
SCS Computing Guide	
Who to See for What	
Department Approach to Press & Media Relations	
Women@SCS	
<b>Degree Attainment</b>	
Statute of Limitations	pg. 13
Full-time/Part-time Status Requirements	pg. 13
<b>Course of Study</b>	
Overview	pg. 13
Preparation	
Course Qualifiers	pg. 14
Core Course Qualifier	
Specialized Course Qualifier	
Waivers	
Research Qualifier	pg. 16
Master's Writing and Speaking	
Thesis	pg. 18
Robotics Orientation	pg. 19
Advising and The Matching Process	pg. 20
Timeline of Study	pg. 20

Review of Progress	pg. 21
Master's Degree in Robotics	pg. 22
Core Courses	pg. 22
Perception Core Courses	
Cognition Core Courses	
Action Core Courses	
Math Foundations Core Course	
Research Qualifier	pg. 23
Research Skills	
Speaking	
Writing	
Teaching (Non-Native Speakers of English)	
Independent Study	pg. 25

### Resources and Regulations Governing Research at Carnegie Mellon

Grades & Grading	pg. 25
Academic Integrity	pg. 26
PhD Criteria for Advancement to Candidacy	pg. 26
Internship Opportunities	pg. 26
Graduation and Certification	pg. 26
Leave of Absence	pg. 27
Withdrawal of Degree	pg. 27
Enrollment Verification	pg. 27
Directed Research	pg. 27

### Additional Department Policies/Protocol

Assistance for Individuals with Disabilities	pg. 28
Summary of Graduate Student Appeal & Grievance Procedures	pg. 28
Safeguarding Educational Equity Policy Against Sexual Harassment and Sexual Assault	pg. 29
Maternity Accommodation Protocol	pg. 29
Change of Address	pg. 29
"Grandfather" Policy	pg. 30

### Financial Support

Stipends	pg. 30
Summer Stipend	
Tuition	pg. 30
Fellowships	pg. 31
Consulting and Outside Employment	pg. 31
Semester Breaks and Vacations	pg. 31
Taxes	pg. 32

### Financial Aid Information

Financial Assistance	pg. 32
University Financial Aid	pg. 32

Estimates of the Time Allocated to Each Component of the Ph.D. Program	pg. 33
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Appendix A - University Resources for Graduate Students and the WORD, Student Handbook

**Key Offices for Graduate Student Support**

Office of the Vice Provost for Graduate Education	pg. 34
Office of the Dean of Student Affairs	pg. 35
Center for Student Diversity & Inclusion	pg. 35
Assistance for Individuals with Disabilities	pg. 36
Eberly Center for Teaching Excellence & Educational Innovation	pg. 36
Carnegie Mellon Ethics Hotline	pg. 36
Graduate Student Assembly	pg. 37
Intercultural Communication Center (ICC)	pg. 37
Office of International Education	pg. 37
Veterans and Military Community	pg. 38

**Key Offices for Academic & Research Support**

Computing and Information Resources	pg. 38
Research at CMU	pg. 38
Office of Research Integrity & Compliance	pg. 38

**Key Offices for Health, Wellness & Safety**

Counseling & Psychological Services	pg. 39
Health Services	pg. 39
Campus Wellness	pg. 39
University Police	pg. 40

<b>The WORD</b>	pg. 40
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## Welcome

We are proud of the open, friendly culture that has been the hallmark of the Robotics Institute since its inception. Faculty keep their office doors open to encourage informal meetings with students and colleagues. Graduate students organize frequent department-wide social activities, ranging from Friday afternoon get-togethers to rock climbing trips. And the department's strong support for collaboration creates an ideal environment for world class robotics research.

The Robotics Institute is an intellectually diverse, multi-disciplinary department. The Institute's faculty and students come from a wide variety of backgrounds and represent many unique areas of expertise. This diversity stems from the multi-disciplinary nature of the robotics, which encompasses aspects of computer science, mechanical engineering, electrical engineering, psychology, and many other disciplines.



The Robotics Institute is an international leader in robotics education. The world's first Robotics PhD program was founded here in 1988 with the goal of providing graduate students with the knowledge, experience, and skills to become the next leaders in robotics research and education. Graduates from the PhD program have taken on roles ranging from faculty in top universities, to designing and controlling Mars rovers, to develop Google's self-driving cars.

Since the start of the Robotics PhD program, we have steadily grown and expanded our programs of study. Today, we offer diverse opportunities at all levels of education - from masters programs and an undergraduate minor for Carnegie Mellon students down to the K-12 level, where our renowned programs, workshops, and summer classes inspire and educate the next generation of roboticists.

*While this handbook is specific to your academic experience in the department, there are several other resources and offices graduate students are encouraged to consult during their tenure at Carnegie Mellon University. Information about The Word, the student handbook, the Office of the Assistant Vice Provost for Graduate Education, the Office of the Dean of Student Affairs and others are included in Appendix A of this handbook.*



## Mission or Philosophy/Brief Overview of Department

Even when robotics technologies were relatively primitive, their potential role in boosting the productivity and competitiveness of the United States was foreseen in the evolving global marketplace. The Robotics Institute at Carnegie Mellon University was established in 1979 to conduct basic and applied research in robotics technologies relevant to industrial and societal tasks. Seeking to combine the practical and the theoretical, the Robotics Institute has diversified its efforts and approaches to robotics science while retaining its original goal of realizing the potential of the robotics field.



## Degrees Offered

### PhD Programs

**Doctor of Philosophy (PhD)** The world's first doctoral program in robotics prepares graduate students to be tomorrow's leaders in robotics research.

**Center for the Neural Basis of Cognition Option** The Center for the Neural Basis of Cognition offers an interdisciplinary training program operated jointly with affiliated doctoral programs at Carnegie Mellon University and the University of Pittsburgh. The affiliated programs include Robotics, Computer Science, Psychology, and Statistics at Carnegie Mellon, and Mathematics, Psychology, and the Program in Neuroscience at the University of Pittsburgh.

The CNBC option for Robotics Ph.D. students allows them to combine intensive training in RI with a broad exposure to cognitive science, neural computation, and other disciplines that touch on problems of higher brain function.

Students must also be separately admitted to the CNBC program; they fulfill the same basic requirements as regular Ph.D. students in Robotics but have additional requirements to fulfill.

### Masters Programs

**Master of Science (MSR)** A two year masters program that teaches the fundamentals of robotics theory and practice through coursework and independent research.

**BS plus MS in Robotics (Accelerated Graduate Program)** A special masters program that enables Carnegie Mellon undergraduates to complete a masters degree in their fifth year.

**Master of Science - Robotic Systems Development (MRSD)** This program is designed to be completed full-time in 21 consecutive months. It's an advanced graduate degree with a combined technical/business focus for recent-graduates/practicing-professionals engaged in, or wishing to enter, the robotics and automation field as practitioners in the commercial sector.

**Master of Science - Computer Vision (MSCV)** A 16 month masters program that teaches the fundamentals of computer vision theory to prepare students for careers in industry.

### Undergraduate Programs

**Additional Major in Robotics** The Additional Major in Robotics focuses on the theme that robotics is both multidisciplinary and interdisciplinary. The Additional Major is open to students in any major of any college at Carnegie Mellon.

**Minor in Robotics** The Minor in Robotics provides an opportunity for undergraduate students at Carnegie Mellon to learn the principles and practices of robotics through theoretical studies and hands-on experience.

## Graduate Student Handbook

### University Policies & Expectations

It is the responsibility of each member of the Carnegie Mellon community to be familiar with university policies and guidelines. In addition to this departmental graduate student handbook, the following resources are available to assist you in understanding community expectations:

The Word/Student Handbook: [www.cmu.edu/student-affairs/theword//index.html](http://www.cmu.edu/student-affairs/theword//index.html)

Academic Integrity Website: <https://www.cmu.edu/student-affairs/ocsi/academic-integrity/index.html>

University Policies Website: [www.cmu.edu/policies/](http://www.cmu.edu/policies/)

Graduate Education Website: <http://www.cmu.edu/graduate/policies/index.html>

Should you need any of the above resources in a different format, you may contact the Graduate Program Coordinator, [Suzanne Muth](#).

Please see Appendix A for additional information about The Word and University resources.



### Carnegie Mellon University Statement of Assurance

Carnegie Mellon University does not discriminate in admission, employment, or administration of its programs or activities on the basis of race, color, national origin, sex, handicap or disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Furthermore, Carnegie Mellon University does not discriminate and is required not to discriminate in violation of federal, state, or local laws or executive orders.

Inquiries concerning the application of and compliance with this statement should be directed to the vice president for campus affairs, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-2056.

Obtain general information about Carnegie Mellon University by calling 412-268-2000.

The Statement of Assurance can also be found on-line at: <https://www.cmu.edu/policies/administrative-and-governance/statement-of-assurance.html>



## The Carnegie Mellon Code

Students at Carnegie Mellon, because they are members of an academic community dedicated to the achievement of excellence, are expected to meet the highest standards of personal, ethical and moral conduct possible.

These standards require personal integrity, a commitment to honesty without compromise, as well as truth without equivocation and a willingness to place the good of the community above the good of the self. Obligations once undertaken must be met, commitments kept.

As members of the Carnegie Mellon community, individuals are expected to uphold the standards of the community in addition to holding others accountable for said standards. It is rare that the life of a student in an academic community can be so private that it will not affect the community as a whole or that the above standards do not apply.

The discovery, advancement and communication of knowledge are not possible without a commitment to these standards. Creativity cannot exist without acknowledgment of the creativity of others. New knowledge cannot be developed without credit for prior knowledge. Without the ability to trust that these principles will be observed, an academic community cannot exist.

The commitment of its faculty, staff and students to these standards contributes to the high respect in which the Carnegie Mellon degree is held. Students must not destroy that respect by their failure to meet these standards. Students who cannot meet them should voluntarily withdraw from the university.



The Carnegie Mellon Code can also be found on-line at:  
<http://www.cmu.edu/student-affairs/theword/code.html>

## Departmental Resources

### Department Personnel

- ▶ [Andrew Moore](#), Dean, School of Computer Science
- ▶ [Martial Hebert](#), Director of the Robotics Institute
- ▶ [David Wettergreen](#), Associate Director for Education, Director of the Ph.D. Program, Research Professor
- ▶ [George Kantor](#), Director of the Masters Program, Senior Systems Scientist
- ▶ [John Dolan](#), Director of the M.Sc. Robotic Systems Development, Principal Systems Scientist
- ▶ [Kris Kitani](#), Director of the M.Sc. in Computer Vision Program, Assistant Research Professor
- ▶ [Hartmut Geyer](#), Chair of the Graduate Program Committee, Associate Professor
- ▶ [Howie Choset](#), Kavcic-Moura Professor of Computer Science
- ▶ [Illah Nourbakhsh](#), Associate Director for Faculty, Professor
- ▶ [Cheryl Wehrer](#), Associate Director for Finance and Administration
- ▶ [Suzanne Muth](#), Graduate Program Manager
- ▶ [Sarah Conte](#), Academic Program Manager
- ▶ [Barbara Jean Fecich](#), Academic Program Manager
- ▶ [Robotics Faculty](#)
- ▶ [Robotics Office Staff](#)
- ▶ Robotics Main Office and Phone Number, Newell Simon Hall 4000B, 412.268.3818
- ▶ [SCS Computing Facilities](#)
- ▶ Graduate Student Department/College Ombudsman  
[David Wettergreen](#) and [George Kantor](#) serve as ombudspersons for graduate students to assist with difficult academic or personal situations where a confidential sounding board and/or an intermediary can be helpful. Examples of situations where students are encouraged to seek advice or assistance include:
  - Difficulty in communications with advisor, particularly when those difficulties may lead to considering changing advisors or leaving the program
  - Conflict with other group members that is difficult to resolve within the group
  - Issues related to diversity or the departmental climate for those in groups who are historically underrepresented in science
  - Personal concerns that interfere significantly with the ability to make timely progress in research or program requirements. These might be due to health, family or financial challenges.
  - Additionally, students may confer with the university graduate student ombudsman, Suzie Laurich-McIntyre, [slaurichmcintyre@cmu.edu](mailto:slaurichmcintyre@cmu.edu), on issues of process or other concerns as they navigate conflicts. Suzie Laurich-McIntyre is the Assistant Vice Provost for Graduate Education.

## Department Information

### Department Directory

### Mail

The correct mailing address to use is: Your Name, The Robotics Institute, 4000 B Newell Simon Hall, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh PA 15213.

### Graduate Student Travel

When funding is available, we support graduate student travel to present papers at refereed conferences, to attend meetings required by research sponsors, or to attend other functions as directed by the faculty.

Graduate student travel must be approved in advance by the student's advisor. For travel to a conference, approval must be obtained before the paper is submitted to the conference; for other travel, approval must be obtained before the student can make a commitment to attend.

It is generally expected that the student's advisor, or other faculty member overseeing the travel, will arrange for funding before granting approval for the travel. If no faculty support is available, the student should contact the Ph.D. Program Chair for approval of departmental sponsorship. The maximum to be reimbursed will be \$200 plus the registration fee, if only attending the conference or workshop; \$600 plus registration fee, if presenting a paper.

Funding must be arranged before the travel request can be approved.

If there are visa concerns for graduate student travel, check the U.S. State Department's [Travel & Living Abroad](#) page.

### Copy, Printing, Scanning

### Conference & Classrooms

### Conference & Classroom Audio/Video Support

### Creative Media

The Robotics Creative Media is an online resource available to students who need information regarding HD video production, audio production, design & print, such as business cards, photography, event materials and specialty items.

### Emergency Situations

### Phone Usage & Information

### RoboOrg - The Robotics Student Organization

### SCS Computing Facilities

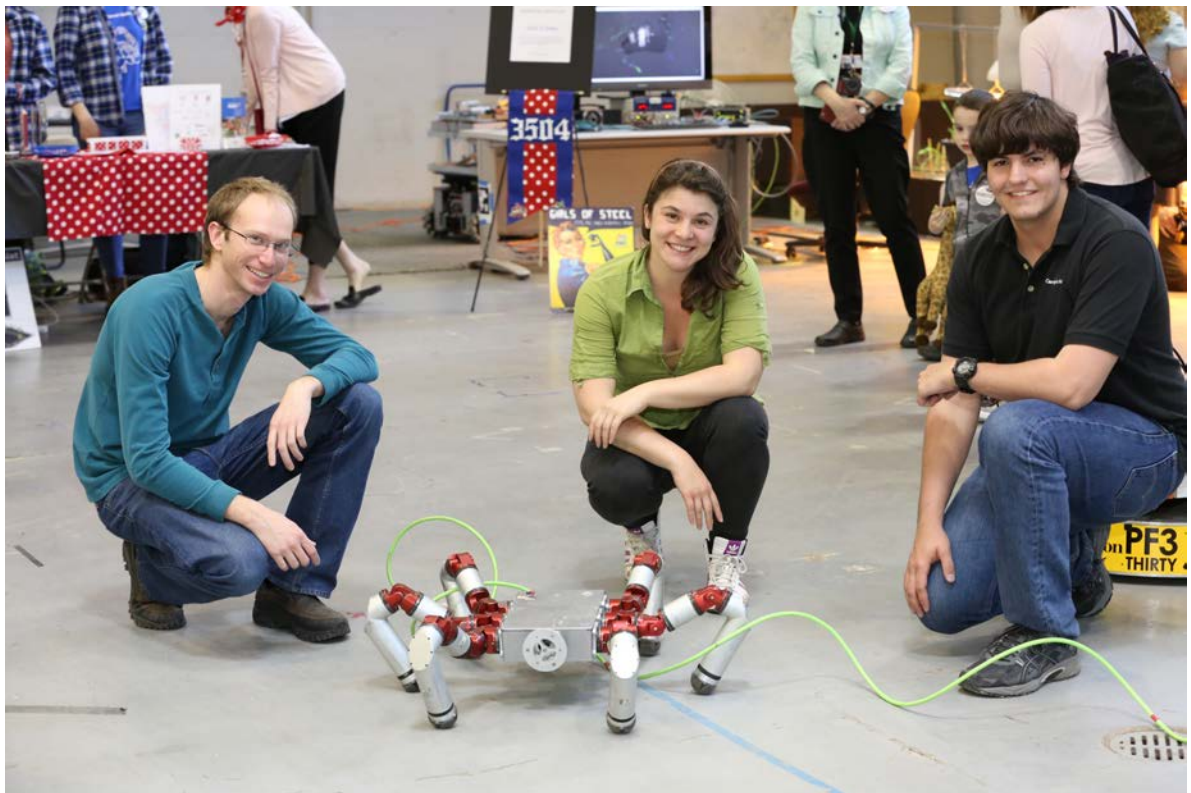
### Who to See for What

### Department Approach to Press and Media Relations

To assure consistency in all communications and to maximize external visibility to target audiences the marketing and communication staff works together to coordinate key messages and activities involving publicity.

The director of media relations in the SCS Dean's Office, Byron Spice, is the point-of-contact between news media and the School of Computer Science community, including faculty, students, administrators and staff. He can assist with strategic planning for publicity, interview preparation, and (depending on the specific project or issue) may assist in developing news stories or multi-media for the SCS website and social media channels.

### Women@SCS



## Degree Attainment

### Statute of Limitations

As outlined in the Doctoral Student Status Policy, students will complete all requirements for the Ph.D. degree within a maximum of ten years from original matriculation as a doctoral student. Once this time-to-degree limit has lapsed, the person may resume work towards a doctoral degree only if newly admitted to a currently offered doctoral degree program under criteria determined by that program.

Under extraordinary circumstances, such as leave of absence, military or public service, family or parental leave, or temporary disability, a school or college may, upon the relevant department's recommendation and with the written approval of the dean, defer the lapse of All But Dissertation status for a period commensurate with the duration of that interruption.

Students, who are pursuing the Ph.D. degree as part-time students for all semesters of their program, as approved by their program, may also appeal to their program or department for extension of the time to degree limit.

### Full-time/Part-time Status Requirements

It is expected that Doctoral students will maintain full-time status throughout the program. Part-time status would need to be approved by the Chair of the Doctoral Program in Robotics, David Wettergreen

## Course of Study

### Overview

This document defines the degree requirements for candidates in the Ph.D. Program in Robotics in the School of Computer Science at Carnegie Mellon University. The program is designed so that a well-prepared student can complete the doctoral degree in four to five years. The Ph.D. program requires completion of:

- Course Qualifiers (Core and Specialized)
- Research Qualifier
- Thesis

The Course and Research Qualifiers are performed concurrently and are designed to take approximately equal amounts of time during the student's first two years. The doctoral dissertation and its associated research will normally require two to three further years for completion.

The exact degree requirements for a student in the program are as defined in the Course of Study as of the date that student first enrolls in the Robotics Ph.D. Program. Any subsequent changes to the Course of Study may optionally be selected by the student, or the student may choose to retain the previous requirements.



Occasionally, it is appropriate for a student to deviate slightly from the requirements as defined in the Course of Study. A student may request approval for a specific proposed alternative from the Chair of the Robotics Ph.D. Program. Generally, the Robotics Program Committee will review the request and make a recommendation to the Chairperson.

### Preparation

The Robotics Doctoral Program accepts strongly motivated and exceptionally talented students from a wide range of educational backgrounds. It is each student's personal responsibility to arrive with, or to acquire rapidly thereafter, basic understanding (at the level of an introductory undergraduate course) in the following areas:

Mathematics: calculus, linear algebra, numerical analysis, probability and statistics

Computer Science: programming, data structures, algorithms

Physics and Engineering: mechanics, dynamics, electricity and magnetism, optics

On request, the faculty will advise incoming students about individually appropriate alternative ways to satisfy these requirements, such as taking an undergraduate course, serving as a teaching assistant in an undergraduate course, or self-study by guided reading and discussion.

### **Course Qualifiers**

Each student must complete the two course qualifiers in:

Core Courses, consisting of one course from each of four core areas

Specialized Courses, comprising 48 units of coursework (typically four graduate courses) in a specialized area defined by the student

Courses must be passed with a grade of B-, or better, to fulfill, or contribute to, completion of a course qualifier.

All of the necessary study and evaluation within the Robotics Ph.D. Program are contained in the Course Qualifiers. There are no other examination requirements for the Doctoral degree in Robotics. Students are encouraged to attend additional courses if they and their advisor agree it would be valuable, but such courses are not required for the Robotics degree and may be substituted for required courses only if approved by the Chair of the Robotics Program. Seminars are valuable educational experiences, but do not count for credit toward a course qualifier.

Students in the Robotics Ph.D. Program must register with the university and enroll for credit for all courses taken as part of fulfilling the Course Qualifiers.

### Core Course Qualifier

Students must pass four Core Courses, one course from each of the following four Core Areas:

Perception: vision, image sensors, range data interpretation, tactile and force sensors, inertial guidance, and other sensors. Core courses in Perception are 16-720 Computer Vision and 16-722 Sensing and Sensors.

Cognition: artificial intelligence for robotics, knowledge, representation, planning, task scheduling, and learning. Core courses in Cognition are 15-780 Artificial Intelligence and 10-701 Machine Learning.

Action: kinematics, dynamics, control, manipulation, and locomotion. Core courses in Action are 16-741 Mechanics of Manipulation and 16-711 Kinematics, Dynamic Systems, and Control.

Math Foundations: optimal estimation, differential geometry, computational geometry, and operations research. The one core course in this area is 16-811 Math Fundamentals for Robotics.

### Specialized Course Qualifier

The Specialized Course qualifier is a sequence of courses chosen by the student to enhance the Core Course subject matter by adding greater depth a particular area. These specialization courses must total at least 48 units of graduate coursework. In this way, the foundational science component of the program is complemented by studies that keep pace with new developments and current topics. The courses should have coherence in subject matter. They may be directly related to the student's thesis research but are not restricted to that topic.

The Specialized Course Qualifier must be defined by the student in conjunction with their Ph.D. Advisor and then approved by the Chair of the Ph.D. Program. Typically the student will identify 4 graduate courses that relate to their interests and will complete and submit a Specialized Qualifier approval form. Students are strongly encouraged to seek approval before completing courses. Any course completed prior to approval is at risk and may not be deemed eligible for their qualifier.

The Specialized Qualifier courses must total at least 48 units, usually four full-semester graduate courses. The following guidelines cover the usually applicable constraints and will help in composing a Specialized Qualifier sequence.

- Graduate level (600 - 800-level) courses only
- No more than 12 units of non-doctoral (600-level) graduate courses
- No more than 12 units of courses completed by waiver
- No more than 12 units of project-only courses
- No more than 12 units of independent study

(Independent study courses must include syllabus, schedule, assignments, and evaluation criteria. Syllabus submitted with the SQ form.)

- Core courses can be used in the Specialized Qualifier sequence, but only in addition to 48-units of Core Qualifier courses
- Teaching Assistantships cannot be included as Specialized Qualifier courses

Students who have completed graduate courses prior to entering the Ph.D. program and have acquired relevant knowledge and experience that is directly related to their area of specialization may request that some portion of their Specialized Qualifier be waived. For graduate courses completed at Carnegie Mellon, the Chair of Ph.D. Program will review the waiver, this includes students matriculating from the Robotics Masters programs who may have completed courses eligible for waiver as Core or Specialized courses. For graduate courses completed at any other institution, a subject area expert from the faculty will be assigned for the waiver review.

### Waivers

At Carnegie Mellon courses can only be credited to a single degree; additionally transfer credit for graduate courses completed at other institutions is not granted in robotics. However if students possess all of the knowledge conferred and evaluated in a particular course, they may apply for a waiver to be released from the requirement of enrolling and completing the course.

On the basis of previous experience and knowledge students may apply, by completing a waiver request form, to waive any course. The Chair of the Ph.D. Program will then assign a suitable faculty member to evaluate the request, typically the relevant course instructor or an expert on the topic. The faculty member will then conduct an evaluation which may include oral examination, proctoring of course quizzes or exams including final exams, assigning course exercises, assignments or projects, or any combination of these. They will assess the extent and quality of knowledge and its sufficiency relative to the course objectives and requirements.

In some cases, the faculty may determine that a student has demonstrated significant knowledge of the research area, but not sufficient to waive the course requirement entirely. In such cases, the faculty may grant a conditional waiver, contingent upon additional work, such as successfully acting as teaching assistant in the course or completing some designated project. If a student disagrees with the outcome of the waiver application, he or she may petition the Robotics Program Committee to review the case.

### **Research Qualifier**

The Research Qualifier examines the skills that are important for every researcher to possess including scholarly research, speaking, writing, and teaching. The Research Qualifier typically requires half of the student's time and effort for two years and is to be completed concurrently with the Course Qualifiers. The primary component of the Research Qualifier is supervised research under the guidance of a faculty member who serves as the student's advisor. In addition, the research qualification process includes serving as a teaching assistant, writing a research paper, and presenting a technical talk.

To oversee this process, the student forms a Research Qualifier Committee consisting of three faculty members and one Robotics Ph.D. student who has completed his or her second year of study. One faculty committee member must hold a primary appointment in Robotics. The faculty members should include the student's advisor(s) and one faculty member who is not participating in the student's research. Forms to verify completion of the parts of the Research Qualifier must be filled out by each member of the Research Qualifier Committee (with the exception of the Teaching requirement, which must be filled out by the instructor of the course for which the student serves as teaching assistant).

It is the student's responsibility to ensure that reviews are completed and submitted by the relevant deadline.

The Research Qualifier comprises four components:

**Research Skills:** The ability to create, explore, refine, and test new ideas in robotics. Students are expected to demonstrate awareness of previous work in their area of research, depth of insight into the problem, creativity in approaching the problem, and substance of results obtained.

**Speaking:** The ability to communicate in oral presentation. Students are expected to demonstrate the ability to present technical material to a technical audience clearly and succinctly. The presentation must be made at a venue open to the public. Ideally, the Research Qualifying Committee will be in attendance, but committee members may designate proxies, subject to approval by the Program Chair, to evaluate the presentation.

**Writing:** The ability to communicate in technical writing. A student is expected to produce a conference-length, or longer, paper, in which he/she is the sole, or the primary, author plus a one page executive summary in which he/she is the sole author. The paper should demonstrate a style, organization and clarity that enables researchers in the field to comprehend the problem, method, and results of the research. Students who have written papers prior to entering the Robotics Program may submit them for evaluation, provided they meet the above criteria.

**Teaching:** The experience of teaching in a classroom environment. This includes demonstration of as many as possible of the following: lecturing, recitation instruction, homework and exam design, grading, office hours, curriculum design. Each student must serve as a teaching assistant in two (2) courses relevant to the Robotics Program. Allowable courses will be defined by the Chair of the Ph.D. Program. Students may arrange to serve as teaching assistant (TA) by contacting the Program Coordinator at the beginning of the semester before the semester in which the student will act as a TA. The student is expected to spend on average 10-15 hours per week or about one quarter of their time on teaching. The instructor should provide feedback to the student concerning the quality of the student's teaching. The instructor should report to the Program Coordinator his or her evaluation of whether the student has carried out the TA activities successfully.

Note that the State of Pennsylvania requires proficiency in English to act as a teaching assistant. Non-native speakers must be evaluated at the ICC and either Pass or Restricted I on

their ITA examination. It is the student's responsibility to achieve this proficiency in time (by their second year) to complete their required TA assignments (by their third year).

### Master's Writing and Speaking

Students completing the Master of Science in Robotics (research masters) at Carnegie Mellon University who intend to matriculate into the Ph.D. program may optionally compose their M.S. thesis committee to meet the requirements of the Ph.D. research committee, as described in the Research Qualifier. Upon successfully completing their Writing and Speaking requirements for their M.S. they may waive the Writing and Speaking requirements for their Ph.D. They cannot be done retroactively (a full research qualifier committee must conduct their M.S. thesis examination) and the students must still complete the Ph.D. Research Skills and Teaching components.

### **Thesis**

The doctoral thesis represents a novel and significant contribution to the state of art in robotics. Researching, writing and presenting a thesis is intended to occupy approximately two to three years of activity, with these specific parts:

1. Thesis Proposal
2. Dissertation
3. Oral Defense of the Thesis

The evaluation of all three of these components must be performed by the Robotics faculty, as represented by the student's Thesis Committee. The committee will consist of at least four members: a minimum of three from Carnegie Mellon, at least two of whom must be faculty members affiliated with the Robotics Institute (at least one faculty member with a primary appointment in Robotics) and at least one qualified researcher who is external to Carnegie Mellon. The student's advisor(s) chair the Thesis Committee. The entire composition of the committee must be approved by the Chair of the Ph.D. Program before the Thesis Proposal is scheduled.

Prior to presenting the Thesis Proposal, the four Core Courses of the Course Qualifier and the research, speaking and writing skills portions of the Research Qualifier must be complete.

In the Thesis Proposal, the student is formally asking the faculty for permission to pursue a line of research leading to the Dissertation. To do this, the student must do the following:

- Describe a problem and its importance;
- Summarize and evaluate what previous work has been done by others to solve this problem;
- State what has been accomplished so far by the student and how and why it will lead to the solution, or partial solution, of the problem;



- Describe and state what the student intends to do to complete the dissertation and how long it is expected to take; and
- Identify what novel and significant contributions it will make to the field of Robotics that merit awarding the degree of Ph.D.

The oral presentation of the proposal is made publically to the entire research community, including particularly the Thesis Committee. The Thesis Committee must then express approval to the Chair of the Program if the proposal is to be accepted.

The Dissertation itself is normally preceded by a year or more of research and writing after the proposal. The Dissertation is a scholarly document describing the problem, related work, the student's approach, the results and insights achieved, and the significance of the work. The written dissertation must be presented to the Thesis Committee for approval.

All Course and Research Qualifiers must be completed before scheduling a Thesis Defense.

The faculty of the Robotics program and the local community must receive notice of all thesis presentations at least one week in advance. Therefore, students are required to provide the Program Coordinator with complete information, no less than ten days before the scheduled presentation, including: title, abstract, committee members, on-line location of thesis document and/or hard copy. The Program Coordinator will advertise theses presentations on appropriate on-line and physical venues.

When the committee gives preliminary approval, the Oral Defense of the thesis can take place. At the Oral Defense, the committee and the entire community will have the opportunity to publically question the work critically. Finally, the Thesis Committee on behalf of the faculty must decide whether to approve the oral defense and whether, or under what conditions, to accept the dissertation and recommend awarding of the doctoral degree.

A student will be certified for graduation and allowed to attend commencement ceremonies when the thesis is unanimously approved by his or her Thesis Committee and it has been delivered to the Program Coordinator in final form. The student will be awarded the degree of Doctorate of Philosophy in the field of Robotics.

## **Robotics Orientation**

The student's research education begins in the Robotics Orientation, which all Robotics students must attend at the beginning of their first semester in the program. The Robotics Orientation is a series of lectures, discussions, and demonstrations that familiarize the students with Carnegie Mellon and the Robotics Program, introduce the research projects and faculty within the Program and affiliated departments, and describe the computational and other resources available to students in the Program. The Robotics Orientation gives students an opportunity to learn what it means to conduct research and to get to know the faculty in the Robotics Program.

## **Advising and Matching Process**

The candidate's advisor will be the faculty member who works most closely with that student. This is usually the most important factor in the student's research education, so choice of an advisor should be based on careful consideration. New candidates and faculty will have extensive opportunity to meet to discuss research, assess compatibility, and evaluate interests. The Matching Committee will match students and faculty advisors based on the preferences of the students and the faculty, subject also to the research agenda (and funding) of the faculty.

In order to make this an informed process, the assignments are made approximately 6 weeks after the Robotics Orientation, giving an ample period of time for the new students to meet the faculty individually. Each new student should use this opportunity to talk to all the faculty whose research interests might overlap those of the student. In this way, the students can learn about all the available research areas of the faculty, and the faculty can meet and talk with the students, before commitments are made. Students and faculty present their preferences for advisor/advisee pairings, and these preferences are used in matching students and advisors. After the Matching process, each student begins guided research under supervision of the advisor.

The duties of the advisor include approving the student's selection of courses, mentoring the student in research, advising the student on methods and skills, providing research opportunities and facilities for the student, and reporting on the student's progress to the faculty.

Advising relationships are mutually agreed and are mutable. It is possible for a student to change advisors with approval of the Chair of the Program. A student may request to switch to a new advisor, to add an additional co-advisor, or to remove a co-advisor. In this way, the student's changing perspectives and research focus can be accommodated by the program. Generally, the student should discuss such matters first with their current advisor(s), then make a tentative agreement with the new advisor(s), then finally request that the new plan be approved by the Chair of the Program. The Chair of the Program is available to help guide the student through this process if needed.

## **Timeline of Study**

It is expected that students will complete both the Course and Research Qualifiers concurrently in two years of dedicated study.

Students who have completed at least half of the required courses in graduate study prior to entering the Program, such as in the Robotics Masters program, will be advanced one year in the timeline for completing the Course Qualifier. This means they are expected to complete remaining courses in only one year of dedicated study.

It is expected that the Thesis Proposal will require about half a year of productive research beyond the Research Qualifier for its preparation and that it will be presented during the student's third year in the Program.

Students who are more than one year beyond the expected completion time for a qualifier or proposal are not making satisfactory progress in the Program. Specifically if not complete with: the Course Qualifier after three years (or two years if advanced due to prior coursework) or the

Research Qualifier after three years or the Thesis Proposal after four years, then students are not in good standing and, subject to the judgment of the faculty in the Review of Progress, may be removed from the Program.

## **Review of Progress**

At the end of each semester, the entire faculty of the Robotics Program meets to discuss the record and progress of all students in the Program (for historical reasons called "Black Friday"). The evaluation for each student is based on several factors:

- The student's status at the start of the semester, as expressed by the previous Black Friday evaluation;
- The student's accomplishments during the semester, as described by the student in a form submitted prior to the meeting, and summarized at the meeting by the student's advisor;
- The advisor's evaluation, expressed in the form of a draft of a Black Friday letter that the advisor proposes to be sent to the student;
- Input from other faculty who have had dealings with the student;
- Discussion by the faculty of all of the above factors at the Black Friday meeting, which may include modifications to the letter drafted by the advisor; and
- Final decision by the Chair of the Program based on the above discussion.

After the meeting, the Chair of the Program will send a letter of progress to each student, based on the recommendation of the faculty at the meeting. Through this mechanism, the faculty can report "satisfactory" or "unsatisfactory" progress, offer recommendations to the student and advisor, set specific progress goals that must be achieved, or, if necessary, terminate a student's participation in the program. The continuation or conditions of a student's funding may also be determined in the meeting, as described in the "Robotics Graduate Student Handbook".

In general, termination will be preceded by at least one unsatisfactory evaluation. An explicit warning (called an "N-1 letter") will normally be given one semester before any decision to terminate a student's participation in the program.

In addition to the progress review, the Black Friday meeting and resultant letters provide an opportunity for the faculty to learn about and acknowledge the students' contributions in service to the Program and achievements such as research publications and awards. Matters of academic policy are frequently discussed at the Black Friday meeting as they arise in the discussion of individual students.

The Black Friday process ensures that each student's progress is reviewed by the entire faculty, and not only by the advisor. The Black Friday process involves a careful consideration by the faculty of each student's case. If the student wishes to appeal the decisions reflected in their Black Friday letter, the student should state their perspective in a request to the Chair of the Program to review the case again. The Chair will undertake such a review, in consultation with the faculty as appropriate, and issue a written response to the student. If the student is not satisfied

with the Chair's response, it may be appealed as described in the Student Handbook for Carnegie Mellon University.

## **Master's Degree in Robotics**

The Robotics Doctoral Program at Carnegie Mellon is principally a Ph.D. program. However a student who is working towards a Ph.D. may receive the degree of M.S. in Robotics upon request by the student and upon completion of the following requirements:

- All four Core Courses from the Course Qualifiers
- At least 36 units of coursework from an approved Specialized Qualifier
- The Writing and Speaking portions of the Research Qualifier.

## **Core Courses**

### Perception Core Courses

16-720: Computer Vision. Topics covered include image formation and representation, camera geometry and calibration, multi-scale analysis, segmentation, contour and region analysis, energy-based techniques, reconstruction of based on stereo, shading and motion, 3-D surface representation and projection, and analysis and recognition of objects and scenes using statistical and model-based techniques.

16-722: Sensing and Sensor. The principles and practices of quantitative perception (sensing) illustrated by the devices and algorithms (sensors) that implement them. Learn to critically examine the sensing requirements of proposed applications of robotics to real problems, to specify the required sensor characteristics, to analyze whether these specifications can be realized even in principle, to compare what can be realized in principle to what can actually be purchased, to understand the engineering factors that account for the discrepancies, and to design transducing, digitizing, and computing systems that come tolerably close to realizing the actual capabilities of available sensors.

### Cognition Core Courses

15-780: Artificial Intelligence. Introduction to Artificial Intelligence tailored toward the algorithms and applications of robotics, manufacturing, and engineering disciplines. Strong focus on modern numerical approaches to AI and robotics, including Bayes nets, classical decision-theoretical problems such as scheduling, and optimal and learning control of Markov systems. Motion planning and spatial reasoning, neural nets, qualitative reasoning, and fuzzy logic are covered in detail.

10-701: Machine Learning. Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the

theory and practice of machine learning from a variety of perspectives. Topics covered include learning decision trees, neural network learning, statistical learning methods, genetic algorithms, Bayesian learning methods, explanation-based learning, and reinforcement learning. The course covers theoretical concepts such as inductive bias, the PAC and Mistake-bound learning frameworks, minimum description length principle, and Occam's Razor. Programming assignments include hands-on experiments with various learning algorithms. Typical assignments include neural network learning for face recognition, and decision tree learning from databases of credit records.

### Action Core Courses

16-711: Kinematics, Dynamic Systems, and Control. Basic concepts and tools for the analysis, design, and control of robotic mechanisms. Topics covered include foundations of kinematics, kinematics of robotic mechanisms, review of basic systems theory, control of dynamical systems. Advanced topics will vary from year, including motion planning and collision avoidance, adaptive control, and hybrid control.

16-741: Mechanics of Manipulation. Kinematics, statics, and dynamics of robotic manipulator's interaction with a task, focusing on intelligent use of kinematic constraint, gravity, and frictional forces. Automatic planning based on mechanics. Application examples drawn from manufacturing and other domains.

### Math Foundations Core Course

16-811: Mathematical Fundamentals for Robotics. This course covers selected topics in applied mathematics. Topics covered in the past have included: polynomial interpolation and approximation; solution of nonlinear equations; roots of polynomials; approximation by orthogonal functions such as Fourier series; optimization; calculus of variations; probability; numerical solution of differential equations.

## **Research Qualifier**

Some students may feel unprepared for the Research Qualifier. To help in that regard, there are courses and materials available that can prepare the student for speaking, writing, and teaching. For international students, the Intercultural Communication Center can recommend remedial course work and ICC workshops and seminars on an individual basis to help ensure that students have the language skills to pass these three portions of the Research Qualifier.

### Research Skills

This is the most important skill learned as a Ph.D. student, and it is the primary responsibility of the advisor to mentor the student in research skills. Students and advisors should meet regularly to discuss research and plan approach.



## Speaking

A suitable course for a student to take to improve speaking ability is:

90-718: Professional Speaking (6 units)

In addition, the School of Computer Science has many videotapes of distinguished lecturers that are available for students to review.

## Writing

A suitable course for a student to take to improve writing skill is:

76-870 Technical Writing for Engineers (9 units)

In addition, it is recommended that students read extensively in the field, especially award-winning papers, to get an idea of what good writing entails. Many papers and presentations exist on techniques for writing well, including Marc Raibert's "Good Writing". A student's advisor can also provide opportunities to review papers for conferences and journals, another helpful tool in improving a student's writing skills.

## Teaching (Non-Native Speakers of English)

There are many courses and seminars offered weekly and each semester through the Eberly Center that can be taken to improve teaching ability.

For non-native speakers of English, Carnegie Mellon policy, in accordance with the Pennsylvania English Fluency in Higher Education Act, requires that all students be tested by the Intercultural Communication Center (ICC) before they can be certified to serve as International Teaching Assistants (ITAs). The ITA test is offered several times during the year. A rating of "Pass" or "Restricted I" must be attained in order to qualify for certification. Students with Restricted I status are permitted to teach, but they must take the "Foundations of Fluency" seminar or must have already completed at least 15 hours of ICC work in previous semesters before beginning their teaching assignment.

While Carnegie Mellon and Commonwealth of Pennsylvania policies require the above standard of students teaching assistants in undergraduate courses, the Robotics Institute requires these standards of all teaching assistants in any Robotics course, and all Robotics students assisting in a course in Robotics or any other department. This holds for both graduate and undergraduate courses. The Program Coordinator will monitor the status of all international students to ensure that a Pass or Restricted I has been attained before any student will be permitted as a teaching assistant. Restricted I students will be monitored throughout the teaching semester to ensure that they are continuing with required training. Students found to be out of status, either by assisting before they have attained a Pass or Restricted I, or by not continuing the required tutoring during the teaching semester, will risk not having the teaching assistant assignment count toward his or her Research Qualifier and having to act as teaching assistant again once the required standards are met.

## Independent Study

Independent Study (16-995) is a course designed to provide students with an opportunity for intensive study of a subject that is either unavailable or insufficiently covered in regular course work. Independent study is not intended to substitute for existing courses, but to provide the opportunity for a specialized educational and research experience.

Any faculty member in the Robotics Institute is eligible to serve as the supervisor of an Independent Study research project. The student must provide a brief prospectus of the project to the faculty supervisor as a basis for reaching agreement on the objectives of the study and provide this to their advisor and to the Program Chair for approval.

## Resources and Regulations Governing Research at Carnegie Mellon

[Office of Sponsored Programs](#)

[Office of Research Integrity & Compliance](#)

[Intellectual Property Policy](#)

[Policy on Restricted Research](#)

[Human Subjects in Research Policy](#)

## Grades & Grading

Passing grade for graduate courses is B- or better. Once the required coursework is completed, students register only for a blanket course (e.g., "Reading and Research") covering all their program activities for that semester, for which they receive a Pass/No Pass grade.

Robotics Ph.D. students may formally register for graduate or undergraduate courses in other departments, in which case they are subject to the grading policies of the University and the department offering the course.

Students enrolled in other programs, but taking courses in Robotics, are assigned either a letter grade or a "Pass/Fail/No Grade," at the option of the instructor. When a letter grade is required by the student's home department in order to receive credit toward the degree, the policy of the home department will be respected.

The University [Policy on Grades](#) offers details concerning university grading principles for students taking courses and covers the specifics of assigning and changing grades, grading options, drop/withdrawals and course repeats. It also defines the undergraduate and graduate grading standards.

## Academic Integrity

Please review the University expectations at: <https://www.cmu.edu/student-affairs/ocsi/academic-integrity/>

Please review the entire policy at: <https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html>

University-wide Protocol: <https://www.cmu.edu/student-affairs/ocsi/academic-integrity/grads.html>

## PhD Criteria for Advancement to Candidacy

### University Policy for Doctoral Status

This is a series of policies that set forth a definition of All But Dissertation (ABD), time limits on doctoral candidacy status, a definition of *in residence* and *in absentia* status for ABD candidates and the tuition charged for candidates in each status. The ABD status agreement form, <https://www.cmu.edu/hub/docs/abd-status-agree.pdf> and ABD status change form, <https://www.cmu.edu/es/docs/abd-status-change.pdf>

## Internship Opportunities

International students are required to consult with the Office of International Education for eligibility before seeking an internship or signing an offer contract.

If students choose a Practicum (internship) for directed research, they must complete a form that is available from the Program Coordinator and to perform a Practicum more than 4 times, they must have prior approval from the Ph.D. Program Chair.

## Graduation and Certification

The Program Coordinator maintains a checklist of procedures for scheduling the thesis oral presentation and completing the other requirements for graduation. The Program Coordinator certifies fulfillment of requirements for graduation only when the final version of the thesis

1. has been approved by the thesis committee, the Department Head, and the Dean, and
2. is submitted to the Graduate Program Coordinator at which time the student will be awarded the degree of Doctorate of Philosophy in the field of Robotics.

Students are not allowed to participate in commencement exercises unless final certification has been made.

If the final copy of the thesis is not submitted within one year of the thesis defense, a second defense may be required before making a final certification.

## **Leave of Absence**

Students who wish to leave the program temporarily may request a leave of absence by submitting a request to the Program Coordinator. Leaves are initially granted for a period of no more than one year, but an extension of up to one additional year may be granted under exceptional circumstances. When an extension is granted, the conditions for return must be negotiated with the advisor and the Ph.D. Program Chair prior to returning to the program. Students not in good standing will have conditions for return determined by the Program Chair in consultation with the advisor.

Students on leave of absence should contact the Program Coordinator two months prior to the end of the leave to indicate their plans for the next year. While a leave can, in principle, start at any time, university regulations allows students to return only at the beginning of a semester (usually late August or early January).

University process for taking and returning from leave of absence:  
<https://www.cmu.edu/hub/registrar/leaves-and-withdrawals/>

## **Withdrawal of Degree**

The university reserves the right to withdraw a degree even though it has been granted should there be discovery that the work upon which it was based or the academic records in support of it had been falsified. In such a case, the degree will be withdrawn promptly upon discovery of the falsification. The complete reference to this university policy is available at: <https://www.cmu.edu/policies/student-and-student-life/withdrawal-of-a-degree.html>.

## **Enrollment Verification**

Enrollment Services is the only University office that can provide an official letter of enrollment, official transcript and enrollment verification. Enrollment verification can be requested online through The HUB at: <https://www.cmu.edu/hub/registrar/student-records/verifications/>.

## **Directed Research**

During a student's first two years, he or she should be doing directed research at least half time; once all coursework is completed and before doing thesis research, full time (except when teaching). Students commonly use the summer semester to make progress on their Ph.D. research. Different students, and different advisors, have different ideas of what directed research means and how progress can be demonstrated. It is the responsibility of both the student and the advisor(s) to formulate for each semester a set of reasonable goals, plans, and criteria for success in conducting directed research.

Students should enroll for 24-48 units of either Graduate Reading and Research (16-997) or Practicum (16-990) for each semester (Fall, Spring and Summer) in which they are active (excludes LOA and ABS status; and dual degree Portugal students). Directed research is graded pass/fail. If students choose a Practicum (internship) for directed research, they must complete a form that is available from the

Program Coordinator and to perform a Practicum more than 4 times, they must have prior approval from the Ph.D. Program Chair.

At each semi-annual Review of Progress meeting, the faculty assess the student's previous semester's research progress and the student's next semester's research plans to ensure that the student is making satisfactory progress. The evaluation of a student's progress in directed research often depends on the student having produced some tangible result; examples include the implementation of pieces of a software system, a theoretical advance, a conference paper or journal article, an annotated bibliography in a major area, or, as part of preparation for doing research, a passing grade in a graduate course (beyond the required 96 course units).

Advisors are individually responsible for adequately supervising this portion of the PhD program.

### **Additional Department Policies/Protocols**

#### **Assistance for Individuals with Disabilities**

<https://www.cmu.edu/disability-resources/>

The Office of Disability Resources at Carnegie Mellon University has a continued mission to provide physical and programmatic campus access to all events and information within the Carnegie Mellon community. We work to ensure that qualified individuals receive reasonable accommodations as guaranteed by the Americans with Disabilities Act (ADA) and Sections 503 and 504 of the Rehabilitation Act of 1973. Students who would like to receive accommodations can begin the process through [Disability Resources secure online portal](#) or email [access@andrew.cmu.edu](mailto:access@andrew.cmu.edu) to begin the interactive accommodation process.

Students with disabilities are encouraged to self-identify with the Office of Disability Resources by contacting Catherine Getchell, 412-268-6121, [getchell@cmu.edu](mailto:getchell@cmu.edu) to access the services available at the university and initiate a request for accommodations.

#### **Summary of Graduate Student Appeal & Grievance Procedures**

<https://www.cmu.edu/graduate/policies/appeal-grievance-procedures.html>

Graduate students will find the Summary of Graduate Student Appeal and Grievance Procedures on the Graduate Education Resource webpage. This document summarizes processes available to graduate students who seek review of academic and non-academic issues. Generally, graduate students are expected to seek informal resolution of all concerns within the applicable department, unit or program before invoking formal processes. When an informal resolution cannot be reached, however, a graduate student who seeks further review of the matter is to follow the formal procedures outlined here. These appeal and grievance procedures shall apply to students in all graduate programs of the University. Students should refer to the department specific information in this handbook for department and college information about the administration and academic policies of the program. Additionally, students may confer with the graduate student ombudsman, Suzie Laurich-McIntyre, [slaurichmcintyre@cmu.edu](mailto:slaurichmcintyre@cmu.edu), on issues of process or other concerns as they navigate conflicts.



## **Safeguarding Educational Equity Policy Against Sexual Harassment and Sexual Assault**

Sexual harassment and sexual assault are prohibited by CMU, as is retaliation for having brought forward a concern or allegation in good faith. The policy can be viewed in its entirety at: [http://www.cmu.edu/policies/documents/SA\\_SH.htm](http://www.cmu.edu/policies/documents/SA_SH.htm). If you believe you have been the victim of sexual harassment or sexual assault, you are encouraged to make contact with any of the following resources:

Sexual Harassment Advisors, found in appendix A of the Policy Against Sexual Harassment and Sexual Assault;

Survivor Support Network, found in appendix B of the Policy Against Sexual Harassment and Sexual Assault;

Sexual Harassment Process and Title IX Coordinators, found in section II of the Policy Against Sexual Harassment and Sexual Assault;

University Police, 412-268-2323; University Health Services, 412-268-2157; Counseling & Psychological Services, 412-268-2922

## **Maternity Accommodation Protocol**

Students whose anticipated delivery date is during the course of the semester may consider taking time away from their coursework and/or research responsibilities. All female students who give birth to a child while engaged in coursework or research are eligible to take either a short-term absence or formal leave of absence. Students in course work should consider either working with their course instructor to receive incomplete grades, or elect to drop to part-time status or to take a semester leave of absence. Students engaged in research must work with their faculty to develop plans for the research for the time they are away.

Students are encouraged to consult with relevant university faculty and staff as soon as possible as they begin making plans regarding time away. Students must contact the Office of the Dean of Student Affairs to register for Maternity Accommodations. Students will complete an information form and meet with a member of the Dean's Office staff to determine resources and procedures appropriate for the individual student. Planning for the student's discussion with her academic contact(s) (advisor, associate dean, etc.) will be reviewed during this meeting.

## **Change of Address**

RI students are responsible for notifying the RI and HUB of all address changes in a timely manner. Students will be held responsible for any failure to receive official college notices due to not having a correct address on file; F-1 students may jeopardize their status if address information is not kept current.

Students can change their address using SIO, which is available via the HUB website: <http://www.cmu.edu/hub/index.html>.

## **"Grandfather" Policy**

When policies are changed it is because the department believes the new rules offer an improvement. However, students currently enrolled whose degree program is affected by a change in policy may choose to be governed by the older policy that was in place at the time of their matriculation. In case degree requirements are changed and certain courses are no longer offered, the department will try to find some compromise that allows those students to satisfy the original requirements.

## **Financial Support**

### **Stipends**

Academic Year Funding:

The stipend will be \$2857/month for the 9 months August 16, 2018-May 15, 2019.

To any student whose spouse or qualifying domestic partner earns less than \$200 per month, the Department pays a dependency allowance that is 10% of the student's SCS monthly stipend per dependent.

Students who receive stipends that are paid for or administered by the university must sign up for direct deposit as University payroll is a paperless system. Stipends are issued semi-monthly. December stipends are usually distributed a little earlier, due to the holiday season. Check with the Graduate Program Coordinator if you are unclear about the distribution of stipends.

### Summer Stipend

Summer stipend is guaranteed for first year students. After the first full year, summer stipend is available for most Ph.D. students, particularly for those working on their dissertation. Please note that all financial support is subject to continued satisfactory progress toward your degree.

We believe it is also good for Ph.D. students to gain experience in industry for one or two summers during their career here at Carnegie Mellon. Faculty and staff will provide help in finding suitable summer employment.

### **Tuition**

As long as the student is in good academic standing (with regard to grade average, progress in the program, and length of time in the program), full tuition remission as well as the activity, transportation and technology fees will be covered. For the academic year 2018-2019, this tuition remission is valued at \$44,282. Students are responsible for the costs of purchasing their own books and miscellaneous supplies.

## **Fellowships**

We encourage students to seek their own external funding since often the award is prestigious (e.g., NSF or Hertz) or the source provides an opportunity to make professional connections. The Robotics Institute supplements the stipends of students with an outside fellowship to meet (and usually exceed) the stipends of students with internal funding.

Students who are interested in applying for external fellowships should see their advisor or check the on-line information provided by the [Office of Scholarships and Fellowships Web site](#). The Web site is an excellent resource for locating an abundance of information regarding available funding for students.

If a student receives an external fellowship/scholarship, they must notify [Rebecca Klaas](#), Manager, Finance & Special Projects.

## **Consulting and Outside Employment**

Consulting is a privilege, not a right. We grant this privilege for one of two reasons:

- The consulting task is relevant to the student's thesis work or a Carnegie Mellon research project.

- The student has exceptional financial obligations.

Consulting is normally limited to a maximum of one day per week.

A student who wishes to consult should obtain permission from his or her advisor and the Ph.D. Program Chair, and fill out an approval form, available from the Program Coordinator.

We may require that students limit outside employment in order to be in compliance with University and government rules.

## **Semester Breaks and Vacations**

Students with graduate assistantships are expected to continue with their research during academic breaks (including the Summer months) with the exception of the official university holidays. A complete list of the official university holidays can be found at the [Human Resources website](#).

Due to federal regulations governing graduate student support, paid time off for personal business and vacations is not provided. A supported graduate student wanting to take a one week break during one of the summer months in which they are receiving a stipend is expected to get approval for that break with their advisor and make up the work during the other three weeks of that month. Supported graduate students wishing to take longer periods of personal time off must do so without pay and must receive advanced approval from their research advisor a minimum of four weeks prior to the requested time off. The advisor must then notify the Graduate Program Manager and Business Manager of this approval so that stipend adjustments can be processed.

## **Taxes**

The deadline for local, state, and federal taxes is April 15. You can obtain tax forms in the mail, at the post office, or at the Carnegie Library. Questions about your tax status should be addressed to the IRSTeleTax at 412-261-1040, or the Pennsylvania Department of Revenue at 412-565-7540. Although subject to federal taxes, student stipends are generally not assessed local or state taxes.

## **Financial Aid Information**

### **Financial Assistance**

Research assistantships are available to qualified, full-time students in the Ph.D. program. Financial aid from the department includes full graduate tuition, activity, transportation and technology fees, plus a stipend paid semi-monthly. Health insurance and other fees are the responsibility of the students. Many students pay for their Carnegie Mellon health insurance and other charges directly from their stipend through TMS. Information regarding this option is available on the [Student Health Office](#) web site. Other questions concerning payment options should be addressed to enrollment services or the payroll office.

Hours: 8:30 a.m. to 5:00 p.m., Monday through Friday  
Location: UTDC 4516 Henry Street, Pittsburgh, PA 15213  
Contact Information: (412) 268-2097 - (412) 268-7068 Fax  
Email: payroll@andrew.cmu.edu

### **University Financial Aid**

Students who find themselves in need of immediate funds for emergency situations should contact the Office of the Dean of Student Affairs (see Appendix A), [www.cmu.edu/student-affairs/index.html](http://www.cmu.edu/student-affairs/index.html), to inquire about an Emergency Student Loan.

## Estimates of the Time Allocated to Each Component of the Ph.D. Program

The following table indicates estimates for an appropriate distribution of effort in the Ph.D. program. It is based on actual student performance over the past few years; it also corresponds to the faculty's judgment of realistic estimates of the time required by various components of the program.

These figures are meant to be suggestive, not prescriptive. We present them so that all faculty and students can develop a shared image of the expectations of the program.

\* Always, except during the Robotics Orientation and when writing the thesis proposal.

COMPONENT	INTENSITY	DURATION	TOTAL TIME
Robotics Orientation	full-time	one week	one week
Courses	1/2 time	1 sem each	4 sem
Teaching	1/4 time	2 sem	2 sem
Skills	variable	variable	variable
Directed Research	1/2 time	*	5-7 sem
Thesis Proposal	1/2 time	2 sem	1 sem
Thesis	full-time	until done	2-4 sem
Good Works	variable	often	--



## Appendix A

### Highlighted University Resources for Graduate Students and The WORD, Student Handbook

#### Key Offices for Graduate Student Support

##### **Office of the Assistant Vice Provost for Graduate Education**

[www.cmu.edu/graduate](http://www.cmu.edu/graduate); [grad-ed@cmu.edu](mailto:grad-ed@cmu.edu)

The Office of the Assistant Vice Provost for Graduate Education, AVPGE, directed by Suzie Laurich-McIntyre, Ph.D., Assistant Vice Provost for Graduate Education, provides central support for graduate students in a number of roles. These include being an ombudsperson and resource person for graduate students as an informal advisor; resolving formal and informal graduate student appeals; informing and assisting in forming policy and procedures relevant to graduate students; and working with departments on issues related to graduate students and implementation of programs in support of graduate student development.

The Office of the AVPGE often collaborates with the division of Student Affairs to assist graduate students with their Carnegie Mellon experience. Senior members of the student affairs staff are assigned to each college (college liaisons) and are often consulted by the Assistant Vice Provost for Graduate Education and departments on an individual basis to respond to graduate student needs.

The Office of the Assistant Vice Provost for Graduate Education (AVPGE) offers a robust schedule of professional development opportunities. Some are geared towards a specific population (master's students, PhD students at the beginning of their program, graduate students seeking tenure track positions, etc.) and others are open to all graduate students (time management, balancing, staying healthy). A full schedule of programs is at <http://www.cmu.edu/graduate/>.

The Office of the AVPGE also coordinates several funding programs, and academically focused seminars and workshops that advise, empower and help retain all graduate students. The fundamental goals of our programs have been constant: first, to support, advise and guide individual graduate students as they work to complete their degrees; second, to contribute to the greatest degree possible to the diversification of the academy. Visit the Graduate Education website for information about:

Conference Funding Grants

Graduate Small Project Help (GuSH) Research Funding

Graduate Student Professional Development: seminars, workshops and resources

## **Office of the Dean of Student Affairs**

[www.cmu.edu/student-affairs/index.html](http://www.cmu.edu/student-affairs/index.html)

The Office of the Dean provides central leadership of the metacurricular experience at Carnegie Mellon. The offices that fall under the division of Student Affairs led by Vice President and Dean of Student Affairs Gina Casalegno, include (not an exhaustive list):

Athletics

Career and Professional Development Center

Cohon University Center

Counseling & Psychological Services (CaPS)

Dining Services

Housing Services

Office of Community Standards and Integrity

Office of Student Leadership, Involvement, and Civic Engagement

University Health Services

Wellness Initiatives

Graduate students will find the enrollment information for **Domestic Partner Registration** and **Maternity Accommodations** in the Office of the Dean of Student Affairs and on the website. The Office of the Dean of Student Affairs also manages the **Emergency Student Loan (ESLs)** process. The Emergency Student Loan service is made available through the generous gifts of alumni and friends of the university. The Emergency Student Loan is an interest-free, emergency-based loan repayable within 30 days. Loans are available to enrolled students for academic supplies, medication, food or other expenses not able to be met due to unforeseeable circumstances.

The Office of Integrity and Community Standards also provides consultation, support, resources and follow-up on questions and issues of Academic Integrity: [www.cmu.edu/academic-integrity](http://www.cmu.edu/academic-integrity).

## **Center for Student Diversity & Inclusion**

<https://www.cmu.edu/student-diversity/>

Diversity and inclusion have a singular place among the values of Carnegie Mellon University. The Center for Student Diversity & Inclusion actively cultivates a strong, diverse and inclusive community capable of living out these values and advancing research, creativity, learning and development that changes the world.

The Center offers resources to enhance an inclusive and transformative student experience in dimensions such as access, success, campus climate and intergroup dialogue. Additionally, the Center supports and connects historically underrepresented students and those who are first in their family to attend college in a setting where students' differences and talents are appreciated and reinforced, both at the graduate and undergraduate level. Initiatives coordinated by the Center include, but are not limited to:

First generation/first in family to attend college programs  
LGBTQ+ Initiatives  
Race and ethnically-focused programs, including Inter-University Graduate Students of Color Series (SOC) and PhD SOC Network  
Women's empowerment programs, including Graduate Women's Gatherings (GWGs)  
Transgender and non-binary student programs

### **Assistance for Individuals with Disabilities**

<http://www.cmu.edu/education-office/disability-resources/>

The Office of Disability Resources at Carnegie Mellon University has a continued mission to provide physical and programmatic campus access to all events and information within the Carnegie Mellon community. We work to ensure that qualified individuals receive reasonable accommodations as guaranteed by the Americans with Disabilities Act (ADA) and Sections 503 and 504 of the Rehabilitation Act of 1973. Students who would like to receive accommodations can begin the process through [Disability Resources secure online portal](#) or email [access@andrew.cmu.edu](mailto:access@andrew.cmu.edu) to begin the interactive accommodation process.

Students with disabilities are encouraged to self-identify with the Office of Disability Resources by contacting Catherine Getchell, 412-268-6121, [getchell@cmu.edu](mailto:getchell@cmu.edu) to access the services available at the university and initiate a request for accommodations.

### **Eberly Center for Teaching Excellence & Educational Innovation**

[www.cmu.edu/teaching](http://www.cmu.edu/teaching)

Support for graduate students who are or will be teaching is provided in many departments and centrally by the Eberly Center for Teaching Excellence & Educational Innovation. The Eberly Center offers activities for current and prospective teaching assistants as well as any graduate students who wish to prepare for the teaching component of an academic career. The Center also assists departments in creating and conducting programs to meet the specific needs of students in their programs. Specific information about Eberly Center support for graduate students is found at [www.cmu.edu/teaching/graduatestudentsupport/index.html](http://www.cmu.edu/teaching/graduatestudentsupport/index.html).

### **Carnegie Mellon Ethics Hotline**

The health, safety and well-being of the university community are top priorities at Carnegie Mellon University. CMU provides a hotline that all members of the university community should use to confidentially report suspected unethical activity relating to financial matters, academic and student life, human relations, health and campus safety or research.

Students, faculty and staff can anonymously file a report by calling 877-700-7050 or visiting [www.reportit.net](http://www.reportit.net) (user name: tartans; password: plaid). All submissions will be reported to appropriate university personnel.

**The hotline is NOT an emergency service. For emergencies, call University Police at 412-268-2323.**



### **Graduate Student Assembly**

[www.cmu.edu/stugov/gsa/index.html](http://www.cmu.edu/stugov/gsa/index.html)

The Carnegie Mellon Student Government consists of an Executive Branch and a Legislative Branch. This is the core of traditional student government, as governed by the Student Body Constitution. The Executive Branch serves the entire student body, graduate and undergraduate, and consists of one president and four vice-presidents. The Legislative Branch for graduate students, The Graduate Student Assembly (GSA) passes legislation, allocates student activities funding, advocates for legislative action locally and in Washington D.C. on behalf of graduate student issues and needs, and otherwise acts on behalf of all graduate student interests. GSA also contributes a significant amount of funding for conferences and research, available to graduate students through application processes managed by the Office of the Assistant Vice Provost for Graduate Education. GSA also plans various social opportunities for graduate students and maintains a website of graduate student resources on and off-campus, <http://www.cmu.edu/stugov/gsa/resources/index.html>. Each department has representation on GSA and receives funding directly from GSA's use of the student activities fee for departmental activities for graduate students. The department rep(s) is the main avenue of graduate student representation of and information back to the graduate students in the department.

### **Intercultural Communication Center (ICC)**

[www.cmu.edu/icc/](http://www.cmu.edu/icc/)

The Intercultural Communication Center (ICC) is a support service offering both credit and non-credit classes, workshops, and individual appointments designed to equip nonnative English speakers (international students as well as international students who attended high school and/or undergraduate programs in the U.S.) with the skills needed to succeed in academic programs at Carnegie Mellon. In addition to developing academic literacy skills such as speaking, reading and writing, students can learn more about the culture and customs of the U.S. classroom. The ICC also helps international teaching assistants (ITAs) who are non-native English speakers develop fluency and cultural understanding to teach successfully at Carnegie Mellon and provides ITA testing, required testing indicating a nonnative speaking student has a language proficiency required before being allowed to work with undergraduates in classes, labs or individual meetings.

### **Office of International Education (OIE)**

<http://www.cmu.edu/oie/>

Carnegie Mellon hosts international graduate and undergraduate students who come from more than 90 countries. Office of International Education (OIE) is the liaison to the University for all non-immigrant students and scholars. OIE provides many services including: advising on personal, immigration, academic, social and acculturation issues; presenting programs of interest such as international career workshops, tax workshops, and cross-cultural and immigration workshops; maintaining a resource library that includes information on cultural adjustment, international education and statistics on international students in the United States; posting pertinent information to students through email and the OIE website, and conducting orientation programs.

## **Veterans and Military Community**

<http://www.cmu.edu/veterans/>

Military veterans are a vital part of the Carnegie Mellon University community. Graduate students can find information on applying veteran education benefits, campus services, veteran's groups at CMU, non-educational resources and international military service information through the Veterans and Military Community website. There are also links and connections to veteran resource in the Pittsburgh community. The ROTC and Veteran Affairs Coordinator can be reached at [uro-vaedbenefits@andrew.cmu.edu](mailto:uro-vaedbenefits@andrew.cmu.edu) or 412-268-8747.

## **Key Offices for Academic & Research Support**

### **Computing and Information Resources**

[www.cmu.edu/computing](http://www.cmu.edu/computing)

Computing Services provides a comprehensive computing environment at Carnegie Mellon. Graduate students should seek Computing Services for information and assistance with your Andrew account, network access, computing off-campus, campus licensed software, email, calendar, mobile devices, computer security, cluster services and printing. Computing Services can be reached at [it-help@cmu.edu](mailto:it-help@cmu.edu).

The Carnegie Mellon Computing Policy establishes guidelines and expectations for the use of computing, telephone and information resources on campus. The policy is supported by a number of guidelines graduate students should know. The policy and guidelines are available at: [www.cmu.edu/computing/guideline/index.html](http://www.cmu.edu/computing/guideline/index.html).

### **Research at CMU**

[www.cmu.edu/research/index.shtml](http://www.cmu.edu/research/index.shtml)

The primary purpose of research at the university is the advancement of knowledge in all fields in which the university is active. Research is regarded as one of the university's major contributions to society and as an essential element in education, particularly at the graduate level and in faculty development. Research activities are governed by several university policies. Guidance and more general information is found by visiting the Research at Carnegie Mellon website.

### **Office of Research Integrity & Compliance**

[www.cmu.edu/research-compliance/index.html](http://www.cmu.edu/research-compliance/index.html)

The Office of Research Integrity & Compliance (ORIC) is designed to support research at Carnegie Mellon University. The staff work with researchers to ensure research is conducted with integrity and in accordance with federal and Pennsylvania regulation. ORIC assists researchers with human subject research, conflicts of interest, responsible conduct of research, export controls, intellectual property rights and regulations, and institutional animal care & use. ORIC also consults on, advises about and handles allegations of research misconduct.

## Key Offices for Health, Wellness & Safety

### **Counseling & Psychological Services**

<https://www.cmu.edu/counseling/>

Counseling & Psychological Services (CaPS) affords the opportunity for students to talk privately about issues that are significant for them in a safe, confidential setting. Students sometimes feel confused about why they are feeling upset and perhaps confused about how to deal with it. An initial consultation with a CaPS therapist will clarify options and provide a recommendation to the appropriate mental health resource at Carnegie Mellon or the larger Pittsburgh community. CaPS services are provided at no cost. Appointments can be made in person or by telephone, 412-268-2922.

### **Health Services**

[www.cmu.edu/HealthServices/](http://www.cmu.edu/HealthServices/)

University Health Services (UHS) is staffed by physicians, advanced practice clinicians and registered nurses who provide general medical care, allergy injections, first aid, gynecological care and contraception as well as on-site pharmaceuticals. The CMU student insurance plan covers most visit fees to see the physicians and advanced practice clinicians & nurse visits. Fees for prescription medications, laboratory tests, diagnostic procedures and referral to the emergency room or specialists are the student's responsibility and students should review the UHS website and their insurance plan for detailed information about the university health insurance requirement and fees.

UHS also has a registered dietician and health promotion specialists on staff to assist students in addressing nutrition, drug and alcohol and other healthy lifestyle issues. In addition to providing direct health care, UHS administers the Student Health Insurance Program. The Student Health Insurance plan offers a high level of coverage in a wide network of health care providers and hospitals. Graduate students should contact UHS to discuss options for health insurance for spouses, domestic partners and dependents. Appointments can be made by visiting UHS's website or by telephone, 412-268-2157.

### **Campus Wellness**

<https://www.cmu.edu/wellness/>

At the university, we believe our individual and collective well-being is rooted in healthy connections to each other and to campus resources. The university provides a wide variety of wellness, mindfulness and connectedness initiatives and resources designed to help students thrive inside and outside the classroom. The BeWell@CMU e-newsletter seeks to be a comprehensive resource for CMU regarding all wellness-inspired events, announcements and professional and personal development opportunities. To sign up for the e-newsletter, text BEWELLATCMU to 22828 and share your preferred email address.

## University Police

<http://www.cmu.edu/police/>

412-268-2323 (emergency only), 412-268-6232 (non-emergency)

The University Police Department is located at 300 South Craig Street, Room 199 (entrance is on Filmore Street). The department's services include police patrols and call response, criminal investigations, shuttle and escort services, fixed officer and foot officer patrols, event security, and crime prevention and education programming. Visit the department's website for additional information about the staff, escort and shuttle, emergency phone locations, crime prevention, lost and found, finger print services, and annual statistic reports.

### Shuttle and Escort Services

University Police coordinates the Shuttle Service and Escort Service provided for CMU students, faculty, and community. University Police [Shuttle & Escort website](#) has full information about these services, stops, routes, tracking and schedules.

Carnegie Mellon University publishes an annual campus security and fire safety report describing the university's security, alcohol and drug, sexual assault, and fire safety policies and containing statistics about the number and type of crimes committed on the campus and the number and cause of fires in campus residence facilities during the preceding three years. Graduate students can obtain a copy by contacting the University Police Department at 412-268-6232. The annual security and fire safety report is also available online at <https://www.cmu.edu/police/Fire%20and%20Safety%20Reports.html>.

## The WORD

<http://www.cmu.edu/student-affairs/theword//>

The WORD is Carnegie Mellon University's student on-line handbook and is considered a supplement to the department (and sometimes college) handbook. The WORD contains campus resources and opportunities, academic policy information and resources, community standards information and resources. It is designed to provide all students with the tools, guidance, and insights to help you achieve your full potential as a member of the Carnegie Mellon community. Information about the following is included in The WORD (not an exhaustive list) and graduate students are encouraged to bookmark this site and refer to it often. University policies can also be found in full text at: <http://www.cmu.edu/policies/>.

Carnegie Mellon Vision, Mission

Carnegie Code

Academic Standards, Policies and Procedures

Educational Goals

Academic and Individual Freedom

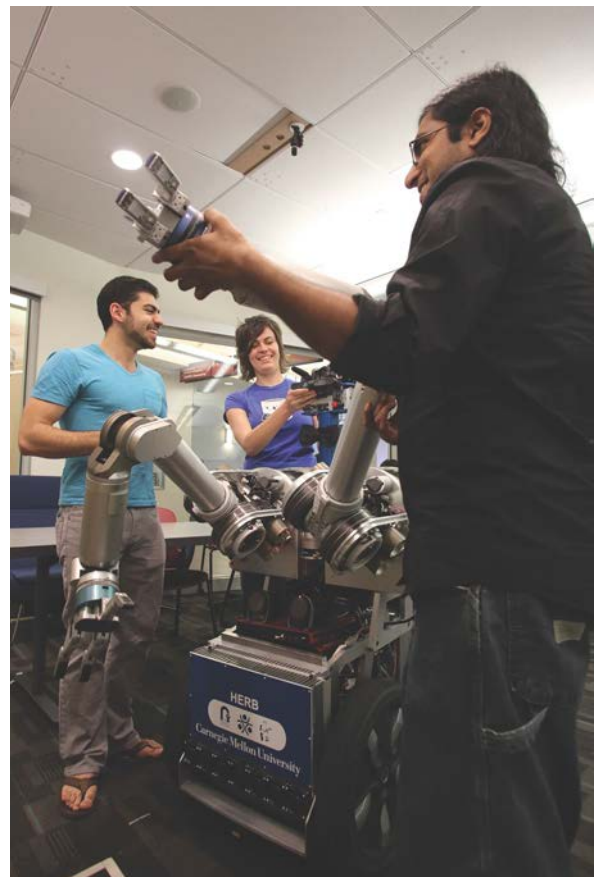
Statement on Academic Integrity

Standards for Academic & Creative Life

- Assistance for Individuals with Disabilities
- Master's Student Statute of Limitations
- Conduct of Classes
- Copyright Policy
- Cross-college & University Registration
- Doctoral Student Status Policy
- Evaluation & Certification of English Fluency for Instructors
- Final Exams for Graduate Courses
- Grading Policies
- Intellectual Property Policy
- Privacy Rights of Students
- Research
  - Human Subjects in Research
  - Office of Research Integrity & Compliance
  - Office of Sponsored Programs
  - Policy for Handling Alleged Misconduct of Research
  - Policy on Restricted Research
- Student's Rights
- Tax Status of Graduate Student Awards

#### Campus Resources & Opportunities

- Alumni Relations
- Assistance for Individuals with Disabilities
- Athletics, Physical Fitness & Recreation
- Carnegie Mellon ID Cards and Services
- Cohon University Center
- Copying, Printing & Mailing
- Division of Student Affairs
- Domestic Partner Registration
- Emergency Student Loan Program
- Gender Programs & Resources
- Health Services
- Dining Services
- The HUB Student Services Center
- ID Card Services
- Leonard Gelfand Center
- LGBTQ Resources
- Multicultural and Diversity Initiatives
- Opportunities for Involvement
- Parking and Transportation Services
- SafeWalk
- Survivor Support Network
- Shuttle and Escort Services
- Spiritual Development
- University Police
- Student Activities
- University Stores



#### Community Standards, Policies and Procedures

- Alcohol and Drugs Policy

AIDS Policy  
Bicycle/Wheeled Transportation Policy  
Damage to Carnegie Mellon Property  
Deadly Weapons  
Discriminatory Harassment  
Disorderly Conduct  
Equal Opportunity/Affirmative Action Policy  
Freedom of Expression Policy  
Health Insurance Policy  
Immunization Policy  
Missing Student Protocol  
Non-Discrimination Policy  
On-Campus Emergencies  
Pets  
Political Activities  
Recycling Policy  
Riotous and Disorderly Behavior  
Safety Hazards  
Scheduling and Use of University Facilities  
Sexual Harassment and Sexual Assault Policy  
Smoking Policy  
Student Accounts Receivable and Collection Policy and Procedures  
Student Activities Fee  
Student Enterprises  
Workplace Threats and Violence Policy

Statement of Assurance

Last updated: August 15, 2018