

# The Graduate Handbook

Daniel Guggenheim School of Aerospace Engineering  
Georgia Institute of Technology  
*Revised Fall 2018*

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## I. General Information

### I.1 Foreword

This document presents a summary of academic requirements for graduate degrees administered by the Daniel Guggenheim School of Aerospace Engineering. It is intended to be used by the AE graduate student in planning a program of study and in completing the necessary administrative procedures dictated by the degree requirements. Many of the requirements stated herein are in addition to degree requirements described in the Georgia Tech General Catalog, but they are not intended to contradict Institute policies and regulations. The statements set forth in this handbook are for informational purposes only and should not be construed as the basis of a contract between a student and the Institute.

### I.2 The Current Graduate Faculty and Staff

Dr. **Mark Costello** is the William R. T. Oakes chair of the School of Aerospace Engineering and oversees all aspects of our undergraduate and graduate program. He is interested in your comments and suggestions for improving the program, and may be reached by appointment at 404-894-3002 or [mark.costello@ae.gatech.edu](mailto:mark.costello@ae.gatech.edu)

Prof. **Stephen Ruffin** is the associate chair for Graduate Programs. He may be reached at 404-894-8200 or [stephen.ruffin@ae.gatech.edu](mailto:stephen.ruffin@ae.gatech.edu). Prof. Ruffin serves as the graduate coordinator in AE and can answer questions you may have about graduate fellowships and admission into our graduate program, approved programs of study, advisor assignments, and general graduate program questions.

Dr. **Oksana Gomas** is the academic coordinator in the AE Academic Office and handles all the paperwork concerning your studies. She can answer most of your questions about our program. She may be reached at 404-894-3022 or [oksana.gomas@ae.gatech.edu](mailto:oksana.gomas@ae.gatech.edu).

M.S.. **Tasha Koon** is an academic assistant II in the AE Academic Office. She handles all the paperwork concerning graduate admission. She may be reached at 404-894-6046 or [tasha.koon@ae.gatech.edu](mailto:tasha.koon@ae.gatech.edu).

Questions about course offerings, schedules and degree petitions can be emailed to: [advising@ae.gatech.edu](mailto:advising@ae.gatech.edu)

### I.3 Academic Procedures

#### I.3.a Academic Advisement

Every entering aerospace engineering graduate student is assigned to a faculty member, who will be available for academic advisement throughout the student's tenure at Georgia Tech. These assignments are made on the basis of matching the faculty member's technical specialty

with the study program interests of the student. The student is expected to consult with the assigned academic advisor on such matters as:

- Designing a program of study.
- Semesterly registration.
- Interpretation of academic regulations.
- Transfer credit procedures.
- General academic problems (grades, withdrawal, etc.).
- Any matter which influences academic performance.
- Graduation procedures.
- Career planning.

In virtually all cases, the academic advisor will also serve as the student's research advisor.

### I.3.b Registration

During the advisement period for Phase I Registration (typically the 7th week of each semester), the student will consult with the academic advisor before registering. Since all faculty are also required to advise a significant number of undergraduate students during this period, it is strongly recommended that each graduate student make an appointment with his/her advisor.

Students may also register for classes during the first week of the semester (Phase II). However, since lightly populated classes may be cancelled prior to Phase II, students are strongly encouraged to register during Phase I.

After consultation with the advisor, it is the student's responsibility to complete all registration procedures and pay tuition and fees. The registration procedures are completely described online in the On-line Student Computer Assisted Registration ([OSCAR](#)). OSCAR also includes a listing of all Georgia Tech courses that have been scheduled for the term. More complete course information can be found in [Georgia Tech's On-line Catalog](#).

### I.3.c Graduation

All masters and doctoral students must indicate their intent to graduate from Georgia Tech early in the term *prior* to their graduation. The graduation application instructions and specific deadlines on the **AE website**.

## I.4 Academic Workload

### I.4.a General Requirements

Although students signed up for 12 credit-hours are considered "full time" by the Institute, students in AE should sign up for 21 credit-hours. As many of these hours as possible, but no less than 12, must be on a letter-grade or pass/fail basis. Students should register for a sufficient number of AE 7000 credit-hours (M.S. students) or AE 9000 credit-hours (Ph.D.

students) to bring their academic load to the required 21 credit-hours. Part-time students, on campus or enrolled in distance learning, may sign up for as little as three (3) credit-hours.

Students assigned to the Institute by the armed forces for the purpose of pursuing a degree, and those with assistantships, fellowships, traineeships, tuition waivers or individual grants, are required to be enrolled full-time (i.e. should be enrolled for 21 credit-hours), even during their graduating term.

Students on F-1 or J-1 visas must be enrolled for 21 credit-hours (letter-grade or pass/fail), except, under certain circumstances, during their first and last semesters. During summer semesters, students on F-1 or J-1 visas may reduce the number of credit-hours or skip summer semester (without leaving the country). For detailed advice, or when in doubt, please contact the Georgia Tech [Office of International Education](#).

#### I.4.b Employed Non-assistantship Students

The maximum allowable semester load for students employed by the Institute (other than graduate assistants) is reduced as a function of the number of hours employed per week as follows:

<b>Work Load per Week:</b>	<b>Maximum Semester Hour Load:</b>
Full time (40 Credit-hours)	6
3/4 of Full time (30 Credit-hours)	9
2/3 of full time (27 Credit-hours)	10
1/2 of Full time (20 Credit-hours or fewer)	12

#### I.4.c Registration Waiver

Graduate students who have completed all of the requirements for their degree, including theses, special problems, projects and removal of incomplete grades by the end of the registration period of the semester in which they are to receive their degree, may request a registration waiver for that term.

Students requesting a registration waiver must have been registered in the semester prior to the semester for which a waiver is requested. No Institute facilities or faculty time are to be utilized by the student during the term for which the student receives a waiver.

A [registration waiver](#) (PDF) must be completed by the student, and signed by the student's academic advisor and the AE school chair or AE associate chair. The completed request letter must be submitted to the Graduate Office by the end of the registration period for the semester in which the registration is to be waived.

Students who have completed all their course work and almost all of their thesis-related work and are not supported through Georgia Tech, may register for only one (1) credit-hour during

this last semester. This exception to the three-hour minimum rule is granted only once for each student. **NOTE:** *International students must notify the Office of International Education before they register less than full-time.*

#### I.4.d Dismissal Policy for Graduate Students

Graduate students at both the M.S. and Ph.D. levels are expected to carry out research as part of their graduate training. Each student must perform acceptably in his/her research work as evaluated by his/her faculty advisor. A student who does not perform satisfactorily in this area may lose his/her research supervision as well as any associated funding, at the discretion of the advisor. This applies even if the student's GPA meets or exceeds the minimum set by the Institute.

A student in danger of being dismissed by his/her advisor can expect to receive sufficient warning (at least 3 months) in the form of an "Unsatisfactory" as his/her research grade (AE 7000 or AE 9000). In addition, the student can expect to receive a letter or e-mail outlining the deficiencies and spelling out at what level he/she would have to perform in order to continue working with the advisor. Funding support will normally not be withdrawn in mid-term since this may cause the student to owe the Institute out-of-state tuition for that term.

A student who no longer has an advisor should ask the associate chair for Graduate Studies for help in finding new research supervision. A student who has lost his/her funding may also request at least partial funding from the associate chair, for example, as a grader, if such a position is available.

A graduate student who cannot find a new advisor after one full term must leave the School of Aerospace Engineering. The associate chair for Graduate Studies may extend this period for one additional term at his/her discretion, under extenuating circumstances, or if there is reason to believe that this will permit the student to find an advisor at Georgia Tech or at another Institution.

A graduate student who is dismissed by the Institute for academic or disciplinary reasons will not normally be readmitted.

#### I.5 AE Website

The School home page is <http://www.ae.gatech.edu> . This site provides news, events, research, curriculum, academic advisement information, course outlines for courses, information about student groups and faculty, and other useful information. AE communications manager [Kathleen Moore](#) and the [AE Computer Support](#) staff maintain the website. Please direct to their attention any necessary corrections or revisions that you become aware of, as well as any broken links.

## II. Master's Degree Requirements

### II.1 Academic Requirements

#### II.1.a Program of Study

Each student enrolled in the Master of Science program will, in conference with the academic advisor, formulate a program of study which satisfies both the technical interests of the student and the degree requirements set forth herein and in the [General Catalog](#). The student should review graduate [course descriptions](#) on the AE website.

**NOTE:** *Sample M.S. degree programs are presented at the end of this section to assist the student in designing a program of study.*

While each program of study can be tailored to the specific interests of the student, it must also satisfy certain minimum coursework requirements in order for the degree to be awarded by the School of Aerospace Engineering. The following table summarizes these requirements for the M.S. degree. (See below for further discussion of these requirements.)

<b>M.S. Credit Hour Requirements</b>	<b>M.S. without Thesis (33 hrs total):</b>	<b>M.S. with Thesis (33 hrs total):</b>
<b>AE Graduate Seminar</b>	AE8801*	AE8801*
<b>Formal Courses (not including: thesis, research or AE8900)</b>	<b>30</b>	<b>24</b>
GT AE Class (minimum)	12	9
Math (minimum)	6	6
Non-technical** (maximum)	6	3
6000 level or above (minimum)	21	15
<b>Research Coursework</b>	<b>3</b> (AE 8900)	<b>9</b> (AE 7000)

\*AE8801 (1 credit hr. P/F) is required during the first year in residence in the graduate program at GT but does not count toward the 33 credit-hours needed for the degree. This requirement is waived for distance-learning students.

\*\*Technical courses are defined as any courses in the College of Engineering, College of Science or College of Computing; all other courses are considered non-technical.

After the program of study is agreed to by the student and advisor, the courses will be listed on the [AE M.S. Program Summary](#) form (PDF). This form will be retained with the student's other academic records in the AE Academic Office. Each semester, when the student confers with the advisor before registration, the advisor will update this form with the grades obtained and enter any modifications to the program of study.

The final approved program of study must be completed within a period of six consecutive calendar years. This must be turned in early in the semester prior to graduation as part of the graduation process. The graduation application instructions and specific deadlines are found on [AE website](#).

### II.1.b M.S. – Thesis Option

All students enrolled in the Master of Science program must decide sometime during the first semester whether or not a thesis will be submitted in partial fulfillment of the degree requirements. Those students who will be submitting a thesis must complete a minimum of 24 credit-hours of formal coursework at the 4000-level or above (with the exception of Math 3215), which do not include any Georgia Tech [Bachelor of Science in AE required courses](#). Formal courses are non-research-based courses taken on a letter-grade basis. Of these 24 credit-hours of formal course work, at least nine (9) must be taken in the School of Aerospace Engineering. Of the remaining hours, no more than three (3) may be in a non-technical subject, as long as the course forms a reasonable part of the program of study. The 24 credit-hours of formal coursework must include at least 15 credit-hours at the 6000 level or above. **All of these minimum credit requirements for formal coursework must be taken on a letter-grade basis.**

During the first year in residence in the graduate program at Georgia Tech, each student must satisfactorily complete one semester of AE8801 AE Graduate Seminar. This requirement is waived for distance-learning students. This 1 credit-hour course is taken on a pass/fail basis and does not count toward the 33 credit-hour requirement for the M.S. degree. The AE Graduate Seminar introduces graduate students to world-class aerospace researchers and topics and introduces students to Institute resources that support the student's academic and research success.

In addition to the formal and seminar coursework described above, the student is also required to satisfactorily complete a minimum of nine (9) credit-hours of Master's Thesis (AE 7000) and submit an approved M.S. thesis to the Office of Graduate Studies and Research.

### II.1.c M.S. – Non-Thesis Option

Students who submit a thesis must satisfactorily complete a minimum of 33 credit-hours at the 4000-level or above (with the exception of Math 3215), which do not include any Georgia Tech [Bachelor of Science in AE required courses](#). Thirty (30) of the 33 credit-hours must be formal coursework, where formal courses are non-research-based courses taken on a letter-grade basis. The remaining three (3) credit-hours must be AE8900 (Special Problems in AE). At least 12 credit-hours of formal coursework must be taken in the School of Aerospace Engineering. Of the remaining credit-hours only six (6) may be in a non-technical subject as long as these courses form a reasonable part of the program of studies. The 30 credit-hours of formal coursework must include at least 21 credit-hours at the 6000-level or above. **All of these minimum credit requirements must be taken on a letter-grade basis.**

During the first year in residence in the graduate program at Georgia Tech, each student must satisfactorily complete one semester of AE8801 AE Graduate Seminar. This requirement is waived for distance-learning students. This 1-credit hour course is taken on a pass/fail basis

and does not count toward the 33 credit hour requirement for the M.S. degree. The AE Graduate Seminar introduces graduate students to world-class aerospace researchers and topics and introduces students to Institute resources that support the student's academic and research success.

The M.S. Without Thesis option must also include 3 research hours (AE8900, Special Problems in Aerospace Engineering). This is designed to provide M.S. students selecting this option with an introduction to planning, carrying out, and documenting a research project. Additional hours of AE8900 may be taken but only three (3) credit-hours will be allowed in the 33 credit-hour requirement for the degree. In order to register for AE8900, you must complete an [AE8900 Special Problem.S. Permit](#) (PDF) and have it approved by your advisor before emailing it to [permits@ae.gatech.edu](mailto:permits@ae.gatech.edu). In order to receive credit for this course, you must submit a report to your advisor and this will be graded on a letter-grade basis. You must then submit a cover sheet showing the letter-grade along with a summary or abstract to the AE Academic Office.

#### II.1.d Mathematics Requirement

Before receiving the Master of Science degree, the student must have satisfactorily completed at least six (6) semester-hours of mathematics beyond the mathematics requirement for the Bachelor of Science in Aerospace Engineering degree at Georgia Tech. These courses must be at the 4000 level or above (with the exception of Math 3215). These courses must either carry the 'Math' prefix or be selected from the list below:

- CS 7530 Randomized Algorithms
- ECE 6601 Random Processes (formerly ECE 6050)
- ISYE 6413 Design and Analysis of Experiments
- ISYE 6414 Regression Analysis
- ISYE 6416 Computational Statistics
- ISYE 6650 Probabilistic Models
- ISYE 6739 Basic Statistical Methods
- PHYS 6124 Mathematical Methods of Physics I
- PHYS 6125 Mathematical Methods of Physics II
- PHYS 6268 Nonlinear Dynamics and Chaos (not with Math 6307)
- PUBP 6114 Applied Policy Methods

The courses in the list above were selected because they primarily introduce mathematical methodology rather than use mathematical techniques to model physical phenomena. Other courses may be added to this list when approved by the AE Graduate Committee. Requests to add additional courses to the list should be submitted to the Committee before the student signs up for the class. Courses in applied math or numerical methods offered in individual disciplines will usually not be acceptable. For example, the course, ME 6758 Numerical Methods in Mechanical Engineering, is **not** approved (a request to approve was rejected by the AE Graduate Committee).

If the additional mathematics courses were taken before entering the graduate program at Georgia Tech, and if those courses were not used to satisfy requirements for another degree, then the student may seek transfer credit for those courses. If transfer credit is not possible or not awarded, then the additional mathematics courses may not be included in the program of study. However, subject to recommendation by the advisor and approval by the AE associate chair for Graduate Programs, those courses may still be used to fulfill the (6) six-hour mathematics requirement. In this case, the final program of study must satisfy the appropriate degree requirements (minimum of 24 credit-hours or 30 credit-hours of formal course work), but there will be less than six (6) credit-hours of mathematics. **All mathematics courses counting towards the six-hour requirement must be completed on a letter-grade basis.**

#### II.1.e Academic Performance

All students enrolled in the Master of Science program in the School of Aerospace Engineering are required to maintain a grade point average of at least 2.7 in order to be in "good academic standing." This average will be computed for all course work that is eligible to be counted towards the degree. However, the registrar compiles the official GPA using all courses taken while a graduate student at Georgia Tech. M.S. students in AE must also meet the Institute requirement of a grade point average of at least 2.7 based on all courses taken while a graduate student at Georgia Tech in order to be in good academic standing.

A student may be admitted to the Master of Science program on "conditional graduate standing" because of marginal undergraduate grades or an undergraduate degree that does not provide sufficient prerequisite material. Such a student must satisfy certain academic requirements that will be established at the time of matriculation before he/she can transfer to full graduate standing. Students with low undergraduate grade point averages must complete at least 18 credits of graduate course work with a grade point average of at least 2.7 before being recommended for "full graduate standing." Students whose undergraduate background does not sufficiently prepare them for the Master of Science program in their discipline of choice must complete certain undergraduate course work as recommended by their academic advisor and approved by the AE Graduate Coordinator. This course work must be completed with a grade point average of at least 2.7 before the student is recommended for "full graduate standing." Eligible courses taken while on conditional standing carry over and count for credit toward the degree.

#### II.1.e Transfer Credit

A student may receive up to six (6) credit-hours of transfer credit for graduate-level courses taken at an accredited institution in the United States or Canada and not used for credit toward another degree. To obtain transfer of credit, the student must confer with the academic advisor to ascertain that the courses to be transferred are a logical part of the student's program of study. If the courses are appropriate, the student must provide a current transcript that verifies

completion of the credit, plus necessary descriptive materials including catalog descriptions and textbooks for evaluation of the credit.

A student may not receive transfer credit towards the M.S. degree from universities outside the United States and Canada. An international student can obtain credit for courses previously taken but not applied toward another degree by passing an appropriate examination. Such students should consult with their advisor in this regard. *See Section XIV in the Georgia Tech Catalog.*

## II.2 M.S. Thesis

Towards the end of the first semester following matriculation, all students who have elected to submit a thesis as part of their M.S. degree program will select their thesis topic. This decision will be made in conference with the assigned academic advisor. Definition of the thesis topic will include identification of the motivation for the investigation, a scheduling of the scope of work associated with the study, and a statement of the anticipated objectives. The purpose of the thesis is to further the educational development by requiring the student to plan, conduct and report on an organized and systematic study of importance.

### II.2.a Advisory Committee & Proposal

Shortly after the thesis topic has been identified, the student and advisor will select a thesis advisory committee. This committee will include the advisor as the committee chairperson and two others who are well qualified in the subject matter of the thesis. At least two of the committee must be members of the faculty of Georgia Tech's School of Aerospace Engineering. The task of the advisory committee is to advise and direct the student on the scope and execution of the investigation.

Shortly after the committee has been selected, the student must write a brief thesis proposal. This proposal, **which should not exceed 20 pages of text plus figures and tables**, should include the motivation behind the topic selection, the scope of work, preliminary results, and the specific objectives. After an editorial review by the advisor, the proposal will be distributed to the other committee members. The student must contact the AE Academic office, provide a filled-in [Thesis Proposal Template](#) form and ask the Academic Office to schedule and advertise the proposal. No less than two (2) weeks following distribution of the proposal, the student will make a presentation of the proposed study to the advisory committee as a whole. After the committee has approved the proposed effort and has signed the [Request for Approval of Master's Thesis Topic](#) form (PDF). This form and a copy of the thesis proposal will be submitted to the AE Academic Office for approval by the chair and forwarding to the Office of Graduate Studies and Research. The AE Academic Office should receive the form **at least six (6) months before graduation.**

## II.2.b Final Examination

At the conclusion of the research effort the student will write the thesis by setting forth in a clear and articulate form the results and conclusions of the study. The "Manual for Graduate Theses," available from the Graduate Office, specifies the requirements for the thesis. After the advisor has completed an editorial review of the thesis, copies will be distributed to the remainder of the advisory committee. No less than two weeks after distribution of the thesis, the student, with the approval of the committee, will schedule the "Final Examination."

The student must contact the AE Academic office, provide a filled-in [Thesis Defense Template](#) form and ask the Academic Office to schedule and advertise the proposal. An announcement of the thesis defense will be distributed to all faculty and graduate students of the School of Aerospace Engineering via e-mail and will be posted by the AE Academic Office on the AE website at least one (1) week prior to the presentation. The announcement will include the title of the thesis and name of the author as well as the time and location of the presentation.

The final examination will consist of a formal presentation of the thesis results and conclusions to the advisory committee and others. Immediately following the presentation and discussion by the general audience, the student will be questioned by members of the committee and any interested members of the academic faculty. This meeting will be used by the committee to ascertain that the student is well versed in the topic of the thesis and to inform the student of any modifications to the thesis that they require to be made before it is submitted to the graduate office.

## II.2.c Thesis Submittal

After the advisory committee has approved the thesis and signed the [Certificate of Thesis Approval](#) form (PDF), the **Certificate of Thesis Approval** must be turned in to the Office of Graduate Studies and Research. The [Institute Theses and Dissertations](#) webpage provides the deadlines and specific instructions for the required electronic submittal of the thesis. The graduate office also requires a publishable thesis abstract of up to 300 words, certified for accuracy by the thesis advisor. **NOTE:** *The deadline for submitting a thesis to the Graduate Office is well before the end of the semester in which the student plans to graduate.*

## II.3 M.S. Special Problem

### II.3.a Registration

All students who will be completing a Special Problem in partial fulfillment of the M.S. degree requirements must register for three (3) credit-hours of Special Problems in Aerospace Engineering (AE 8900). These credits are normally taken during the final semester of the program of study. Before the student is permitted to register for AE 8900, the AE Academic Office must receive a statement signed by the academic advisor that briefly describes the topic

of the investigation and the number of academic credits to be awarded for completion of this part of the project.

### II.3.b Report Submittal

At the conclusion of the Special Problem research effort, the student will write a Special Problem report that describes the task, the results and the conclusions formed on the basis of these results. The format and content of the report will be specified by the academic advisor. A copy of this report will be retained in the files of the advisor for potential future reference by other students and faculty. Before a grade for AE 8900 can be accepted by personnel in the AE Academic Office, they must receive one copy of the title page of the Special Problem report. These documents will be retained in the student's academic files. The title page must include the special problem title, names of the student and advisor, the date of completion, the grade received and a 100- to 300-word abstract briefly describing the effort, results and conclusions of the study.

### II.4 Sample M.S. Degree Programs

The M.S. Without Thesis programs of study presented below are samples that a student could follow if interested in the indicated technical specialty. Students on Graduate Research Assistantships are usually limited to three formal courses per term. **It is expected that each student, in consultation with the faculty advisor, will formulate an individually tailored program of study that is compatible with the student's research and career interests.**

It should be noted that students pursuing the M.S. with Thesis option can modify the programs of study listed below by 1) Not taking AE8900, 2) Replacing 9 credit-hours of the additional coursework shown with 9 credit-hours of AE7000.

#### Aerodynamics and Fluid Mechanics

*16-month program*

FALL	SPRING	SUMMER	FALL
AE 6009	AE 6012	AE 6050	AE 8900
AE 6030/6765	AE 6020/6503/6766	MATH XXXX	AE 6060
AE 6070	AE 6042/6052	MATH XXXX	

#### Aeroelasticity and Structural Dynamics

*16-month program*

FALL	SPRING	SUMMER	FALL
AE 6030	AE 6111	ELECTIVE	MATH XXXX
AE 6230	AE 6107	MATH XXXX	AE 8900
AE6770	AE 6200		ELECTIVE

#### Flight Mechanics and Controls

*16-month program*

FALL	SPRING	SUMMER	FALL
AE 6511/6580	AE 6531	ELECTIVE	AE 6210/6520
AE 6550	ELECTIVE/ MATH XXXX	ELECTIVE/ MATH XXXX	AE 6511/6580
AE 6210/6520	MATH XXXX		AE 8900

### Propulsion and Combustion

#### 16-month program

FALL	SPRING	SUMMER	FALL
AE 6765	AE6766	AE 6050	MATH XXXX
AE 6009	AE 6011	AE 6060	AE 6761/6080/6041/6450
MATH XXXX	AE 6760/6440/8603		AE 8900

### Structural Mechanics and Materials

#### 16-month program

FALL	SPRING	SUMMER	FALL
AE 6769	AE 6100	AE 6104	MATH XXXX
AE 6770	AE 6200	MATH XXXX	AE 8900
AE 6230	AE 6107	AE 6101	AE 7792

### SystemS. Design and Optimization

#### 16-month program-SSDL

FALL	SPRING	3 <sup>RD</sup> TERM*	4 <sup>TH</sup> TERM*
AE 6373	AE 6374	AE 6450	AE 8900
AE 6353	AE 6322	MATH XXXX	AE 6354 OR 8803 BRA
AE 6765	AE 6766	MATH XXXX	

#### 16-month program-ASDL

FALL	SPRING	3 <sup>RD</sup> TERM*	4 <sup>TH</sup> TERM*
AE 6373	AE 6374	MATH XXXX	AE 8900
AE 6341	AE 6342	QUALS 3	
AE 6372	QUALS 3		

\*Design students often intern during the summer term; therefore 3<sup>rd</sup> term may be fall semester the second year.

\*\*Electives may be design or discipline electives. Electives can be used to support subsequent Ph.D. qualifying exams.

\*\*\*Design Seminar is a 1 hour Pass/Fail course required of all design students, but P/F hours do not count toward academic degree requirements.

## III. Doctor of Philosophy Degree Requirements

### III.1 Academic Requirements

The academic requirements specify formulation of a Program of Study for each student that must meet the Course Credit Requirements and the Mathematics Requirement. Transfer credits from prior coursework may also be used. When pursuing the Program of Study, the student must meet an academic performance requirement.

### III.1.a Program of Study

Each student enrolled in the Doctor of Philosophy (Ph.D.) program will, in conference with his/her academic advisor, formulate a program of study that satisfies both the technical interests of the student and the degree requirements set forth herein and in the General Catalog. No sample Ph.D. degree programs are presented in this section. Students entering with a Bachelor's Degree in Aerospace Engineering will generally follow the sample program of the M.S. degree during their first year. Beyond that point, programs of study should be tailored to the individual need of the students using courses offered by the School of Aerospace Engineering and related courses offered by other schools at Georgia Tech.

While each program of study can be tailored to the specific interests of the student, it must also satisfy certain minimum coursework requirements set by the School of Aerospace Engineering. The following table summarizes these requirements for the Ph.D. degree. (*See below for further discussion of these requirements.*)

<b>Ph.D. Credit Hour Requirements</b>	<b>Hrs. after Bachelor's Degree</b>
<b>AE Graduate Seminar</b>	AE 8801*
<b>Formal Courses (not including: thesis, research or AE8900)</b>	<b>42 hrs total</b>
GT AE Classes (minimum)	18
Math (minimum)	9
Non-technical** (maximum)	6
Hours at 6000 or above (minimum)	36

\*AE8801 (1 credit hr. P/F) is required during the first graduate year in residence at GT but does not count toward the 42 credit-hours needed for the degree.

\*\*Technical courses are any courses in the College of Engineering, College of Science or College of Computing; all other courses are considered non-technical.

After the program of study is agreed to by the student and advisor, the courses will be listed on the [AE Ph.D. Program Summary](#) form (PDF). This form will be retained with the student's other academic records in the AE Academic Office. Each semester, when the student confers with the advisor before registration, the advisor will update this form with the grades obtained and enter any modifications to the program of study.

### III.1.b Course Credit Requirements

All students enrolled in the Doctor of Philosophy program must satisfactorily complete a minimum of 42 credit-hours of formal course work beyond the bachelor's degree. These courses must be at the 4000-level or above, which do not include any Georgia Tech [Bachelor of Science in AE required courses](#) .

Formal courses are non-research-based courses taken on a letter-grade basis. Of these 42 credit-hours, at least 18 must be taken in the School of Aerospace Engineering. Of the

remaining hours, no more than nine (9) may be in non-technical areas and only if these courses form a reasonable part of the program of studies. These 42 credit-hours must include at least 36 credit-hours at the 6000 level or above. **Special Problem course credits and research course credits may not be included in the above minimum credit requirements.** AE 8900 credits may not be counted toward the Ph.D. course requirements. **All of these minimum credit requirements must be taken on a letter-grade basis.**

During the first year in residence in the graduate program at Georgia Tech, each student must satisfactorily complete one semester of AE8801 AE Graduate Seminar. This one (1) credit-hour course is taken on a pass/fail basis and does not count toward the 42 credit hour requirement for the Ph.D. degree. The AE Graduate Seminar introduces graduate students to world-class aerospace researchers and topics and introduces students to Institute resources that support the student's academic and research success.

### III.1.c Mathematics Requirement

For the Doctor of Philosophy degree, the student must have satisfactorily completed at least 9 semester-hours of mathematics beyond the mathematics requirement for the Bachelor of Science in Aerospace Engineering degree at Georgia Tech. These courses must be at the 4000 level or above. **Math 3215 does not count toward the Ph.D. requirement of 9 credit-hours of mathematics and does not count toward the Ph.D. requirement of 42 credit hour total.** These mathematics courses must either carry the 'Math' prefix or be selected from the list below:

- CS 7530 Randomized Algorithms
- ECE 6601 Random Processes (formerly ECE 6050)
- ISYE 6413 Design and Analysis of Experiments
- ISYE 6414 Regression Analysis
- ISYE 6416 Computational Statistics
- ISYE 6650 Probabilistic Models
- ISYE 6739 Basic Statistical Methods
- PHYS 6124 Mathematical Methods of Physics I
- PHYS 6125 Mathematical Methods of Physics II
- PHYS 6268 Nonlinear Dynamics and Chaos (not with Math 6307)
- PUBP 6114 Applied Policy Methods

The courses in the list above were selected because they primarily introduce mathematical methodology rather than use mathematical techniques to model physical phenomena. Other courses may be added to this list when approved by the AE Graduate Committee. Requests to add additional courses to the list should be submitted to the Committee before the student signs up for the class. Courses in applied math or numerical methods offered in individual disciplines will usually not be acceptable. For example, the course, ME 6758 Numerical Methods in Mechanical Engineering, IS NOT approved (a request to approve was rejected by the AE Graduate Committee).

If the additional mathematics courses were taken before entering the graduate program at Georgia Tech, and if those courses were not used to satisfy requirements for another degree, then the student may seek transfer credit for those courses. If transfer credit is not possible or not awarded, then the additional mathematics courses may not be included in the program of study. However, subject to recommendation by the advisor and approval by the AE Associate Chair for Graduate Programs, those courses may still be used to fulfill the nine-hour mathematics requirement. In this case, the final program of study must satisfy the appropriate degree requirements (minimum of 42 credit-hours of formal course work), but there will be less than nine (9) credit-hours of mathematics. **All mathematics courses counting towards the nine-hour requirement must be completed on a letter-grade basis.**

#### III.1.d Academic Performance

All students enrolled in the Doctor of Philosophy program in the School of Aerospace Engineering are required to maintain a grade point average of at least 3.25 in order to be in good academic standing. This average will be computed for all course work eligible towards the Ph.D. degree and taken at Georgia Tech. However, the registrar compiles the official GPA using all courses taken while a graduate student at Georgia Tech. Ph.D. students in AE must also meet the Institute requirement of a grade point average of at least 3.0 based on all courses taken while a graduate student at Georgia Tech in order to be in good academic standing.

In addition to the overall grade point average of 3.25, the student must maintain at least a 2.8 grade point average in all mathematics courses taken as a graduate student at Georgia Tech.

The student must satisfy the above grade point average requirements in order to take the Ph D. qualifying exam, be admitted to the candidacy, present a thesis proposal or graduate.

#### III.1.d Transfer Credit

A student may receive up to thirty (30) semester-hours of AE transfer credit for graduate-level courses taken at an accredited institution anywhere in the world and not used for credit toward an undergraduate degree. To obtain this transfer of credit, the student must confer with the academic advisor to ascertain that the courses to be transferred are a logical part of the student's program of study. If the courses are appropriate, the student must provide a current transcript that verifies completion of the credit, plus necessary descriptive materials including catalog descriptions and textbooks for evaluation of the credit. AE transfer credit in mathematics must be approved by the School of Mathematics. A record of the courses accepted for AE transfer credit will be made on the "AE Graduate Student Transfer Credit" form that may be obtained from the AE Academic Office. This record will be retained in the AE Academic Office with the remainder of the student's academic files. This transfer credit will **not** appear on the student's transcript.

## III.2 Qualifying Examination

To be accepted as a candidate for the Ph.D. degree, a student must take and successfully complete the Aerospace Engineering Ph.D. qualifying examination. The exam is typically offered by the AE faculty two times each year and must be formally scheduled by the student. An in-depth overview of the Ph.D. qualifying exams may be found on the [AE website](#).

### III.2.a Scheduling the Examination

The Ph.D. qualifying examination is offered twice a year, usually in the second week of the Fall and Spring semesters. Approximately three months before the date on which the student wishes to take the qualifying examination, the advisor must recommend to the AE Graduate Committee that the student be permitted to continue in the Ph.D. program and, thus, to register for the exam. To do this, the student must submit a Ph.D. Qualifying Exam Request form (which can be obtained from the AE Academic Office) and have it approved by his/her advisor and the AE Graduate Committee. Students are generally expected to take this examination during their second year of full-time graduate study. In order for a graduate student to be permitted to take the Ph.D. Qualifying examination, the student must have taken a minimum of 12 credit-hours of coursework at Georgia Tech. In addition, the student must have at least a 3.25 grade point average in coursework taken at Georgia Tech, which will count toward the 42 credit-hour Ph.D. requirement. If a student retakes a class, only the most recent grade will be used to compute this GPA for AE Ph.D. qualifying exam eligibility.

### III.2.b Administering the Examination

As described in the [overview of the Ph.D. qualifying exams](#), the student, in consultation with his/her advisor, will select two [qualifying examination areas](#) (PDF). It should be noted that the general scope of each examination will be based on the enumerated **primary** courses plus all associated **prerequisite** and **background** material at the graduate and undergraduate level. Every Ph.D. student will take an oral examination in each of the selected areas. Each examination will be administered by three faculty members.

All degree requirements must be completed within five years from the end of the semester in which the student passes the Ph.D. qualifying examination.

### III.2.c Reexaminations

If a student fails the qualifying examination (i.e. fails one or both examination areas), a reexamination will be automatically permitted. This reexamination must be taken the next time the examination is offered. The reexamination will be given in the same two areas as the first examination. However, if student obtained unanimous passing grades in one of the areas during the first attempt, that student does not need to be reexamined in that area. Such a student's reexamination will occur only in the area in which he/she did not get unanimous

passing grades. A second failure of the examination will result in dismissal from the AE Ph.D. program.

### III.3 Ph.D. Dissertation

Each Ph.D. candidate must carry out original research and describe it in a dissertation. This requires determination of a research topic, selection of a dissertation advisory committee, preparation of a research proposal (oral presentation followed by comprehensive examination), completion of the research and preparation of the dissertation, and lastly, oral presentation followed by final examination (i.e., thesis defense).

All students enrolled in the Ph.D. degree program will determine their topic of research, which will lead to their dissertation, as early as possible. This decision will be made in conference with their academic advisors. The research effort should represent an original and significant contribution in the major field of study. Definition of the research topic will include identification of the motivation for the investigation, a scheduling of the scope of work associated with the study, and a statement of the anticipated objectives. One purpose of the dissertation is to further the educational development by requiring the student to plan, conduct and report on an organized and systematic program of research in the major field of study; the other is to advance fundamental knowledge in the field of aerospace engineering.

#### III.3.a Advisory Committee & Proposal

Shortly after the Ph.D. Qualifying examination has been passed and the research topic has been defined, and no later than one year after passing the qualifier, the student and advisor will select a dissertation "Advisory Committee." This committee will include the advisor as the committee chairperson and two others who are well qualified in the subject matter of the research. At least two members of the committee must be members of the School of Aerospace Engineering Faculty and hold an earned Ph.D. degree. The task of the Advisory Committee is to advise and direct the student on the scope and execution of the research, and the student and the advisor should generate a course of study, including courses and topics for self-study, that will benefit the student's preparation for the thesis research.

The student must write a brief technical report that describes the proposed research effort. This **Research Proposal** should include the motivation behind the topic selection, a brief account of work conducted by others on the topic, the scope of work to be completed, preliminary results, and the specific objectives of the study. The length of this proposal document is typically limited to about 20 pages of text (single-spaced, font 10-point or larger, 1-inch margin), plus tables and figures, and is not to exceed 25 pages, excluding citations. After an editorial review by the advisor, the proposal will be distributed to the other committee members.

No less than two weeks following distribution of the proposal, the student will make a presentation of the proposed research effort to the Advisory Committee as a whole, after which the committee will question the student on the proposed research as well as his/her depth in specific technical areas surrounding the research topic as defined in their approved course of study. The total time block should be approximately two (2) credit-hours, divided into two parts. The first part is the presentation by the student followed by public questioning and is limited to approximately 40 minutes. The second part is devoted to comprehensive questioning of the student on the proposed research by the Advisory Committee.

Possible outcomes of this comprehensive examination are: Pass, Retake (two retakes are allowed), or Fail. Three passes are required for an overall pass of the exam. Three fails are required for an overall fail of the exam.

**This presentation should be made no later than one year after the student has passed the Ph.D. Qualifying examination.** Approval to schedule the presentation is given by the AE Graduate Committee in response to a written request from the advisor. At least two weeks prior to the presentation, the student must contact the AE Academic office, provide a filled-in [Thesis Proposal Template](#) form and ask the Academic Office to schedule and advertise the proposal.

After the Advisory Committee has approved the proposed effort, has verified that the student is technically qualified to conduct the effort, and has signed the [Request for Admission to Ph.D. Candidacy](#) form. This form, and a copy of the research proposal, will be submitted to the AE Academic Office for approval by the chair and forwarded to the Office of Graduate Studies and Research.

### III.3.b Final Examination

At the conclusion of the research effort the student will write the dissertation by setting forth in a clear and articulate form the results and conclusions of the investigation. The [Institute's Theses and Dissertation](#) format must be followed.

After the academic advisor has completed an editorial review of the dissertation and have found it to be satisfactory, copies will be distributed to the Thesis Advisory Committee and two others who are well qualified in the subject matter of the research and hold an earned Ph.D. degree. This group of five will constitute the "Final Doctoral Examination Committee." This committee must include at least one but no more than two members from outside the general faculty of School of Aerospace Engineering. Any member of this committee who is not part of the general faculty of the Institute, must be approved by the AE Graduate Committee and the Institute.

No less than three weeks before the proposed examination date, the student and advisor will submit a Request to Schedule the Ph.D. Defense form, which can be obtained in the AE Academic Office. This form will list the proposed members of the Final Doctoral Examination

Committee and provide the title and abstract for the defense advertisements. Resumes must be provided for any proposed committee members who are not part of the general faculty of the Institute for review and approval by the AE Graduate Committee.

Once the committee is approved, the AE Academic Office will post the defense announcement on the AE website, email copies to all AE faculty and graduate students, and post it on the undergraduate and graduate bulletin boards at least one week prior to the presentation.

Furthermore, the members of the Final Doctoral Examination Committee must receive copies of the thesis at least two (2) weeks before the defense date. The defense must be scheduled at least three (3) days before the thesis due date of the term in which the student is to graduate.

The Final Examination will consist of a formal presentation of the research results and conclusions to Final Examination Committee and others in attendance. Immediately following the presentation and discussion by the general audience the student will be questioned by the committee and any interested members of the general faculty. The examination committee will then decide what modifications to the dissertation, if any, they require to be made before it can be submitted to the Office of Graduate Studies and Research.

### III.3.c Dissertation Submittal

After the advisory committee has approved the thesis and signed the [Certificate of Thesis Approval](#) form (PDF), the Certificate of Thesis Approval must be turned in to the Office of Graduate Studies and Research. The [Institute Theses and Dissertations](#) webpage provides the deadlines and specific instructions for the required electronic submittal of the thesis. The graduate office also requires a publishable thesis abstract of up to 300 words, certified for accuracy by the thesis advisor. Please note that the deadline for submitting a thesis to the Graduate Office is well before the end of the semester in which the student plans to graduate.

### III.4 Sample Ph.D. Degree Programs

Due to the course flexibility of the Ph.D. program, no sample Ph.D. programs are provided. However, during their first year, students entering in the graduate program with a B.S. degree will follow a program similar to that outlined in the M.S. section of this handbook. Students entering the program with an M.S. will need to tailor their program carefully to their background with the help of their academic advisor. In any case, the student is encouraged to schedule classes related to his/her qualifying examinations, whether similar classes have been taken elsewhere or not.