2023 – 2024
MS in Robotics
GRADUATE HANDBOOK

GEORGIA INSTITUTE of TECHNOLOGY

July 2023

Robotics MS Handbook

Purpose of this Handbook

The purpose of this handbook is to familiarize Robotics graduate students with degree program requirements, policies, procedures, and the resources available to students and is intended to be a supplement to the General Catalogs, Student Handbooks of Georgia Tech, and academic departments. The info here does not replace or supersede the materials in those resources.

As Robotics is an interdisciplinary program, students are responsible for understanding the policies and procedures for both their major programs and their home department in addition to the General Catalogs. The home department has ultimate decision-making responsibility for students assigned to their “home school.”

Although students are encouraged to seek advice from the Robotics Program Director, faculty advisors, home departments, and the Program Manager, the Georgia Tech Registrar's Office, the Office of Graduate Education, OIE (for international students), and other resources on campus, it is ultimately the student’s responsibility to know and meet the rules and regulations for degree completion.

See the Appendix sections for additional various resources, including faculty and staff contact information and important websites.

Transitioning to Graduate School

Graduate school is different from undergraduate. Approach it as a full-time job; it is more demanding and requires a greater level of commitment.

Grad school entails a critical transition from *consumer* of knowledge to *producer* of knowledge.

In graduate school, learning is no longer rote. Success requires analysis and a deeper level of comprehension. Whereas one can fly through undergrad by attending class without studying much, in grad school, just getting by isn't good enough, a graduate student needs to step up and stand out.

Graduate students are expected to be independent and proactive. Those who succeed in graduate school are extremely self-motivated. In contrast, undergraduate work can be more passive - professors tell you what to do and how to do it. In graduate school, students learn to make many decisions for themselves and be an independent scholar.

Students must provide their own motivation and have **good time management skills:**

-Create a calendar – note due dates
-Block out times for studio work and studying
-Review schedule each Sunday night
-Prioritize tasks
-Use free time wisely
-Review notes before and after class
-To do lists and planners

Please review additional tips, including finding funding, at: Succeeding in Graduate School tips.docx

Do not rely on other students to inform you of policies. This can lead to missing important deadlines or finding out you have not completed all the requirements. **It is a student's responsibility to read up on policies and be aware of information and deadlines.**

Graduate students are governed by the policies of the Institute, the home unit, and program. Students are expected to become familiar with these policies. The GT Catalog online is the primary source of information on policies and program degree requirements. While some administrative policies may change after printing, the student is responsible for knowing the changes.

It's not as important to remember a fact as much as it is to know *where to find it*.

Stay informed – Check your email regularly!

All students are provided a "GT Account" upon enrollment; information about student accounts is available online at http://www.oit.gatech.edu/. New students can activate their account at the following web page: https://passport.gatech.edu/

All students are responsible for maintaining a valid GT e-mail address. It is assumed that students are reading their email daily. Crucial messages, such as the availability of tuition bills or registration Time Tickets, will be sent directly to the student's GT e-mail account.

IRIM and the Robotics Academic Program Manager also maintain separate e-mail listservs, which is used to convey important information, event information, etc. Matriculated students are usually added to these after the first week of classes.

Georgia Tech Academic Regulations

The academic regulations and definitions listed below constitute answers to some of the most frequently asked questions regarding Institute and school policies and guidelines, which are outlined in-depth in The GT Catalog under the following:

https://catalog.gatech.edu/

https://catalog.gatech.edu/academics/graduate/

https://catalog.gatech.edu/academics/graduate/masters-degree-info/

As well as the GT Policy Library:

https://policylibrary.gatech.edu/

https://policylibrary.gatech.edu/academic-affairs/graduate-student-policies

Institute and Program Academic Standing

Students must maintain good standing with the Institute.
https://registrar.gatech.edu/info/academic-standing

Good academic standing is defined as a cumulative GPA above 2.7. *

If a student does not maintain a cumulative GPA of 2.7 or above, the student may be put on academic warning, probation, or dismissed from the Institute. https://catalog.gatech.edu/rules/6/

Note students must* ***earn a cumulative GPA of 3.0 or higher in order to meet the graduation requirements for the MS Robo program.*

MS Program in Robotics

This 36 credit-hour, cohort-based program is a **professional Master of Science in Robotics** over four semesters designed to produce industry-ready engineers and scientists with the theoretical knowledge and practical skills needed to meet the challenges of rapidly growing interdisciplinary technologies in professional careers related to designing and developing robotics and automation solutions. Such a program is in high demand by not only students but also a growing list of local and global companies interested in robotics and factory automation.

The MS Robotics program provides its graduates with a **practitioner-oriented degree** that clearly distinguishes them as trained professionals in the field. Its curriculum is specifically tailored to the educational needs for robotics professionals by requiring courses in multiple core areas of Robotics (e.g., AI and Mechanics). In addition to coursework, the students will spend a summer performing an **internship** at one of our industrial robotics **partners and complete a capstone project** providing them with practical experience directly applicable to their careers.

The Institute for Robotics & Intelligent Machines (IRIM) serves as the flagship for Tech's robotics efforts; therefore, IRIM has an integral relationship with the program, and many IRIM faculty members serve as research advisors to students pursuing the degree. The Robotics program supports Tech's mission to provide instruction in disciplines related to science, technology, and interdisciplinary areas.

Home Units

The MS in Robotics is an interdisciplinary program and is independent of any particular academic school. The program is supported by the participating academic units called Home Schools or Home Units, which include the Schools of Aerospace Engineering (AE), Biomedical Engineering (BME), Electrical and Computer Engineering (ECE), Mechanical Engineering (ME), the School of Interactive Computing (IC), and School of Physics (PHYS).

A home unit (or home school) is an academic unit (Department, Division, or School) at Georgia Tech that has agreed to formally participate in the Robotics programs. Students and the home unit must mutually agree on home unit affiliation. An initial home unit is determined during either the admissions process or in the process of transferring to a Robo program from another academic graduate program at Georgia Tech. Requests to change home units are approved at the discretion of the home units and students must submit a valid and strong justification for the change request in addition to meeting any additional requirement of the new home unit. Approvals for home unit changes within the MS Robotics program are rarely granted.

Each academic unit determines admission requirements (deadlines, GRE, etc), rules for allocation of space and financial assistance (e.g., teaching and research assistantships) for

students applying to and who are homed in that unit. Home units may also have additional departmental requirements. Check with the home unit directly for any specific requirements.

Students are responsible for ensuring that they understand and satisfy any home unit requirements as well as the Robotics program and Institute requirements.

Regardless of home unit, students must fulfill the Robotics degree requirements specified in this handbook to complete their program.

Admissions

Students can apply to the MS-Robotics program through any of the six participating schools, the choice of which usually reflects that student's intended area of specialization and general background. Students with diverse and eclectic backgrounds are encouraged to apply, including those with previous work or research experience. Each school has its own set of admission criteria, but the program generally requires a minimum GPA of 3.3. Applications are accepted for the fall semester only.

Final admission decisions will be made by the Robotics MS Program Committee in coordination with the home units. They are based on a combination of factors, including academic degrees and records, the statement of purpose, letters of recommendation, test scores, and relevant work experience. Particular efforts are made to recruit women and members of underrepresented minority groups.

For questions regarding admissions requirements and deadlines, please contact the home school representatives of the Robotics program.

Transfer Admissions

MS in another major to MS Robo

Students can request to transfer into the Robotics MS if they are currently enrolled in another MS program at Georgia Tech, pending approval of Robo faculty committee and home units.

Submit the following items to the Robotics Program Director:

- Student cover letter/personal statement stating the reasons for transferring to Robotics.
- Current GT and undergraduate transcripts.
- A letter of recommendation from a GT Robotics faculty member or member of one of the six home units.

Each transfer case is reviewed and voted on by the ROBO faculty committee. If approved, a Change of Major Form will be completed by the student’s current major program and the Robotics Program Director.

MS Robo to PhD Robo

Students may transfer into the Robotics PhD if they are currently enrolled in another graduate program at Georgia Tech, pending approval of Robo faculty committee and the home unit(s). Note some home units, such as CoC home schools, will not accept a MS to PhD transfer and students will be required to apply as an external application through GT Graduate Education.

Submit following items to the Robotics Program Director:

- Student cover letter/personal statement stating the reasons for transferring to Robotics.
- Current GT and undergraduate transcripts.
- A recommendation email letter from each advisor/co-advisor guaranteeing GRA support from one of the Robo home units

Each transfer case is reviewed and voted on by the ROBO PhD committee. If approved, a Change of Major Form will be completed by the student's current program and the Robotics Program Director.

PhD degree and MS Robo

Since the MS Robo program is a terminal degree, it cannot be pursued "on the way" for PhD students. In special circumstances, a PhD student may desire to switch from the PhD in Robotics to the MS in Robotics and should contact the Program Director to discuss this process.

New Student Orientation

There will be a new student orientation for all new Robotics graduate students the week before classes start in Mid-August. It will consist of a short presentation by the director on the degree requirements, and several events organized by the RoboGrads student organization. This will be in addition to the orientation the incoming students may have with their home schools.

Program Advising

Advising on non-academic issues can be sought through the Robotics Academic Program Manager including:

- MS and PhD Robo Program and curriculum requirements
- General advising and CoC registration Info
- Institute policies and procedures
- Transfer credit requests
- Degree audits

Note the Robotics Academic Program Manager may sign documents requiring a signature from the Robotics "Graduate Coordinator," such as internship forms from the GT Career Center.

Contact information for the Robo Academic Program Manager and “who to go for what” guide can be found in the Appendix section of this handbook.

General Registration Information

All previously enrolled MS in Robotics students are required to register for Georgia Tech coursework during Phase I registration for the following semester. Phase I registration occurs midway through the current semester. This is generally November for the spring semester and April for the summer and fall semesters.

New graduate students will register during Phase II for their first semester in August. After the first semester, new graduate students will be able to register during Phase I. Information regarding registration dates can be found online at: https://registrar.gatech.edu/calendar/

The Robo Program Manager will send registration reminders and detailed information prior to the start of phase I and II registration periods. Please be sure to read these emails and save for reference.

Students including those on student F1 or J1 visas, students with a fellowship, and/or hired as GTAs or GRAs, must be full-time per **Institute policy**, and enroll for a minimum of 12 credit hours (9 hours must be for letter grade or pass/fail) in the fall and spring semesters to maintain full-time status.

If hired as a GTA/GRA, students will need to follow the procedures of the hiring department of that academic or research unit regarding registration for credit hours (i.e., some departments require 21 hours for research), if applicable, and other policies.

Registration policies and procedures vary by home unit. Note permits can only be issued by the home unit offering the course. **Robo staff cannot issue permits for courses.**

Contact the unit offering the course for any questions about how to register for courses. https://registrar.gatech.edu/registration/permits-and-overloads

How to Register and all things registration related, including error messages, holds, how to videos, permit info: https://registrar.gatech.edu/registration

It is a student’s responsibility to ensure degree requirements and full-time status requirements are met.

Prerequisites

Most graduate level classes such as CS courses are informational only and will not prevent registration. Check with the academic department offering the course if a student gets a pre-req registration error or contact the course instructor with any questions.

Course requirements

Program of Study

The program requires 36 hours of **letter-grade coursework** with a minimum GPA of 3.0. A maximum of two classes (6 semester hours) at the 4000 level (undergraduate) may be used as open electives toward the required 36 credit hours. The students are encouraged to select additional elective courses from the diverse offerings available at Georgia Tech.

See additional course descriptions on pages 20-21.

Component	Courses	Hours Required
Intro to Robotics Research	CS/AE/ECE/ME/BME 7785, Introduction to Robotics Research.	3
Robotics Professional Preparation	CS/AE/ECE/ME/BME/PHYS 7741, 7742, 7743, Robotics Professional Preparation: A sequence of three one-hour seminars taken with the cohort targeted at the professional development of students at their stage in the program.	3
Foundation Courses	Three foundation courses, each selected from distinct core areas: Mechanics, Controls, Perception, Artificial Intelligence, Human-Robot Interaction (HRI), and Natural Systems.	9
Robotics Elective Courses	Three targeted elective courses, each selected from the same three core areas used for the foundation courses.	9
Open Electives	Two free elective courses, must be 4000+ level in ANY area, can be non-Robotics courses	6
Robotics Internship	CS/AE/ECE/ME/BME/PHYS 8740, A summer-long internship at a partner company, GTRI or a Robotics faculty member's lab.	0
Robotics Capstone Project	CS/AE/ECE/ME/BME/PHYS 8741, Robotics Capstone taken in the second year of the program.	6
	TOTAL	**36**

***Note students can take ANY section (CS/AE/ECE/ME/BME/PHYS) of a course with multiple section offerings from ANY home unit as they all fulfil the same degree requirement.**

Robotics Internship

A summer-long internship at a partner company, GTRI, or a faculty member's lab in any of the six Robotics home units.

It is the student's responsibility to secure an internship position.

- Helpful Resources
  - Preparation provided in 7741-42 courses
  - GT Career Center: https://career.gatech.edu/
    - Career Fairs in fall and spring
    - Helpful workshops and events
    - CareerBuzz Job board
  - IRIM sponsors Industry Mixers and other events

CS 8740: Robotics Internship Registration

All students with a summer internship register for CS 8740

CS 8740: Robotics Internship, is 1-21 credit hours taken for audit (A) only in the GT Catalog. Credit hours are considered contact hours to be associated with the course and align with the number of hours a student might work per week at the internship. All students should register for at least 1 credit hour and **will not** be billed any tuition or fees for these CS 8740 audit hours. If students register for additional credit hours, tuition and fees will apply as normal. The course CS 8740 should be taken in conjunction with any additional course registration requirements such as for a GRA or international student with an external internship. See below for more details.

Outlined below are the options to fulfil the internship requirement:

1). External position – outside of GT/ internship with external company (paid or unpaid)
-Register internship with Career Center Graduate Internship Program: https://career.gatech.edu/graduate-internship-program-information
- **Registration** with the Graduate internship Program is Required for international students. Recommended for domestic students.
-Must create a CareerBuzz account and complete Experiential Learning Application
-Required orientation for any student registering external internship through the GT Career Center: https://career.gatech.edu/graduate-students/online-orientation
-Guidelines and application process: https://career.gatech.edu/graduate-student/application-process
-GIP advisor approval form sent to Robo Manager, Chris Middleton

International Students Requirements
https://isss.oie.gatech.edu/content/curricular-practical-training-cpt-georgia-tech
-Must follow procedure to work legally in the US
-Need CPT approval from OIE
-First register for Graduate Internship Program through Career Center (see above)
- Register for: INTN 6012 (12 hrs) + 8740 (1 hr)

Domestic Students
-Recommended to register internship with Career Center, but not required.
-Register for: 8740 (12 hrs) OR INTN 6012 (12 hrs) + 8740 (1 hr) (if through Career Center)

2). ANY student with a paid GRA/GTA/fellowship (includes tuition waiver)
-Includes GRA through GTRI or with GT faculty
-Must register for 12 credit hours to be fulltime, 6 hours must be letter grade or pass/fail. The other 6 may be audit hours for summer enrollment.
-Must register for GRA and/or research hours or appropriate hours (xx8998, etc) as indicated by the hiring unit
-Do not register through Career Center.
-Register for: 6 hrs (audit hours - 8998 + 8740) + 6 hrs (letter grade or pass/fail)
-For CS, BME, ME, or PHYS GRAs = xx 8998 (3 hrs) + CS 8740 (3 hrs) + 6 hours (letter grade or pass/fail).
-For ECE GRA – ECE 8998 (1 hr) + 8740 (5 hrs) + 6 hours (letter grade or pass/fail).
-For AE GRA – 8740 (6 hrs) + 6 hrs (letter grade or pass/fail).
-Course offerings and availability vary across home units and instructor. Please contact the unit offering the course if permit is required or with any questions.

3). ANY student with paid hourly position - Graduate Assistant (GA) or Student Assistant (SA) (no GRA/GTA or tuition waiver)
-Do Not register through Career Center
-Institute requirement for these positions – audit hours only are ok:
-For GA - Register for: 8740 (12 hrs (minimum of 3 hrs required)
-For SA - Register for: 8740 (1-2 hrs maximum total registration)

4). ANY student with unpaid research with GT faculty or GTRI (no GRA/GTA or tuition waiver)
-Do Not register through Career Center
-For unpaid - Register for: 8740 (1 hr minimum required, recommended 12 hrs for full time position)

Students will be required to submit an "Internship Completion form" via the xx7743 course with a short report about their internship experience.

Notes about GRA and Special Problems

It is generally not possible to earn academic credit, (course with letter grade such as xx8903) and get paid (GRA) for the same work on a project. However, some exceptions may be allowed, pending approval from the project advisor and home unit. The student will need to determine, along with their project advisor, how much of the paid work overlaps with the hours for any special problems course taken for letter grade (xx 8903, etc). The student should not expect that paid work time covers the time expected for the independent study course. In other words, the work done for GRA must be different and separate from the work done for the academic credit (e.g. special problems).

If a student is hired as a GTA/GRA and doing an external internship, please contact the GTA/GRA hiring unit for eligibility and international students should additionally check with the Career Center and OIE.

If student is on a fellowship, they need to check with the fellowship administrator/coordinator for rules and policies on conditions of any additional funding (external or internal positions).

Capstone Project

MS-Robotics Capstone Project Guidelines

- It is the student's responsibility to find advisor willing to oversee capstone project.
- Capstone advisor must be a faculty in one of the six home units.
- As soon as a capstone advisor is determined, the paperwork should be submitted via the 7742 Canvas course site.
- Must declare advisor with the "Capstone Proposal Approval" form due at end of spring term via the 7742 Canvas course site. A copy of the proposal will also be submitted with the form.
- All 8741 sections (e.g., ME 8741 with Prof. XXX) in all home units are permit restricted. Registration for these sections requires an approved capstone proposal form signed by the student's capstone advisor.

- *Note if a student's advisor is different from the home unit, the student will register within the school of the advisor (e.g., student in AE and their advisor is in ECE, the student will register for ECE 8741 section with their advisor).*
- If a student is starting their capstone project in either fall or summer semesters, please contact the Robo Manager for the process.
- Students will submit a "Capstone Project Completion form" and submit their final capstone project via a dropbox link provided by the Robo Manager via email at the end of the final semester.

Notes about GRA and Capstone

If a student will be doing this project as part of a paid job (GRA), they will need to determine, along with the project advisor and/or work supervisor, how much paid work overlaps with the required hours of the capstone credits. Students should not expect that their paid work time covers the time expected for their project. In other words, the work done and paid with the GRA must be different from the work for the capstone.

If a student is doing special problems in addition to capstone and GRA, then the work will have to be separated among the three in terms of what will count towards the GRA, capstone, and special problems, so there is no overlap in what counts towards the paid position, capstone project, and independent study course. It is recommended to take Special Problems as pass/fail hours if offered the academic unit.

Program of Study Coursework Plan

The Program of Study (PoS) form is a document that describes the coursework that a student intends to take to satisfy their degree requirements.

Students must submit a coursework plan via a Program of Study (POS) throughout their program including, but not limited to:

- End of the first semester (via 7741 canvas site)
- *Anytime there is a change to coursework*
- Semester prior to and during final semester for degree audit

Submission does not guarantee approval, and students are cautioned against enrolling in courses that are not on an approved PoS under an assumption that the course will be approved.

ALWAYS submit a REVISED program of study for approval when there are ANY changes to ANY coursework on an APPROVED Program of Study.

The PoS must be submitted before the end of the first semester and anytime thereafter when a student's intended coursework changes.

Avoid common mistakes that led to crises, such as:

1. Taking a course without receiving approval (do not assume that taking the course is grounds for approval)

2. Requesting a Program of Study change at the last minute (a student's desire to graduate is not sufficient grounds to approve a course)

3. Requesting course approval because a student is up against a registration deadline. It is understood that that some schools may change course offerings with short notice and is sympathetic to such requests when such situations occur. A list of previously approved courses and the relevant categories for the Program of Study is listed in the Appendix on courses previously approved. Any course NOT LISTED will require the approval - No exceptions.

4. Students with any previous GT coursework. Some 4000 level courses may have 6000 level equivalents and are not eligible to be retaken for credit (regardless of degree level). It is a student's responsibility to be aware of such conflicts. Contact departments offering the courses and refer to the GT Catalog and Oscar Schedule of Classes.

The Program Director also reviews and approves requests from students to count courses currently not listed as approved.

Degree Works and Degree Audits

- Students can review their degree requirements in Degree Works and monitor their academic progress by logging into Degree Works www.degreeworks.gatech.edu.
- Students should review their Degree Works at least four times a semester (before and during registration to ensure courses applyto your program requirements, after registration, after grades are posted, any time changes are made to your schedule/record).
- If you make a change to your schedule/record (adding/dropping courses, withdrawing from courses, grade mode changes, etc.) it can take Degree Works up to 24 hours to reflect any change.
- Degree works may not be up to date; especially certain times such as reg periods when many changes happen; however, it is more important to ALWAYS have an approved PoS up to date.
- **Note Robo electives and open electives will default to "fallthrough courses." Completed courses will be assigned to the correct major requirement after the first degree audit after a student has applied to graduate and submitted an up-to-date Program of Study form.**
- Having an updated PoS will help advisors to match to Degree Works for degree audits. Changes or "exceptions" must be manually updated by Robo staff and sometimes the Registrar.
- After a student has applied to graduate and notified of degree audits, it is the student's responsibility to monitor their Degree Works and inform their advisor of any discrepancies and/or inaccuraciesthat they find.

Program Completion Timeline

The MS in Robotics program is intended for students to complete the degree program in 5 semesters, including one summer enrollment for the internship. However, if a student finds themselves in a situation where they may need to graduate outside of the standard recommended timeframe, please contact the Robotics Program Manager to discuss options.

Online Application for Graduation OAG

Students should refer to the Registrar's Online Application for Graduation (OAG) and submit a petition to graduate the semester before they plan to graduate. (e.g. if planning to graduate in Spring 2024, then the OAG is due in Fall 2023). This allows time to correct any unfulfilled requirements. See the GT academic calendar for OAG deadlines: https://registrar.gatech.edu/calendar. If a student has previously applied but did not graduate, they must cancel the previous application with the Robo Program Manager and repeat the same process to graduate by submitting a new OAG for the new term.

To view graduation status, login to DegreeWorks. Near the top of the audit, under a section titled *Student View*, there will be a field for *Graduation Information*. The text that appears in that field is the current graduation application status. To review missing requirements, see the section *Degree Requirements*.

The Robo Program Manager will send notifications each semester in preparation for upcoming degree candidates and reminders to submit an updated Program of Study form. Several degree audits will be performed from the time a student submits their OAG in the semester before their intended graduation term until graduation by both Robo program staff and GT Registrar.

Last semester Registration Options

- Register as normal as a full-time student. This is required if you have a GTA/GRA or fellowship.
- Reduced courseload for international students - need prior approval from OIE: https://isss.oie.gatech.edu/isss/enrollment-requirements
- Enrollment Waiver. This is for students who missed the final submission deadline for their target graduating semester, but all degree requirements are completed and will no longer require any of the Institute's facilities or faculty time. The enrollment waiver applies to students who will complete ALL degree requirements prior to the close of Phase II Registration for the term in which they plan to graduate.
- If none of these seem to fit, students should discuss their case with the Robo Program Manager.

Graduation and Commencement Information

For all things related to graduation and commencement, including dates, RSVP, regalia purchase info, and day of event info: https://commencement.gatech.edu/

Questions: events@comm.gatech.edu

Diploma information: https://registrar.gatech.edu/records/diplomas

Course Transfer Credit

Only 9 credit hours of graduate course work from another institution may be transferred. https://catalog.gatech.edu/academics/graduate/policies-and-regulations/

Note courses cannot be transferred if they counted towards a bachelor's degree. They must be graduate level courses that did not satisfy any bachelor's degree requirements (i.e. must be fall through courses). Proper documentation from the previous institution will be required for verification.

To request transfer credit, students should send an email to the Robo Program Manager with the transcripts and syllabus from the other school. Please include the name of the course(s) from the other school and which course at GT it is most equivalent to (for instance, "I believe CICS 5746 is equivalent to CS 7630") and if it is a core or elective requirement. Website links to other schools and/or GT courses/syllabi are helpful.

Note CS/AE/ECE/ME/BME/PHYS 7785, 7741-3, 8740 internship, and 8741 capstone courses cannot be transferred.

Requests for transfer credit may not submitted until after a student has matriculated into the program and cannot be submitted during Phase II registration. Requests will be reviewed after the first two weeks of classes. Note the process to review transfer credit requires faculty evaluation and may take several weeks to months for a decision and if approved, additional time for processing Institute required paperwork.

For students with a bachelor's degree from GT:

A maximum of 6 hours of 4000 level classes can only be used if they were fall through courses (did not count towards any BS degree requirements). *These can be used towards open electives only.* 4000 level classes cannot be used if they were used to satisfy BS requirements.

6000 level classes taken in a GT BS degree may be double counted, max of 6 hours if certain requirements are met, per the Institute: https://catalog.gatech.edu/academics/undergraduate/credit-tests-scores/undergraduate-students-taking-graduate-courses/

Cross-listed/equivalent Courses for students with previous GT degree or coursework

- Some 4000 level courses have graduate course equivalents (CS 4641/7641, etc). If you have already received course credit for a 4000 level courses at ANY time at Georgia Tech regardless of degree, major, program, or level, you will **NOT** receive credit if you also take the listed graduate equivalent course (and vice versa). If the course in

question is required for your program of study, please communicate with the academic program advisor to determine an alternative.
- For CS courses, please refer to the course equivalency chart: https://www.cc.gatech.edu/equivalent-courses
- For other academic units, please refer to the GT Catalog or contact the unit directly.

GT Multiple Master's degrees

If a student has another master's degree or is pursuing another Master's degree at GT, then only 6 credit hours of graduate level course work (6000+) can be used towards both degrees.

https://catalog.gatech.edu/academics/graduate/masters-degree-info/

Appendix

Administration and Contacts

Program Director
Dr. Nader Sadegh

Robo Academic Program Manager
Christian "Chris" Middleton

Who to go to for What:

Go to the Robotics Academic Program Manager for:

- Advisor for MS and PhD Robo curriculum and program requirement requirements
- General advising and College of Computing (CoC) registration Info
- Transfer Credit Requests (note requests are only accepted after a student has matriculated into Robo program, and after week 2 of classes)
- Non-academic issues (resource referrals, etc.)
- Signs as Graduate Coordinator for Graduate Internship forms and Graduate Education forms
- Reduced course load requests from OIE
- Degree audits/degree completion inquiries
- Leave of Absence and Readmissions Requests (coordinated with student's home unit)
- Maintain MS Robo mailing list

- **Contact Christian Middleton: christian.middleton@cc.gatech.edu**

Program Director

- CS/AE/ECE/ME/BME/PHYS 7741-7743 instructor
- Leads Robo FAC committee on admissions and curriculum concerns
- Organizes Capstone requirements (midterm reviews, presentations, etc)
- Change of Major/Transfers requests
- Ultimate approval regarding any curriculum or program decisions (with Robo FAC)
- Robo recruitment events and orientation (organized by Robo admin staff)
- Aids if unable to find summer internship or capstone advisor
- **Contact: Dr. Nader Sadegh: sadegh@gatech.edu**

Go to the Home Unit for:

- Admission decisions processing, including deferral requests
- General info on GTA/GRA positions/processes*
- Initial I-20 requests or updates
- Funding/financial questions and concerns
- Research hours registration**
- Registration Permits***
- Home Unit Recruitment events and orientation
- Home school mailing lists
- **Home Unit General Contacts:**
    - Aerospace Engineering (College of Engineering): ae-graduate-info@aerospace.gatech.edu
    - Biomedical Engineering (College of Engineering):MS: msbmed@gatech.edu
    - Electrical and Computer Engineering (College of Engineering): grad-help@ece.gatech.edu
    - Interactive Computing (College of Computing): ic-academics@cc.gatech.edu
    - Mechanical Engineering (College of Engineering): graduate.programs@me.gatech.edu
    - Physics (College of Sciences): gradinfo@physics.gatech.edu

Note: If a student is hired as a GTA or GRA outside of their home unit, then contact the hiring manager of the unit offering the position with any questions (paperwork, payment details, duties, etc)

**Note: If a student's research advisor is another home unit, then the student will register for research hours under the faculty's home unit. (e.g., student's home unit is AE, but advisor is in ECE, then student registers for research hours under ECE)

***Contact the academic unit offering the course with any questions or permits (e.g., permit for ME 6705 should contact the ME department): https://registrar.gatech.edu/registration/permits-and-overloads

Additional Information, forms, and Links

Institute for Robotics and Intelligent Machines (IRIM): https://robotics.gatech.edu/

RoboGrads student organization: http://robograds.gatech.edu/

MS in Robotics Program Microsoft Teams: email request to join to the Robo Program Manager. Useful program info and forms with opportunity to connect with fellow MS Robo students.

General GT Catalog: http://www.catalog.gatech.edu/rules/

Master's degree info catalog info: https://catalog.gatech.edu/academics/graduate/masters-degree-info/

Catalog Information for Grad Students: http://www.catalog.gatech.edu/academics/graduate/

Registrar's Office: http://www.registrar.gatech.edu • Registration, Graduation, Commencement, Degree Completion Verification • Enrollment Certification • Letters of Completion • Institute Academic Policy

Office of International Education: www.oie.gatech.edu • Visa and Immigration Matters • Optional Practical and/or Curricular Practical Training Matters

Bursar's Office: http://www.bursar.gatech.edu • Student financial accounts, Fee Payments • Refunds

Career Center: https://career.gatech.edu • Internship Opportunities • Graduate Internship Program • Workshops, Career Fairs, resume assistance, career coaching

GT Graduate Studies Office: http://www.grad.gatech.edu

Student Financial Assistance: http://www.finaid.gatech.edu • Loans • Tuition Waivers • Fellowships

Student Forms

MS Program of Study form

Capstone Proposal Guidelines

Capstone Project Proposal Approval form

Capstone Project Guidelines

Capstone Completion form

Internship Completion form

Financial Support

All issues of financial support through a GRA or GTA are a matter between the home school, hiring unit, (if position is outside of home school), faculty advisor, and the student. The student's home school is responsible for the administration of tuition waivers.

Please follow the home school's policies regarding forms and deadlines to avoid any discontinuation of support. This is especially important if the home school is not that of the student's advisor.

Two main types of financial aid are available to qualified graduate students:

1.GRA/GTAs (Graduate Research Assistantships/Graduate Teaching Assistantships).

It is a master's student's responsibility to seek out assistantship opportunities, which may be outside of a student's home unit.

Please note: the last day a student can be placed on a GRA for the semester is the last day of the first week of classes. After this date, even if a professor wishes to financially support a student, the student cannot be supported as a GRA until the following semester.

2. External Fellowships. Most are only available to US citizens and permanent residents. For more information, see https://grad.gatech.edu/paying-for-grad-school.

Note both of these types of financial support require students to be enrolled for full-time.

GT Graduate Student Enrollment and Employment:
https://policylibrary.gatech.edu/academic-affairs/graduate-student-enrollment-and-employment

MS in Robotics Tuition Differential

The MS in Robotics program's tuition is higher than a regular graduate tuition but comparable to other professional MS degree programs.

Tuition and fees for the MS-Robotics degree program can be found on the GT Bursar's webpage.

Tuition Differential and Tuition Waivers

GRA/GTA awards pay for the "regular" portion of graduate tuition and **does not** cover the tuition differential. The remaining tuition and fees are the student's responsibility.

Please see fall 2023 Graduate Assistantship Tuition and Fees:
https://www.bursar.gatech.edu/student/tuition/fa23_gra.pdf

Note international students have an additional $100 international student fee.

Tuition waivers are applied to student accounts by a student's home unit, regardless of which unit the student is hired in.

Special Course Types

Special Topics (xx8803, 8813, 8843, etc) – These courses are offered on a limited basis and NOT permanently listed in the GT Catalog. Any Special Topics course taught by a faculty member in any of Robo home units may be used as a core elective with prior approval. They may also be used towards open electives. Check with the Robo Program Manager if any questions or if not sure which core area the course may counts towards.

List of approval Special Topics courses may be found at: **Robotics courses - all.docx**

Special Problems (xx8903, etc) – These are research projects with a Robotics faculty member in *any* home unit and will require faculty approval and a permit to register. See academic unit for more details. **Special Problems may count towards open elective credit if taken for a letter grade and must not be also paid as GRA for the same work on a project in the same semester.** It is a student's responsibility to seek out these opportunities if desired and register correctly per the home unit.

GT Catalog Course listings

Catalog Descriptions of Fundamental Courses

CS/AE/ECE/ME/BME 7785 Introduction to Robotics Research: Provides students with a familiarization of the core areas of robotics including Mechanics, Control, Perception, Artificial Intelligence, and Human Robot Interaction. Provides an introduction to the fundamental mathematical and computational tools required in robotics research. (3 credit hours).

The desired learning outcome is to provide a strong theoretical foundation for students on the multidisciplinary subject matters found in robotics. This is accomplished by:

1. Providing an introduction to the fundamentals of robotics in the core areas of mechanics, control, perception, artificial intelligence, and Human Robot Interaction.
2. Providing the basic theoretical and computational tools to support the core areas in robotics.

3. The course will familiarize the students with a mobile robot platform based on the Robot Operating System (ROS). The students have access to the lab space housing the mobile robots around the clock.

CS/AE/ECE/ME/BME/PHYS 7741, 7742, 7743, Robotics Professional Preparation, A sequence of three one-hour seminars taken with the cohort targeted at the professional development of students at their stage in the program. The seminar is designed to create a sense of community amongst participants and their MS Robotics cohort.

The seminar aims to prepare students for success in their studies and careers. It includes presentations by industrial and academic Robotics practitioners concerning career choices and preparation and new developments, and discussions about potential internships and capstone projects.

CS/AE/ECE/ME/BME/PHYS 8740 Robotics Internship, A summer-long internship at a partner company, GTRI or a Robotics faculty member's lab. The internship should be selected in consultation with a robotics faculty member advisor with the expectation that the student will transition internship topic to a successful capstone project.

CS/AE/ECE/ME/BME/PHYS 8741 Robotics Capstone Project, Students in the MS Robotics program complete a 6-credit project over two semesters. When feasible, the Capstone project should represent a collaboration between the student, the student's internship supervisor and the student's faculty advisor.

The capstone project is a comprehensive assessment of the knowledge and skills acquired throughout the program. There is freedom for great diversity in project topics and options for investigating, designing, and/or developing artifacts that are relevant to Robotics research and technology areas.

While most students will choose to complete an individual project, groups of 2-3 students may also work together on projects. Projects are typically completed during the second year of the program and are graded based on satisfactory progress towards the expectations set forth in the project syllabus. Deliverables include (but not limited to) a mid-point presentation, final written report, and completion presentation. Expectations include:

- Critically assessing the prior art in an area outside his/her own,
- Performing state-of-the-art experimental or simulation work in a multidisciplinary area,
- Coherently reporting, at the level of a conference publication, on the research performed.

All deliverables will be reviewed by the faculty advisor and when possible, a partner company collaborator.

See attachment in appendix for complete capstone details.

Core Area Courses

Courses satisfying foundation and elective requirements are listed for each area below. Foundation courses indicated with **an asterisk (*) in bold.**

Mechanics

Note it is acceptable to take two foundational courses in Mechanics if in different areas (ie, one in Dynamics and one in Robotics).

- **AE 6210*, Advanced Dynamics I – Kinematics of particles and rigid bodies, angular velocity, inertia properties, holonomic and nonholonomic constraints, generalized forces. Prerequisite: AE 2220. *3 credit hours***
- AE 6211, Advanced Dynamics II – A continuation of AE 6210. Equations of motion, Newtonian frames, consistent linearization, energy and momentum integrals, collisions, mathematical representation of finite rotation. Prerequisite: AE 6210. *3 credit hours*
- AE 6230, Structural Dynamics – Dynamic response of single-degree-of-freedom systems, Lagrange's equations; modal decoupling; vibration of Euler-Bernoulli and Timoshenko beams, membranes and plates. Prerequisites: AE 3120, AE 3515. *3 credit hours*
- AE 6263, Flexible Multi-Body Dynamics – Nonlinear, flexible multi-body dynamic systems, parameterization of finite rotations, strategies for enforcement of holonomic and non holonomic constraints, formulation of geometrically nonlinear structural elements, time-integration techniques. Prerequisites: AE 6211, AE 6230. *3 credit hours*
- AE 6270, Nonlinear Dynamics – Nonlinear vibration methods through averaging and multiple scales, bifurcation, periodic and quasi-periodic systems, transition to chaos, characterization of chaotic vibrations, thermodynamics of chaos, chaos control. Prerequisite: AE 6230. *3 credit hours*
- AE 6520, Advanced Flight Dynamics — Reference frames and transformations, general equations of unsteady motion, application to fixed-wing, rotary-wing and space vehicles, stability characteristics, flight in turbulent atmosphere. *3 credit hours*
- **BMED 8813*, Robotics — Robot kinematics, statics, and dynamics. Open-chain manipulators and parallel manipulators as well as an understanding of trajectory planning and non-holonomic systems. *3 credit hours***
- CS 7496, Computer Animation — Motion techniques for computer animation and interactive games (keyframing, procedural methods, motion capture, and simulation) and principles for storytelling, composition, lighting, and interactivity. *3 credit hours*
- AE/6ME 6705, Introduction to Mechatronics – Modeling and control of actuators and electro-mechanical systems. Performance and application of microprocessors and analog electronics to modern mechatronic systems. Prerequisites ME 3015 or equivalent, or with the consent of the instructor. *4 credit hours*
- **ME 6407*, Robotics – Analysis and design of robotic systems including arms and vehicles. Kinematics and dynamics. Algorithms for describing, planning, commanding and controlling motion force. Prerequisites ME 3015 or ECE 3550. *3 credit hours***
- **ME 6441*, Dynamics of Mechanical Systems – Motion analysis and dynamics modeling of systems of particles and rigid bodies in three-dimensional motion. Prerequisites: ME 3015 or equivalent, or with the consent of the instructor. *3 credit hours***
- ME 6442, Vibration of Mechanical Systems – Introduction to modeling and oscillatory response analysis for discrete and continuous mechanical and structural systems. Prerequisites: ME 3015 and ME 3201. *3 credit hours*

- ME 7442, Vibration of Continuous Systems – Equations of motion and oscillatory response of dynamic systems modeled as continuous media. Prerequisites: ME 6442 or equivalent, or with the consent of the instructor. *3 credit hours*
- **PHYS 6101*, Classical Mechanics I. *3 credit hours***
- PHYS 4142, Statistical Mechanics. *3 credit hours*
- PHYS 7224, Nonlinear Dynamics. *3 credit hours*

Control

- AE 6252, Smart Structure Control – Modeling smart sensors and actuators, development of closed loop models, design of controllers, validation of controllers, application to vibration control, noise control, and shape control. Prerequisite: AE 6230. *3 credit hours*
- AE 6504, Modern Methods of Flight Control – Linear quadratic regulator design. Model following control. Stochastic control. Fixed structure controller design. Applications to aircraft flight control. Prerequisite: AE 3521. *3 credit hours*
- AE 6505, Kalman Filtering – Probability and random variables and processes; correlation; shaping filters; simulation of sensor errors; Wiener filter; random vectors; covariance propagation; recursive least-squares; Kalman filter; extensions. Prerequisite: AE 3515. *3 credit hours*
- AE 6506, Guidance and Navigation – Earth's shape and gravity. Introduction to inertial navigation. GPS aiding. Error analysis. Guidance systems. Analysis of the guidance loop. Estimation of guidance variables. Adjoint analysis. Prerequisite: AE 3521. *3 credit hours*
- AE 6511, Optimal Guidance and Control – Euler-Lagrange formulation; Hamilton-Jacobi approach; Pontryagin's minimum principle; Systems with quadratic performance index; Second variation and neighboring extremals; Singular solutions; numerical solution techniques. Prerequisite: AE 3515. *3 credit hours*
- **AE 6530*, Multivariable Linear Systems and Control. Prerequisite: AE 3515. *3 credit hours***
- Techniques for analysis and description of multivariable linear systems. Tools for advanced feedback control design for these systems, including computational packages
- AE 6531, Robust Control I – Robustness issues in controller analysis and design. LQ analysis, H2 norm, LQR, LQG, uncertainty modeling, small gain theorem, H-infinity performance, and the mixed-norm H2/H-infinity problem. Prerequisite: ECE 6550. *3 credit hours*
- AE 6532, Robust Control II – Advanced treatment of robustness issues. Controller analysis and design for linear and nonlinear systems with structured and non-structured uncertainty. Reduced-order control, stability, multipliers, and mixed-mu. Prerequisite: ECE 6531. *3 credit hours*
- AE 6534, Control of AE Structures – Advanced treatment of control of flexible structures. Topics include stability of multi-degree-of-freedom systems, passive and active absorbers and isolation, positive real models, and robust control for flexible structures. Prerequisite: AE 6230, AE 6531. *3 credit hours*
- AE 6580, Nonlinear Control – Advanced treatment of nonlinear robust control. Lyapunov stability theory, absolute stability, dissipativity, feedback linearization, Hamilton-Jacobi-Bellman theory, nonlinear H-infinity, backstepping control, and control Lyapunov functions. Prerequisite: ECE 6550. *3 credit hours*
- AE 8803 THE, Nonlinear Stochastic Optimal Control *3 credit hours*
- **ECE 6550*, Linear Systems and Controls – Introduction to linear system theory and feedback control. Topics include state space representations, controllability**

and observability, linear feedback control. Prerequisite: Graduate Standing. *3 credit hours*

- ECE 6551, Digital Controls – Techniques for analysis and synthesis of computer-based control systems. Design projects provide an understanding of the application of digital control to physical systems. Prerequisites: ECE 6550 Minimum Grade of D. *3 credit hours*
- ECE 6552, Nonlinear Systems and Control – Classical analysis techniques and stability theory for nonlinear systems. Control design for nonlinear systems, including robotic systems. Includes design projects. Prerequisites: ECE 6550 Minimum Grade of D. *3 credit hours*
- ECE 6553, Optimal Control and Optimization – Optimal control of dynamic systems, numerical optimization, techniques and their applications in solving optical-trajectory problems. Prerequisites: ECE 6550 Minimum Grade of D. *3 credit hours*
- ECE 6554, Adaptive Control – Methods of parameter estimation and adaptive control for systems with constant or slowly varying unknown parameters. Includes MATLAB design projects emphasizing applications to physical systems. Prerequisites: ECE 6550 Minimum Grade of D. *3 credit hours*
- ECE 6555, Optimal Estimation – Techniques for signal and state estimation in the presence of measurement and process noise with the emphasis on Wiener and Kalman filtering. Prerequisites: ECE 6550 Minimum Grade of D. *3 credit hours*
- ECE 6558, Stochastic Systems. Advanced techniques in stochastic analysis with emphasis on stochastic dynamics, nonlinear filtering and detection, stochastic control and stochastic optimization and simulation methods. Prerequisites: CEE/ISYE/MATH 3770. *3 credit hours*
- **ME 6401*, Linear Control Systems – Theory and applications of linear systems, state space, stability, feedback controls, observers, LQR, LQG, Kalman Filters. Prerequisite: ME 3015 or equivalent, or with the consent of the instructor. *3 credit hours***
- ME 6402, Nonlinear Control Systems – Analysis of nonlinear systems, geometric control, variable structure control, adaptive control, optimal control, applications. Prerequisite: ME 6401 or equivalent, or with the consent of the instructor. *3 credit hours*
- ME 6403, Digital Control Systems – Comprehensive treatment of the representation, analysis, and design of discrete-time systems. Techniques include Z- and W-transforms, direct method, control design, and digital tracking. Prerequisite: ME 3015 or equivalent, or with the consent of the instructor. *3 credit hours*
- ME 6404, Advanced Control System Design and Implementation – Analysis, synthesis and implementation techniques of continuous-time and real-time control systems using classical and state-space methods. Prerequisite: ME 6403 or equivalent, or with the consent of the instructor. *3 credit hours*

Perception

- **CS 6476*, Computer Vision – Introduction to computer vision including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification and scene understanding. Credit not awarded for both CS 6476 and CS 4495 or CS 4476. Credit will not be awarded for both CS 6476 and ME 6406. *3 credit hours.***
- CS 7476, Advanced Computer Vision – Advanced topics in computer vision, which includes a deep dive into both the theoretical foundations of computer vision to the practical issues of building real systems that use computer vision. Credit not awarded for CS 7476 and CS 7495. *3 credit hours*

- CS 7616, Pattern Recognition – This course provides an introduction to the theory and practice of pattern recognition.It emphasizes unifying concepts and the analysis of real-world datasets. *3 credit hours*
- CS 7636, Computational Perception – Study of statistical and algorithmic methods for sensing people using video and audio. Topics include face detection and recognition, figure tracking, and audio-visual sensing. Prerequisites: CS 4641 and (CS 4495 or CS 7495) *3 credit hours*
- CS 7643 Deep Learning,. Prerequisite: CS 7641. *3 credit hours*
- CS 8803, 3D Reconstruction and Mapping – Course focuses on multi-robot/multi-camera mapping and reconstruction. Topics range from SLAM, graphical model inferences, and understanding the practical issues regarding multi-platform reconstruction. *3 credit hours*
- CS 8803, BHI Behavioral Imaging – Theory and methods for measuring, recognizing, and quantifying social and communicative behavior using video, audio, and wearable sensor data. *3 credit hours*
- ECE 6255, Digital Processing of Speech Signals – The application of digital signal processing to problems in speech communication. Includes a laboratory project. Prerequisites: ECE 4270 Minimum Grade of D. *3 credit hours*
- ECE 6258, Digital Image Processing – An introduction to the theory of multidimensional signal processing and digital image processing, including key applications in multimedia products and services, and telecommunications. Prerequisites: ECE 4270 Minimum Grade of D. *3 credit hours*
- ECE 6273, Pattern Recognition – Theory and application of pattern recognition with a special application section for automatic speech recognition and related signal processing. Prerequisites: ECE 4270 Minimum Grade of D. *3 credit hours*
- ECE 6560, PDEs in Image Processing and Computer Vision – Mathematical foundations and numerical aspects of partial-differential equation techniques used in computer vision. Topics include image smoothing and enhancement, edge detection, morphology, and image reconstruction. Prerequisites: ECE 6550 Minimum Grade of D. *3 credit hours*
- **ME 6406*, Machine Vision – Design of algorithms for vision systems for manufacturing, farming, construction, and the service industries. Image processing, optics, illumination, feature representation. Prerequisite: Graduate Standing in engineering or related discipline. Credit will not be awarded for both CS 6476 and ME 6406.** ***3 credit hours***

Artificial Intelligence

- **CS 6601*, Artificial Intelligence – Basic concepts and methods of artificial intelligence including both symbolic/conceptual and numerical/probabilistic techniques. Prerequisites: CS 2600**
- **ME 8813*, Machine Learning Fundamentals for Mechanical Engineering Students may take CS 6601 as the foundation course and ME 8813 as the elective. Credit not awarded for both CS 7641 and ME 8813.**
- CS 7612, AI Planning – Symbolic numerical techniques that allow intelligent systems to decide how they should act in order to achieve their goals, including action and plan representation, plan synthesis and reasoning, analysis of planning algorithms, plan execution and monitoring, plan reuse and learning, and applications. Prerequisites: CS 6601
- CS 7640, Learning in Autonomous Agents – An in-depth look at agents that learn, including intelligent systems, robots, and humans. Design and implementation of computer models of learning and adaptation in autonomous intelligent agents. Prerequisites: CS 3600 or CS 4641

- CS 7641 Machine Learning – Machine learning techniques and applications. Topics include foundational issues; inductive, analytical, numerical, and theoretical approaches; and real-world applications. Prerequisites: CS 6601, **Credit not awarded for both CS 7641 and ME 8813.**
- CS 7643 Deep Learning, Prerequisites: CS 7641. 3 credit hours
- CS 8803, Mobile Manipulation – The objective of the course is to gain knowledge of methods for design of mobile manipulation systems. The course covers all aspects of the problem from navigation and localization over kinematics and control to visual and force based perception.
- CS 8803, Robot Intelligence: Planning in Action – Course covers methods for planning with symbolic, numerical, geometric and physical constraints. Topics will range from classical and stochastic planning to continuous robot domains and hybrid control of dynamic systems.
- CS 8803, Computation and the Brain
- CS 8803, Special Topics on Reinforcement Learning
- CS 8803, Statistical Techniques in Robotics

Human Robot Interaction (HRI)

HRI includes two core courses. Students are encouraged, but not required to take both HRI core courses. Students taking both core courses may use their second core class in place of an HRI elective course.

- **AE 6721*, Evaluation of Human Integrated Systems – Evaluation of human integrated systems including translating research questions into measurable objectives, overview of evaluation methods and data analysis techniques applicable to such systems. *3 credit hours***
- **CS 7633*, Human-Robot Interaction – Survey of the state of the art in HRI research, introduction to statistical methods for HRI research, research project studio. A petition has been filed for this to be added to the permanent CS curriculum and have permanent course number. *3 credit hours***
- CS 6455, User Interface Design and Evaluation – Qualitative empirical methods for understanding human-technology interaction. *3 credit hours*
- CS 6750, Human-Computer Interact – Describes the characteristics of interaction between humans and computers and demonstrates techniques for the evaluation of user-centered systems. *3 credit hours*
- CS 8803 CSR, Computational Social Robotics *3 credit hours*
- ISYE 6215, Human-Machine Systems – The development and use of mathematical models of human behavior are considered. Approaches from estimation theory, control theory, queuing theory, and fuzzy set theory are considered. *3 credit hours*
- ISYE 6224, Human-Integrated Systems – State-of-the-art research directions including supervisory control models of human command control tasks; human-computer interface in scheduling and supervision of flexible manufacturing systems. *3 credit hours*
- PSYC 6011, Cognitive Psychology – Survey course on human cognition including pattern recognition, attention, memory, categorization, problem solving, consciousness, decision making, intention, and the relation between mind and brain.
- PSYC 6014, Sensation & Perception – This course examines how sensations and perceptions of the outside world are processed by humans, including physiological, psychophysical, ecological, and computational perspectives. *3 credit hours*

- PSYC 6017, Human Abilities – Theory, methods, and applications of research on human abilities, including intelligence, aptitude, achievement, learning, aptitude treatment interactions, information processing correlates, and measurement issues. *3 credit hours*
- PSYC 7101, Engineering Psych I – Basic methods used to study human-machine systems including both system analysis and human performance evaluation techniques. These methods will be applied to specific systems. *3 credit hours*
- PSYC 7104, Psychomotor & Cog Skill – Human capabilities and limitations for learning and performing psychomotor and cognitive skills are studied. *3 credit hours*

Natural Systems

- **CS 7492*, Simulation of Biology -- Course topics include self-replication, artificial chemistry, multi-cellular development, simulation of evolution, cellular automata, mass-spring simulators, L-systems for plant development, animal locomotion (walking, swimming, jumping), flocking and herding behavior in groups, predator/prey systems, parasites, and foraging behavior. *3 credit hours.***
- PHYS 8814 – Special Topics: Neurophysics. . *3 credit hours.*
- PHYS 4854 – Special Topics: Physics of Living Systems. *3 credit hours.*
- PSYC 6011, Cognitive Psychology – Survey course on human cognition including pattern recognition, attention, memory, categorization, problem solving, consciousness, decision making, intention, and the relation between mind and brain.
- PSYC 6014, Sensation & Perception – This course examines how sensations and perceptions of the outside world are processed by humans, including physiological, psychophysical, ecological, and computational perspectives. *3 credit hours*
- PSYC 6017, Human Abilities – Theory, methods, and applications of research on human abilities, including intelligence, aptitude, achievement, learning, aptitude treatment interactions, information processing correlates, and measurement issues. *3 credit hours*

Note the above courses have been officially approved by the necessary GT governing entities as noted in the GT Catalog. **Please see additional list of unofficially approved courses and anticipated offerings at: Robotics courses - all.docx List is subject to change. (Note requires GT email address to access)**

Current semester offerings are also available prior to start of Phase I registration and viewable at: https://oscar.gatech.edu/

Health and Wellness Resources

STAMPS health services offer a wide range of programs and services that can help students who may need assistance. The Wellness Empowerment Center site includes information on many stress-management services available on campus (e.g., yoga, mindfulness), as well as diet and lifestyle resources.

Questions about Student Health Insurance should be directed to Jennifer White at STAMPS at: jennifer.white@health.gatech.edu.

If a student just needs to talk to another graduate student who knows what they are going through, the Peer Coaching Program provides students with another way to receive support with their academic, social, and other concerns. Students are matched with a fellow Tech

student who has been extensively trained to navigate mental health conversations and who is knowledgeable about campus resources.

Additional resources on campus that are there to assist graduate students include the Women's Resource Center, the LGBTQIA Resource Center and the Veteran's Resource Center.

During graduate school some students may experience health problems (sickness, injury, mental health, etc.), legal problems, or upsetting major life events, such as the death of a family member. In addition, some students find that they are unable to cope effectively with the stresses they encounter while in graduate school. Students in these situations are encouraged to take advantage of on- or off-campus resources for managing either general stress or specific problems. The following is a list of some available resources for graduate students:

Counseling Center www.counseling.gatech.edu

Professional counselors are available to consult confidentially with students about any issue, whether personal or school-related.

Dean of Students www.deanofstudents.gatech.edu

The Dean of Students office advocates for students in handling missed classes and making up work due to sickness, injury, and other adversities. If you experience a problem that interferes with classes for more than a few days, you should contact the Dean of Students office for advice and assistance.

National Graduate Crisis Line
1.877.GRAD.HLP (1.877.472.3457)https://gradresources.org/crisis/

An off-campus, non-profit center for graduate students in crisis that is available 24/7.

In a small number of cases a health problem or life event may be so significant that it prevents a student from making progress in classes or research. In these extreme cases it may make sense to consider a leave of absence, and students should discuss the situation candidly with their advisor, Associate Chair for Graduate Studies in their home unit, Robo Program Manager, and/or the Dean of Students office.

Put the Georgia Tech Police number in your phone (404-894-2500) to call for any safety concerns. Call 911 for emergencies.

The bottom line: if you need help with anything, please ask! There are many resources available to ensure your Ph.D. experience is all you want it to be.

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