Ph.D. in Applied Science and Technology

North Carolina Agricultural and Technical State University

STUDENT HANDBOOK

2024-2025

This student handbook is a description of program requirements, policies, procedures and documents pertaining to the College of Science and Technology's Applied Science and Technology Ph.D. program. This document is to serve only as a guide and is subject to change.

Revised August 2024

Welcome and Introduction

Congratulations on being accepted into the Applied Science & Technology (AST) Ph.D. Program. The AST Graduate Student Handbook is meant to help familiarize new and continuing graduate students with our degree program and serve as a reference for program requirements, procedures, university policies, procedures and regulations throughout a student's matriculation in this graduate program. This handbook is meant to be a guide that all AST students will refer to as needed throughout their time in our program. We thank the graduate program coordinators, faculty members, staff, and previous students whose contributions have made creation of this handbook possible. Please note that this handbook is a work in progress. We welcome your feedback and suggestions to ensure that this handbook will continue to be a trusted and valuable source of helpful information for future AST graduate students.

Table of Contents

North Carolina Agricultural and Technical State University

College of Science and Technology

Applied Science and Technology Ph.D. Program

AST PhD STUDENT HANDBOOK ACKNOWLEDGEMENT FORM

The College of Science and Technology (CoST, College) Applied Science and Technology (AST) Ph.D. Program (Program) Student Handbook (Handbook) provides important information about the College and Program, respectively.

I acknowledge that I have been provided with a copy of the Handbook in electronic form on the College's website (and/or in hard copy), and it is my responsibility to read and familiarize myself with its content. I understand that the information, policies, and procedures described in the Handbook are subject to change during my time at the College, and that revisions to these policies may supersede, modify, or eliminate existing policies. I acknowledge that the College and Program will communicate any such changes through official notices, but the effectiveness of such changes is not contingent on the Program giving such notice or my receiving it. I understand that updated versions of the Handbook will be posted on the AST PhD Program Blackboard site, as well as on the College's website. I understand that I will be held accountable to all stipulated academic requirements and for adhering to all policies put forth in this document, or its subsequent versions.

I, _____(student's name) have been provided with a copy of the AST PhD Student Handbook, which can be accessed on the AST Program website, https://www.ncat.edu/academics/graduate-programs/cost/applied-science-and-technology.php.

_____

Student's name (printed) Student's signature Date

Rights clause of the CoST AST PhD Student Handbook: The College of Science and Technology AST PhD Program reserves the right to amend, modify, add to, or delete rules, policies and procedures.

I. Administrative Personnel

Program Director/Chair
Dr. Jenora Waterman
Associate Professor of Biology
Gibbs Hall 301
jdwaterm@ncat.edu, 336-285-2329

Executive Assistant
Ms. Connie Mayberry
Gibbs Hall 302E
clmayberry@ncat.edu, 336-285-2334

Liaison for Research & Related Affairs
Dr. Misty Thomas
Associate Professor of Biology
Barnes Hall, Room G11
mthomas1@ncat.edu, 336-285-2178

AST Concentration Graduate Program Coordinators (GPCs) and Internal Advisory Committee Members

Applied Chemistry: **Dr. Bishnu Bastakoti** Assistant Professor Department of Chemistry New Science Building bpbastakoti@ncat.edu, 336-285-2233	Applied Physics: **Dr. Solomon Bililign** Professor of Physics Department of Physics Marteena Hall 306, Gibbs Hall 302 bililign@ncat.edu, 336-285-2328	Atmospheric, Energy & Environmental Science: **Dr. Yuh-Lang Lin** Professor of Physics Department of Physics Gibbs Hall 302 ylin@ncat.edu, 336-285-2127
Bioscience: **Dr. Misty Thomas** Associate Professor of Biology Department of Biology Barnes Hall, Room G11 mthomas1@ncat.edu, 336-285-2178 *primary GPC for PhD students **Dr. Liesl Jeffers-Francis** Associate Professor of Biology Department of Biology Barnes Hall 8 ljeffers@ncat.edu, 336-285-2179	Data Science & Analytics: **Dr. Seongtae Kim*** Associate Professor of Statistics Department of Mathematics & Statistics Hines Hall 123B skim@ncat.edu, 336-285-4758 *primary GPC for PhD students **Dr. Alexandra Kurepa** Professor of Mathematics Department of Mathematics & Statistics Marteena Hall 111 kurepa@ncat.edu, 336-285-2079	General: Built Environment/Geomatics/EHS: **Dr. Leila Hashemi-Beni** Associate Professor Department of Built Environment Price Hall 112 lhashemibeni@ncat.edu, 336-285-3133 **Dr. Musibau Shofoluwe** Professor Department of Built Environment Price Hall 106 musibaus@ncat.edu, 336-285-3130 Other areas: **Dr. Jenora Waterman** AST Program Director Gibbs Hall 301 jdwaterm@ncat.edu, 336-285-2329
Information Technology: **Dr. Hossein Sarrafzadeh** Distinguished Professor Department of Computer Systems Technology hasarrafzadeh@ncat.edu, 336-285-4261	STEM Education: **Dr. Jenora Waterman** AST Program Director Gibbs Hall 301 jdwaterm@ncat.edu, 336-285-2329	Technology Management: **Dr. Xiaochuan "Frank" Lu** Associate Professor Applied Engineering Technology Dept. Smith Hall xlu@ncat.edu, 336- 285-3111

The AST staff and faculty are committed to doing everything we can to promote doctoral student success while at N.C. A&T and student future career success. This requires a strong partnership, teamwork, work ethic, and accountability among staff, faculty, and students.

Please check the AST Program website for resources, events, and updates. The Graduate College has created an EXCELLENT website for new and continuing graduate students at N.C. A&T and in Greensboro. Please explore the websites below.

Resources for Graduate Students: https://www.ncat.edu/tgc/new-students/resources-for-grad-students.php

First Things First: https://www.ncat.edu/tgc/new-students/first-things-first.php

II. Purpose of the Student Handbook

The Graduate Handbook provides detailed requirements for the AST Program. Each graduate student should read and conform to the policies and procedures contained in this handbook. If there is any doubt regarding the interpretation of any regulation or requirement in this handbook, or if there are questions about the graduate program involving matters not covered in this manual, the student should consult the AST Director/Chair or the AST Executive Assistant.

This handbook includes the requirements, policies, and procedures adopted by the AST faculty for successful completion of doctoral degrees. The requirements set forth apply only to graduate programs in AST. Further requirements have been established by N.C. A&T's Graduate College, and AST graduate students must meet the requirements of both the Graduate College and the AST program for successful degree completion.

The provisions of this handbook do not constitute a contract, expressed or implied, between any applicant or student and the AST Program or North Carolina A&T State University. The University and the Program reserve the right to change any of the provisions, schedules, programs, courses, rules, regulations, or fees whenever university or departmental authorities deem it appropriate to do so.

III. About the Applied Science and Technology (AST) Ph.D. Program

The Applied Science & Technology Ph.D. program was created in 2018 and its mission is to prepare students for high-level science and technology careers in industry, research, and government. Graduates will be able to conceive, develop, and conduct original research that applies physical, mathematical, and technological methods to provide solutions to a broad range of emerging local, national, and global problems related to Atmospheric, Environmental and Energy Science; Applied Physics; Bioscience; Applied Chemistry; Data Science and Analytics; Applied Engineering Technology; Information Technology; Technology Management; Geomatics; and STEM Education.

The primary goal of graduate education in the AST PhD Program is to prepare the next generation of science and technology leaders. To achieve this goal, we endeavor to instill in each student a capacity for professionalism, scholarship, critical thinking, effective communication, and integrity. The AST Program, members of the graduate faculty, and students work cooperatively to achieve this goal. Below is a summary of general responsibilities and expectations of each of these parties.

The AST PhD Program Staff: The AST program is responsible for publicizing program-specific guidelines, procedures and policies governing study across the concentrations it encompasses. It will provide new and enrolled students with a clear structure of expected milestones and stages of progress toward obtaining the PhD; a curriculum and schedule of courses necessary to complete the doctoral degree in a timely manner; and details about potential career opportunities for students. The program will communicate and enforce departmental/program, college, and university policies governing graduate students. The Director of the AST PhD Program and Executive Assistant will serve as a general resource for its graduate students and faculty.

AST Graduate Faculty Advisors/Dissertation Advisory Committees: AST faculty consist of graduate faculty of the College of Science and Technology and those faculty members serving as advisors, major professors and dissertation committee members for AST students. AST faculty support the AST program by helping to teach courses, serving as advisors and mentoring to AST PhD students. Members of the AST faculty, and the dissertation committees on which they serve, provide guidance for research and didactic training of AST students and are responsible for ongoing evaluation of graduate students' performances in the aforementioned areas. In their roles as advisors and mentors, the AST faculty provide a framework to help AST students develop the necessary teaching, research, networking, professional and outreach skills to prepare them for a variety of career opportunities in academic, government, and industry.

AST PhD students: Graduate students in the AST PhD program are responsible for working toward completion of their doctoral degree in a timely manner. Upon completion of their degree, it is expected that graduate students will gain and demonstrate effective verbal and written communication skills; critical thinking, analytical and judgement skills; disciplinary expertise and independent scholarly research/creative skills. Graduate students are professionals in training, and thus, are expected to learn and disseminate knowledge through instruction, demonstration/presentation, and publication, and how to apply knowledge to specific local, national and global problems that will improve the human condition. Where appropriate and with guidance from their advisor/dissertation committee, students are expected to seek out opportunities to improve their research and teaching capacity, including enhancing written and verbal communication, technical and quantitative/analytical skills.

AST PhD students are responsible for working with their faculty advisor to develop an expectations document, called the AST Student Compass (see appendix). This expectations document should be completed and revised on an annual basis and submitted to the AST Director at least once annually.

IV. New Student Onboarding & Important Steps/Tasks -- Before and During Your Ph.D. Journey (Read Carefully)

1. **Establishing North Carolina Residency for U.S. Citizens:** For tuition purposes, all US citizens are expected to establish North Carolina residency within the first year of residence in the state. It is critically important that students complete the necessary steps to become a resident within the first 10 days of living in North Carolina. The requirements and steps for becoming a resident are outlined on the Graduate College website: https://www.ncat.edu/admissions/graduate/residency-determination.php#:~:text=Under%20North%20Carolina%20law%2C%20to,presence%20in%20the%20state%2C%20and. Failure to establish North Carolina residency within the first year will lead to hefty out-of-state tuition charges in the second year for which the student may be responsible.

2. **Getting Paid:** The procedure for getting paid depends on the source of support. The current primary source of support for Graduate Research Assistants (GRAs) is through faculty advisor grant resources. The paperwork will be completed by the home department of your advisor. For Graduate Administrative/Academic Assistants (GAAs) or Graduate Teaching Assistants (GTAs), the paperwork will be completed by the department where the teaching/administrative support is provided. In the College of Science and Technology (CoST), GTAs are generally supported through the departments that provide instruction for science and mathematics general education courses, i.e., the Departments of Biology, Chemistry, Mathematics & Statistics, and Physics. For students supported by fellowships, such as the Woodland Hall Fellowship or the Chancellor's Distinguished (Title III) Fellowship, your paperwork will be completed by the Graduate College. Graduate students are paid either bi-weekly or monthly via direct deposit. ***Note, you must be registered full-time before any salary or scholarship paperwork can be processed.***

3. **Financial Support:** The financial aid goal of the AST program is to support all full-time students who have been admitted into the program with an aid package that provides for tuition, health insurance, fees, and stipend/assistantship. Obviously, the ability to provide these aid packages depends on the availability of funds. Stipends/assistantships come from a variety of sources both within and outside the AST Program and are usually provided in return for work performed on a specific research project or for serving as a teaching assistant. The target level of stipend support is at least $9,000-$10,000/semester during the academic year and $6,500-$8,000 for the summer (with target annual salary at least $28,000/year). If funds are not available to pay for fees and health insurance, attempts will be made to increase the amount of stipend to compensate students for paying for their own fees. We are not able to provide/guarantee support for students enrolled part-time.

   Limited financial support is available from AST for positions as Graduate Teaching Assistants (GTA) or Graduate Research Assistants (GRA). A description of the policies, which apply to all graduate assistantships, is provided in the Graduate College Catalog. Given that we are a State of North Carolina institution, the GTA funding priority is for new in-state, then out-of-state students that are in their first year, then second year. Students in year 3 and beyond should be supported through GRA positions from their faculty advisor or some other fellowship available to internal or external funding mechanisms. The number of assistantships available varies from semester to semester. Students should make known their financial needs to their research advisor and to the AST Director as early as possible. The research advisor may have graduate research assistant support available for his/her students. If a student chooses an advisor that does not have funds to support a student, that student will need to identify a different source of support, e.g., applying for scholarships, fellowship, securing a TA position (these are becoming more competitive as the program grows), or self-supporting. The student may also consider other advisors that have support for their students. The final decision on the award of an assistantship to any student is made by the AST Director. Students who are admitted by February 1 for the fall semester request financial aid will have higher priority for consideration of financial support. There are some financial aid programs especially for African-American students interested in earning doctoral degrees: Department of Education Title III Program.

   Students should not depend on assistance from N.C. A&T in making their financial plans. Assistantships are dependent on the availability of funds and student performance. Student performance indicators that will be used to determine eligibility for funding are GPA at time of admission (at least 3.25 GPA for post-BS students and at least 3.0 GPA post-MS students) and in courses taken since enrolling in the AST program that apply to the approved Plan of Study (AST GPA must be at least 3.0); passing the AST Qualifying Exam at the end of a student's second semester in the program pursuing the AST Ph.D. degree full-time by being on campus at least 40 hours/week participating in courses and doing research; completion of and follow

through on AST Individual Development Plan (IDP, also called a career plan); passing the Preliminary Exam/Proposal Defense no later than the second semester of the second year for post MS students and by the second semester of the third year for post BS students; positive reviews on graduate assistant evaluations; maintaining standards of research ethics covered in AST 830; maintaining office/lab space in a clean, orderly, and safe manner; responding quickly to program requests for information; and integrity in dealing with N.C. A&T faculty, staff, and fellow students.

Out-of-State U.S. students are expected to complete and submit an Application for In-State Residency for Tuition Purposes) https://www.ncat.edu/admissions/graduate/residency-determination.php when they near a year (365 days) of residency in North Carolina. This process must be initiated within the first 10 days of living in North Carolina. These students should regularly communicate with the AST Program Director their residency status in this process. Failure to establish in-state residency within the first year in the program will result in substantial out-of-state tuition charges in the second year for which the student may be responsible. Please plan accordingly. Note that international students on F-1 visas cannot qualify for in-state residency status.

The University offers a variety of fellowships available to Ph.D. students such as the LSAMP Bridge to the Doctorate Program -- https://www.ncat.edu/tgc/lsamp-bd.php; Woodland Hall Fellowship -- https://www.N.C. A&T.edu/tgc/woodland-ellroy-hall-fellowship-progam.php; or the Title III Chancellor's Distinguished Fellowship -- https://www.ncat.edu/provost/academic-affairs/title-iii/hbgi-fellowships.php. Students are encouraged to apply for these and other funding opportunities available through the university. https://www.ncat.edu/tgc/university-funding-opportunities-for-graduate-students.php. Students are also encouraged to apply for individual fellowships from federal agencies such as the National Science Foundation or the Department of Defense. The National Defense Science and Engineering Graduate (NDSEG) Fellowship program typically accepts applications between August and October annually, plan ahead -- https://ndseg.org/apply-link. Please work with your advisor as you prepare your application packet for these prestigious fellowship opportunities. Other external sources of funding https://www.ncat.edu/tgc/other/external-funding-sources.php.

4. **Student Payroll**

Assistantships generally require students to work about 20 hours per week as a Research Assistant on a research project or as a Teaching Assistant. As such, paperwork is processed to provide payroll for the student classifying them as student employees of N.C. A&T. Graduate student employees must complete a new hire package and sign a Personal Service Agreement (PSA) which details how many hours the student is required to work, the time period, and the amount the student will be paid for that period. The Office of the State Controller requires all state employees (to include students) paid through Central Payroll to be paid by direct deposit.

The University Payroll Department receives payroll checks for students at the end of each month. After processing the payroll, checks are disbursed by direct deposit to the students' account. Questions arising regarding the amount of a particular check, withholdings, etc. should be addressed directly to payroll. The monthly payroll schedule for students can be accessed at http://N.C. A&T.edu. Please note that because of the pay period each semester and the closing period, a new hire should not expect to receive a full paycheck until approximately one month after beginning employment.

5. **Health Insurance**

The Student Health Insurance Plan works in partnership with the university health fee to provide seamless health care at a reasonable cost to students. The university health fee covers provider charges at the Sebastian Health Center, while the student health insurance plan helps cover other charges, i.e. lab, x-ray, and pharmacy charges. If you have other insurance and wish to waive the student insurance plan, you may do so by going to the www.N.C. A&T.edu, click on N.C. A&T's popular sites and click on Health Center for details on how to waive the insurance for the semester. The insurance charge will then be removed from your tuition bill after the waiver has been verified.

Graduate students enrolled in at least six or more credit hours of graduate level courses, in good academic standing and making appropriate progress toward graduation, and all *international students* (regardless of hours) must have student health insurance. U.S. students registered for less than six credits hours will not be granted student health insurance through the university. There are no exceptions to this rule. Students in this category desiring health insurance will need to secure private health coverage if they are not covered by a parent or spouses' policy. Students may contact the Student Insurance Coordinator, NC A&T State University, Student Health Center, 112 N. Benbow Road, Greensboro, NC 27411, 336-285-2916 , 336-256-2613 fax for assistance with recommendation.

6. **Taxes:** All or a portion of your stipend (for fellowship)/salary (for assistantships) may be taxable. It is your responsibility to make arrangements to pay your taxes, particularly if these are not being withheld each pay period. ***Note, graduate

assistants who are enrolled less than 9 credit hours (full-time) may need to complete a payroll Student FICA Exemption Request Form to prevent this tax from being withheld from their payroll (not generally withheld from payroll of graduate students enrolled in at least 9 credit hours). The form may be obtained from and submit to the University Payroll Office, Dowdy Administration Building, Suite 305, payroll@ncat.edu.*** Because AST Program personnel are not tax experts, please contact the University Payroll Office or the IRS (www.IRS.gov) for tax questions.

7. **Social Security Number for International Students:** All international students must obtain a social security number (SSN) to be paid to work in the U.S. Please visit the Office of International Affairs to obtain the necessary paperwork/letter that you must take to the Social Security Administration to apply for a SSN. It is a priority to apply for a SSN as soon as possible upon arrival in the U.S. because the process can take up to several weeks. Failure to obtain a SSN will mean that your paychecks will be held until you have provided your SSN. Because graduate students are generally paid monthly (at the end of each month), delays in applying for and receiving a SSN can subsequently delay payroll processing for months and potentially create hardship for some students. Please plan ahead and make getting a SSN a priority.

8. **Tuition:** To learn about graduate tuition information, visit this link https://hub.ncat.edu/administration/business-and-finance/comptroller/treasurers-office/tuition-and-fees.php. Please note, tuition is due prior to the start of the semester and the due date is posted on the university's website and in Aggie Access (generally 2-3 weeks before the start the first day of classes). Your advisor, AST Program, fellowship or other sources may be able help cover the cost of tuition and fees. However, the student is ultimately responsible for all tuition and fees for their education. You may review your bill through Aggie Access. **If there is any portion of your bill that is unpaid by the due date, you must set up payment arrangements with the Treasurer's Office so that your courses do not get dropped. Failure to set up payment arrangements for a balance on your student account, even though you may be expecting a scholarship to help cover the cost of tuition, is considered negligence and will result in your courses being dropped. If your courses get dropped and you do not re-enroll before the end of the add/drop/switch period, you will not be able to attend that semester. Likewise, it is critical to communicate any balance on your account to your advisor and Ms. Mayberry in a timely manner.** If you need a Treasurer's Letter to make payment arrangements, please contact Ms. Mayberry for assistance and be prepared to share your financial assistance letter and/or other documentation of financial support so that she can prepare the Treasurer's Letter for you. Upon receipt, you must take the Treasurer's Letter to the Treasurer's Office and sign a payment plan agreement. Afterward, please follow up with your advisor and Ms. Mayberry to ensure that your any anticipated financial assistance is applied to your student account in a timely manner.

9. **Tuition/Scholarships & Financial Aid:** You may be eligible for a tuition scholarship through The Graduate College and/or the College of Science and Technology's Tuition resources. Priority is given to new Ph.D. students, particularly those in their first year, and are in-state residents, followed by out-of-state residents. . **Out-of-state U.S. residents are expected to establish and apply for N.C. residency within their first year of study. Obtaining N.C. residency greatly reduces the amount of tuition costs. If you do not apply for N.C. residency, you may be responsible for out-of-state tuition costs.** See this link for details about establishing N.C. residency for tuition purposes: https://www.ncat.edu/admissions/graduate/residency-determination.php. Visit the Office of Financial Aid and Scholarships to learn about scholarships, fellowships and other funding opportunities. Dowdy Administrative Building, Suite 100, (336) 334-7973 or Toll free (800) 443-0835, M-F, 8 am – 5 pm. Appointment hours 8:30 am – 4:30 pm. https://www.ncat.edu/admissions/financial-aid/index.php

10. **Aggie Access, AggieOne Card, and AggieAlert!**

    a. The Aggie Access portal is a resource to help you maintain your academic career activities while at A&T. In Aggie Access you will be able to view the Schedule of Courses, register for classes, view your student financial aid account, set privacy settings, personal references, sign up for AggieAlert! (the University's text notification system for emergencies, life-threatening situations, and inclement weather) and more. All students are required to sign up for AggieAlert! or a hold will be placed on their account and they may not be permitted to register. It takes just a few moments to sign up (see details below).

        i. As a student, you can login to Aggie Access Online (Banner SSB) by using the following instructions:
            1. Go to the NCAT Home Page (http://www.ncat.edu).
            2. Select the menu (hamburger icon) in the top right corner.

3. Select Current Students.
4. Select Aggie Access.
5. Login using OneID credentials.

ii. If you cannot login, please contact **Client Technology Services at 336-334-7195** for further assistance.

b. The Aggie OneCard is your official university ID card and is linked to many services on campus. Visit the Aggie OneCard Center to obtain your card -- Student Center, Suite 242, M-F, 8 am – 5 pm, 336-334-7114. For updates and to learn about winter break hours, visit the Aggie OneCard website: https://www.ncat.edu/campus-life/campus-enterprises/aggie-onecard/index.php.

11. **Office Space:** The AST Program offers shared student office spaces in Gibbs Hall and Hines Hall. These office spaces are limited in number and are available on a first-come, first-served basis. Please contact Ms. Mayberry if you need office space. Your advisor will likely have office space near/within your research space, be sure to ask your advisor/team manager about office space.

12. **Registration for Classes:** After getting access to Aggie Access you will be able to register for courses. Detailed instructions on how to register for classes can be found at the following link: https://www.ncat.edu/registrar/registration.php. For convenience of new students, they are listed here. All students are expected to register themselves for courses. Course should be discussed with the advisor and listed in the student's Plan of Study (POS). The POS must be signed by the student and their advisor and submitted to the AST Program Director for approval. Any courses substitutions must be approved by the AST Program director before enrolling. If it is determined that a student is not taking courses outlined in the approved POS, that student may lose their tuition remission/scholarship award and will be responsible for payment of their tuition. Students should follow their approved Plan of Study when selecting and registering for courses.

New students that do not have a POS will be given guidance (by the AST Program Director, their advisor and/or the Graduate Program Coordinator for their concentration) on the courses you should take during your first semester. Your Major Professor/Committee Chair, Advisory Committee will provide guidance on subsequent courses to provide a solid foundation in the discipline and dissertation research area.

Advising and registration occurs twice a year: once in October and November, respectively, for the spring semester, and again in March and April, respectively for summer and fall semesters. Each year you should meet with your Major Professor/advisor to review the courses you plan to take, even if you have an approved POS. After this meeting, your advisor should provide your alternate PIN. A new PIN is generated for each semester and it should not be obtained prior to advising. Advising is critical to student success and reduces the likelihood of taking wrong a course.

Course Restrictions for Research Courses – **AST 997 Doctoral Dissertation** is a research course for students that have passed the Qualifying Examination and have completed all other coursework. **AST 984 Laboratory Internship** course is for students that have not identified an advisor and is interested in conducting rotation, or need to work in several labs to gain research experience. **AST 994 Doctoral Supervised Research** is for students that have not passed the Qualifying Exam and are in need of a research course because they have completed all required coursework. Please contact the AST Program Director if you have questions about your eligibility to enroll in a research course.

Course Load

A student using any resource of the university must register for at least one credit hour during the semester of the thesis/project or the dissertation. Full time enrollment is at least 9 credit hours. After a student has completed all course requirements, they may enroll in one credit hour of AST 997 Doctoral Dissertation per semester until they graduate. Some AST concentrations encourage alternating between enrollment in one credit hour of AST 997 and AST 992 Doctoral Seminar until graduation so that students are continually engaging in reading, discussing literature and demonstrating practical skills required for their field; the AST Office supports this model of didactic and practical research training. ***Note, some funding sources require a letter confirming that a student is considered full time if they are enrolling in one credit hour post completion of coursework; the AST Director (in collaboration with the Major Professor/Committee Chair) can provide such a letter. Please contact the AST Office if you need such support.

Student Registration via Aggie Access (follow the steps below and view holds, as needed)

1. Go to the A&T homepage, www.ncat.edu.

2. At the top of the page click on Current Students.
3. Click on Aggie Access Online.
4. Click on Enter Secure Area and type in your OneID (same as your email address, leave off the "@.aggies.ncat.edu") and PIN.
5. Click on Student (Register for classes, View your academic records.)
6. Click Student Account >View Holds
7. Click Aggie Alert Registration. Follow the instructions on the screen.

Academic Advising by Major Professor/Advisor & Alternate PINs
Advising is critical to student success, even at the doctoral level. Please schedule a meeting with your advisor to review your Plan of Study, and the Schedule of Courses (in Aggie Access to see which courses are being offered in a given semester) and discuss courses you plan to take. Please use the "Degree Evaluation" feature in Aggie Access to track progress towards completion of degree requirements. Students can do this, by logging into Aggie Access and use the Degree Evaluation link to generate a report to track their progress towards degree completion. If you need to substitute a course, it must be approved by your advisor and the AST Director before you substitute a course. This approval must be given in writing, initially through email if a quick substitution is needed, but ultimately though the Plan of Study process.

If you need help with registration, please contact Ms. Mayberry, clmayberry@ncat.edu. Advisors can perform a Degree Evaluation in Aggie Access as follows (students can too, by selecting Degree Evaluation on Student tab in Aggie Access Online):

1. Sign into Aggie Access
2. Select Faculty and Advisor
3. Select Advisor Menu
4. Select Degree Evaluation (Degree Works)
5. Enter student's banner ID or name
6. Click Submit to select the student
7. You will see Degree Works page
8. Select Please click here to log into Degree Works (not sure why you must select student twice)
9. Enter student's banner ID and press Enter
10. The Degree Works application will display the student's progress toward degree completion

Alternate PIN Numbers: All NC A&T students must obtain their Alternate PIN number from their advisor during the Advisement and Registration period. New students, use the alternate PIN described during orientation.

Advisors can access their advisee's PIN by logging into Aggie Access as follows:

1. Sign into Aggie Access
2. Select Faculty and Advisor
3. Select Term (e.g., Fall 2023)
4. Select Student Information
5. Select Advisee Listing (Alternate PIN column on this page has student PINs for all advisees)
6. If your advisees is not listed or you have any questions/issues finding the PIN, please contact Ms. Mayberry

13. **Official Transcripts from Other Institutions:** The Graduate College must have an official copy of all final transcripts with the degree earned and date conferred clearly indicated. Please do not have transcripts sent to the AST Program Office. The Graduate College must also receive official transcript for all course work, and whether a degree was conferred or not.

    Please order transcript and have it sent to The Graduate College:

    North Carolina A&T State University
    The Graduate College
    1601 E. Market Street
    Gibbs Hall, room 120
    Greensboro, NC 27411

14. **Transfer Credit from Other Institutions:** Up to 40% of the required coursework can be transferred from another university if this work was not part of any prior degree requirement and if, in the opinion of the AST Program Director/Chair and advisor, the content adequately replaces current graduate offerings in the student's curriculum (https://hub.N.C.

A&T.edu/policies/graduate/graduate-college-forms.php). However, approvel of transfer credit is not automatic, particularly for doctoral courses given the specific alignment of courses with a student's program of study and dissertation research project. Coursework being considered for transfer credit must be at the graduate level and require consultation with the student's major professor/advisor and the AST Program Director as part of the Plan of Study process. **Credit used towards a MS or other graduate/professional degree at another institution cannot be counted towards the AST PhD.** If you took additional courses beyond your MS/graduate/professional degree requirements or graduate level courses taken at the BS level that did not count towards a degree requirement (e.g., accelerated BS to MS, ABM), those extra courses may be considered. Note, the AST PhD Program does not accept or approve international transfer credits for individual courses, rather, we accept conferred international degrees with certified transcript evaluation (from WES, ECE or Spantran) as part of our admission requirements. Please contact the AST Program Director if you are interested in transferring credit from another institution.

Course Substitutions/Transfer Credit Request Logistics: In alignment with Graduate College policy and procedures on Transfer Credits, any course substitution must first be discussed and approved by your advisor/major professor and then me (through the Plan of Study approval process).

- Students are required to provide descriptions for the NCAT required course and substitute course (from NCAT or other institution) to their advisor (first, ideally) and me.
- If course credit is to be transferred from another institution, then the Request for Transfer Credit form (https://www.ncat.edu/tgc/continuing-students/forms/transfer_external.pdf, accessible with OneID credentials) must be completed (and submitted to me). If your transcripts (including from the transferring institution) are already on file with the Graduate College, you do not need to submit another one. If the course is not included in a transcript you've submitted to A&T, then you must have it sent to the Graduate College (at address above).
- Note, the Request for Transfer Credit form (along with descriptions) is to be submitted by the Graduate Program Coordinator (me, for AST students), students should not submit the form or course descriptions to the Graduate College.

15. **AST 997 Doctoral Dissertation and Required Committee Meetings.** Only students that have passed the Qualifying Examination are permitted to take AST 997. Students taking AST 997 are required to meet with their dissertation committee at least once per semester. During these meetings, students are expected to provide an update of their research progress (successes, any challenges, project timeline) and report research products (e.g., results, conference presentations, awards, honors, publications) and receive critical feedback on their progress, research design/results, communication skills and related. (see AST 997 course description)
    a. Students should provide a 1-page abstract/summary of their research rationale, question/hypothesis, approach and preliminary results at least one-week ahead of the meeting.
    b. Committee meetings, generally, should be no more than one hour (25 to 30-minute presentation (do not go over this time limit), 10-15 minutes for questions, 10-15 minutes for committee closed session and providing feedback).
    c. Students must complete the **Report of Dissertation Committee Meeting** and file it with the AST Program office within two weeks of the committee meeting. Please visit the AST Blackboard Organization for details. You may also contact the AST Liaison for Research and Related Affairs for guidance.
    d. Note, the Preliminary Exam counts as a committee meeting.

16. **Parking & Transportation Services:**

    a. A parking permit is required to park on campus. Visit Parking Services -- Obermeyer Parking Deck -- to obtain a permit. Contact information: 336-285-2027, ncatpark@ncat.edu, M-F, 7:30 am – 5 pm. https://www.ncat.edu/campus-life/campus-enterprises/parking-and-transportation/index.php

    b. Aggie Shuttle
        i. Aggie Shuttles Hours: Monday-Friday: 7:30am - 11:00pm
        ii. Aggie Ride Request Hours: Monday-Friday: 11:00pm - 2:00am
        iii. Park & Ride Shuttle Hours: Monday-Friday: 7:30am - 6:00pm
        iv. Visit Parking Services Website for winter break hours -- https://www.ncat.edu/campus-life/campus-enterprises/parking-and-transportation/index.php

17. **Computer and Office Policies**
    a. Computer Problem Help

The Cherwell Service Management (CSM) Platform (https://N.C. A&T.cherwellondemand.com/CherwellPortal/AggieHelp?_=6c7fc376#0) is used to request help with computer-related problems, including e-mail, blackboard and wireless access. (You have to sign in to Aggie Hub first. https://hub.N.C. A&T.edu/administration/its/index.php)

b. **Blackboard**
Blackboard is N.C. A&T's campus wide E-learning platform or learning management system. With this tool, you can manage your class assignments, communicate with classmates, check your course grades and collaborate with instructors and fellow students on-line. You must be an enrolled and validated (tuition bill paid) student and have an N.C. A&T e-mail account to access Blackboard. To obtain an account, go to "Get Connected" at http://www.N.C. A&T.edu.

c. Print Management System Policies
Printers are available for limited student use in Gibbs Hall and in Hines Hall. All AST students who would like access to the department printers should consult with the AST Executive Assistant for access. The printers are to be used for course/research printing only. Printing in large volumes (i.e. textbooks) and excessive copying will not be allowed. Printing and/or copying should be kept to a minimum, e.g., requesting a copy of a signed form or letter for your records is an example of an allowed use of departmental printers/copiers. Within your respective home departments, research advisors and departments may provide for printing copies of articles or research related documents. Please check with your research advisor for copier access. *Please note: copy privileges are only for university computers, not personal laptops. Students can also print documents at Bluford Library.

18. Gibbs/Hines Hall Office Key Policies

a. AST students will have office access in either Gibbs Hall or Hines Hall, as available. Students will be given a key (or in some instances a door access code) to their specific area of assignment, which is usually shared with at least one other AST student. All key requests/access codes must be obtained through the AST Executive Assistant and will be distributed based on availability. Each student is responsible for his/her key. Keys must be returned to the AST Executive Assistant upon leaving the program for any reason.

19. Graduate College and University Policies

a. Make sure you are aware of university level/Graduate College level policies that govern students.
b. Academic Affairs (Policies for students near bottom of webpage)
    i. https://hub.ncat.edu/administration/legal/policies/sec2-acad-affairs/index.php
c. Student Affairs
    i. https://hub.ncat.edu/administration/legal/policies/sec4-stud-aff-Issues/index.php
d. Department Policies (Applied Science and Technology)
    i. Students taking AST courses must adhere to policies specified by the College of Science & Technology, Graduate College and the University. It is the student's responsibility to become familiar with these policies. Links are provided below.
e. College Policies (College of Science and Technology)
    i. Academic Integrity Policy https://www.ncat.edu/cost/_files/cost-academic-integrity-policy-finaldraft.pdf
    ii. Grade Appeal Policy https://www.ncat.edu/cost/student-success/grade-appeal-policy-2022.pdf
    iii. Both are binding.
f. Use of Artificial Intelligence (AI) and Generative AI in AST courses and research products
    i. When making ChatGPT or any other generative artificial intelligence (AI) technology into course assignments, discussions, assessments, research products including but not limited to abstracts, white papers, manuscripts, proposals, thesis/dissertation documents/presentations, the AST PhD Program promotes ethical and socially responsible use of these tools. This includes providing proper attribution when AI-generated content is used or presented in any capacity. Citations should follow the guidelines specified by academic writing styles such as APA, IEEE, MLA, or other relevant citation styles. Here's an example from APA: https://apastyle.apa.org/blog/how-to-cite-chatgpt
    ii. The AST Program encourages students to discuss the use of AI and generative AI tools with their instructors, advisor(s) and committee members to determine whether AI tools are approved or use and to what extent in coursework and research, respectively. The AST program requires students to focus on the originality in their work and uphold university values related to academic integrity. The AST Program requires the highest academic integrity of its students and encourages transparency among students and faculty in attribution and alerting the learner/student to any detection software and methods employed, respectively.
    iii. As with any software/license-bound technology, it is essential for faculty members and students to be aware of the licensing agreements and terms of service associated with the use of AI language models like

ChatGPT or other generative AI technologies. Different language models may have varying usage restrictions, and compliance with ethical and legal guidelines is crucial. Faculty members and students are encouraged to refer to official documentation provided by the language model's developers, such as OpenAI's website, and any relevant platform-specific guidelines with respect to language model or other generative AI technologies, such as for ChatGPT usage. Standards specific to the dissemination of scholarly products in various venues (e.g., conferences, journals, etc.) must be reviewed and followed to prevent chance of research misconduct (e.g., plagiarism). The AST PhD Program aims to produce highly skilled graduates that are ready to address global problems through their original ideas and application of leading-edge technologies and resources. AI language models represent a relatively new group of technologies that are still evolving and their use comes with both benefits and challenges. Therefore, students and faculty are strongly encouraged to be transparent, aware of potential biases inherent in the language models (i.e., thus students still need to be focus on building their "own" foundational and advanced knowledge in their respective field) and informed about the use of these tools, while keeping the focus on originality, scholarship and advancing our ability to contribute to respective scientific communities and society.

iv. Regarding language models and other generative AI technologies, including those such as ChatGPT, and their use in academic and research pursuits, the AST PhD Program explicitly prohibits use of AI tools to generate entire manuscripts, proposals and dissertations (outside of AI tool evaluation processes for learning). Submitting those AI generated documents as "original" work to meet program requirements is in violation of the University's Academic Dishonesty Policy.

20. **Research Productivity Documentation.** Continue to update your individual development plan (IDP) and resume/CV to document your accomplishments. Please send accomplishments (e.g., awards, honors, scholarships, fellowships, presentations, publications, patents, and other products) to the AST Office as often as they occur. AST students are required to publish at least two peer-reviewed journal articles prior to scheduling the final dissertation defense. Students are also required to give conference presentations (at least two) of their dissertation research activities. Students are encouraged to give an average of at least one conference presentation per year. At the time of scheduling the final dissertation defense, the AST Program Office will request documentation of your research productivity. The documentation can be in the form of a separate list or your updated curriculum vitae (CV); full citations are required no matter the submission format.
21. **Workshop and Professional Development Opportunities.** There are a variety of workshops and professional development opportunities available to graduate students through the Graduate College. Please visit the following link to learn about these opportunities https://www.ncat.edu/tgc/continuing-students/workshops-for-graduate-students.php The AST Ph.D. program also offers workshops for students. Please check the AST Program Blackboard Organization for announcements.
22. **AST Graduate Student Association – The "AST Graduate Council for Pre-Professionals" (AST Grad Council or AST-GC)** is a Special Interest Group of the university-wide Graduate Student Association (GSA), https://www.ncat.edu/tgc/continuing-students/gsac.php). Formed during the 2022-23 academic year, the AST-GC is a student-led organization of the AST PhD program that focuses on student success and improving the academic and research training and professional development experiences of doctoral-level students. The mission of the Applied Science & Technology Graduate Council for Pre-Professionals is to promote a safe space for open communication among currently enrolled graduate students of the AST doctoral program, and with faculty and staff, and administrative personnel of the College and University. AST-GC strives to be a positive representative of all currently enrolled CoST AST and graduate students needs at select university, college meetings and departmental faculty meetings held at NCAT, as appropriate. An important goal of AST-GC as an organization is to develop enriching programs that promote student success and strengthen the Program's graduate students academically, professionally, culturally, and socially to become the next generation of leaders in science, technology, mathematics and related areas. All AST students are encouraged to join and become active members of the AST-GC. The AST Program Director serves as the faculty advisor to the organization.. If you are interested in joining and getting involved with the AST-GC, please contact Dr. Waterman, AST Program Director.
23. **Campus Safety:** If you have not registered for AggieAlert!, N.C. A&T's emergency notification system online, please sign up by following the instructions below. You can visit this link to learn more about campus safety resources: https://www.ncat.edu/campus-life/safety/index.php.
    a. Go to the A&T homepage, www.ncat.edu.
    b. At the top of the page click on **Current Students** or **Faculty & Staff**
    c. Click on AggieAlert! (via Aggie Access Online.)
    d. Click on **Enter Secure Area** and type in your User ID and PIN.
    e. Click **Aggie Alert Registration**. Follow the instructions on the screen. Enter a valid **10-digit mobile device, area code and mobile device telephone number** (i.e., 3362560862). Do not enter special characters such as dashes and parenthesis since this will interfere with your ability to receive text messages.
    f. Click **Submit**.

V. Program Requirements and Student Expectations

The Applied Science & Technology (AST) doctoral program at North Carolina A&T State University (N.C. A&T) offers concentrations in Atmospheric, Environmental & Energy Science, Applied Physics, Applied Chemistry, Bioscience, Information Technology & Technology Management, STEM Education, and Data Science & Analytics as well as a general program option. The graduate faculty associated with Applied Science & Technology has the responsibility of administering the Ph.D. program including: admitting students, determining course requirements, administering comprehensive examinations, and supervising graduate student dissertation research. A graduate student assumes full responsibility for current knowledge of the policies, procedures, and regulations of the Graduate College (see the Graduate College Catalog, https://www.N.C. A&T.edu/tgc/graduate-catalog/index.php and https://hub.N.C. A&T.edu/administration/legal/policies/index.php for the most recent policy changes), and the departmental program requirements and guidelines. For assistance, the student should see the AST program director, the AST executive assistant, or his or her research advisor.
https://www.N.C. A&T.edu/academics/graduate-programs/cost/applied-science-and-technology.php

1. Program Outcomes:

Student learning outcomes are assessed at the time of degree completion,

- **Communication Skills** – (1) Students completing the Applied Science & Technology Ph.D. program will exhibit effective oral communication skills in terms of customizing presentations to the audience, displaying information, and delivering the presentations. (2) Students completing the Applied Science & Technology Ph.D. program will exhibit effective written communication skills in terms of content/ideas, organization, word choice, and grammar.

- **Critical Thinking Skills** - Students completing the Applied Science & Technology Ph.D. program will effectively use quantitative and qualitative analytical problem-solving skills in terms of defining hypotheses/research questions, reviewing research literature, developing a research plan, identifying the broader impacts of research, and developing a research timetable.

- **Disciplinary Expertise** - Students completing the Applied Science & Technology Ph.D. program will demonstrate discipline - specific expertise in terms of the scientific method, applying technical knowledge to answer research questions, experimental plans and data analysis, analytical methods, and research ethics.

- **Research/Creative Engagement** - Students completing the Applied Science & Technology Ph.D. program will demonstrate ability to engage productively in the review and conduct of disciplinary research in terms of making conference presentations and publishing refereed journal publications.

2. Admission Requirements

- B.S. degree in a science, technology, engineering, math (STEM) or related discipline with a GPA≥3.25/4.0 or a M.S. degree in a science, technology, engineering, math (STEM) or related discipline with a GPA≥3.0/4.0 from a college or university recognized by a regional or general accrediting agency
- GRE verbal and quantitative scores, no minimum score requirement

3. Degree Requirements

Total credit hours: 66 (post B.S.), 42 (post M.S.)

- Core courses (9 credits):
    - AST 830 (Foundations of Scientific Research)*
    - AST 831 (Math and Computational Modeling)* or other graduate analytical modeling course that builds upon a student's previous background
    - MATH 721 (Multivariate Statistical Analysis)* or other graduate statistics course that builds upon a student's previous background
- AST 992 Doctoral Seminar* (6 credits post B.S., 3 credits post M.S.)
- AST 997 Doctoral Dissertation* (21 credits post B.S., 15 credits post M.S.)
- In consultation with advisor, take 18 credit hours (15 post M.S.) within one of the following concentrations:
    1. Applied Chemistry
    2. Applied Physics

3. Atmospheric, Environmental and Energy Science
4. Bioscience
5. Data Science and Analytics
6. Information Technology
7. Technology Management
8. STEM Education
9. General – no specified concentration

- In consultation with advisor, take 12 credit hours (post B.S.) of additional courses relevant to research area
- Continuous enrollment
- Maintain cumulative and semester GPA of 3.0 or higher
- Dissertation advisor and advisory committee (composed of at least four members of the graduate faculty)
- Two (2) peer reviewed journal publications
- Conference presentations (at least two)
- Pass Qualifying Examination, Preliminary Exam, and Dissertation Defense**

**These are required courses.*
***Students are expected to publish at least two manuscripts from their dissertation work prior to scheduling the final oral defense.*

4. Administration of the AST Doctoral Program

All requirements, policies, and procedures for the AST Graduate Program are approved by the AST faculty at faculty meetings where a quorum is present. The AST Program Director is charged with the responsibility for resolving conflicts that may arise regarding policy or procedural issues. The AST Program Director is responsible for supervising the implementation of requirements, policies, and procedures adopted by the AST faculty. The program executive assistant is the source of information on the graduate program including, but not limited to, appropriate forms for the graduate program and Graduate College requirements, applications for admission and financial aid, and other routine paperwork related to the graduate program.

5. Admission to the Doctor of Philosophy Program in Applied Science & Technology

To apply for admission to the AST Ph.D. program, applications must be submitted online at the website of the Graduate College (https://www.N.C. A&T.edu/admissions/graduate/index.php). Questions about applications should be directed to the Graduate College Admissions Office (Anita Sanders: asanders@NCAT.edu). Once an application is determined by the Graduate College Admissions Office to be complete and is sent to the program, the AST Program generally makes application decisions within a month.

If the highest degree is from a non-English speaking country, a TOEFL score (at least 80 or higher internet-based score), IELTS score (6.0 or higher), or PTE Academic score (53 or higher) is required. The link below lists the countries with English as its official language and language of instruction. Applicants from these countries are exempt from the English language proficiency requirement.
https://www.N.C. A&T.edu/tgc/english-countries.php

This link shows all the admissions requirements including TOEFL information:
https://www.N.C. A&T.edu/admissions/graduate/admission-requirements.php

Prior research experience and research publications are desirable.

6. Ph.D. Program Requirements & Related

6.1 Grade Point Average and Academic Standing

To maintain good academic standing and to meet the requirements for graduation, a student must demonstrate acceptable performance in coursework after being admitted to the AST program. This requires a minimum cumulative AST Grade Point Average (GPA) of 3.00 or higher. The AST grade point average is calculated from the courses appearing on an AST approved Plan of Graduate Study form (https://hub.N.C. A&T.edu/policies/graduate/graduate-college-forms.php). These courses will include courses taken after enrollment in the AST program plus any courses transferred with grades.

Furthermore, good academic standing requires satisfactory progress in the overall AST program. The AST Program Director/chair, student's research advisor, and/or dissertation committee may render judgments as to whether satisfactory progress is being made toward the AST degree, taking into account all aspects of academic performance and promise, not necessarily coursework alone. Termination of a student's graduate status may be recommended at any time if the student is not making satisfactory progress toward the AST degree. Examples of unsatisfactory progress may include, but are not limited to, inadequate GPA, inadequate research and/or research skills, or failing the qualifying, preliminary, or final oral examination.

Academic Warning: Any AST student who is not making satisfactory progress toward the degree and demonstrating promise, not coursework alone, may be placed on academic warning. Examples of unsatisfactory progress that may results in placement on academic warning may include, but are not limited to, enrollment in course(s) that do not count towards the Plan of Study instead of taking required courses, inadequate research and/or research skills, or failure to cooperate with the major professor/committee chair or dissertation committee in completion of the dissertation activities.

Academic Probation: Any student who has less than a 3.0 cumulative AST GPA will be placed on academic probation. A student on academic probation will be required to improve his/her cumulative GPA to 3.0 or higher by the end of the next regular (non-summer) semester to return to good academic standing.

Dismissal: A student who is placed on probation and who fails to improve his/her cumulative GPA to 3.0 or higher by the end of the probationary period, that is, by the end of the next regular (non-summer) semester, will be dismissed. Dismissal of a student may also be recommended at any time if a student:
 is conditionally admitted and fails to meet the conditions of his/her admission;
 is not making satisfactory progress toward the degree (regardless of grades), for example, inadequate progress on research projects, or failing the qualifying, preliminary, or final oral examination;
 receives an "F" grade in a required course;
 receives an "F" grade in a course beyond the first semester of enrollment; fails to maintain continuous registration without an approved leave of absence;
 fails to complete program requirements in the maximum allowed time for the degree; or
 is guilty of ethical misconduct or violates the N.C. A&T Student Handbook.

6.2 Grade Appeal Policy, Procedures and Guidelines
The AST Ph.D. Program is housed within the academic structure of the College of Science and Technology. Therefore, the AST Program adheres to the grade appeal policy, procedures and guidelines administered by the College of Science and Technology. AST students wishing to appeal a grade can find the relevant policy, procedures, guidelines and form at the link below (or the most recent policy as published on the College of Science and Technology website):
https://www.ncat.edu/cost/student-success/grade-appeal-policy-2022.pdf. Graduate Appeals that cannot be resolved between the student and faculty member, and department will be handled by The Graduate College.

6.3 Expected Timetable
Students are expected to complete the various requirements according to the schedule below. Please note that this is a schedule for full-time students only. Part-time students may take longer to complete each of the requirements.

Required Milestone/Task	**With MS**	**Without MS**	**Completed (date)**
Identify advisor	1st semester	1st semester	
Plan of Study	1st semester	1st semester	
Form dissertation committee **required for Part 2-Oral Exam of the qualifying exam; submit Report of dissertation committee composition (RDCC) form*	2nd semester	2nd semester	
Qualifying exam	End of 2nd semester	End of 2nd semester	
Apply for Research Clearance Letter **must have proposal ready*	2-3 months prior to scheduling Preliminary Exam	2-3 months prior to scheduling Preliminary Exam	
Preliminary Exam – Written and Oral Research Proposal Defense	3rd or 4th semester	5th or 6th semester	
Conference Presentations At least two conference presentations	Throughout course of study	Throughout course of study	
Publish Dissertation *At least two published or accepted journal article manuscripts approved by Dissertation Committee before defense can be scheduled*	Throughout course of study	Throughout course of study	1st publication 2nd publication
Apply for Graduation	Semester before planned final defense	Semester before planned final defense	

Schedule Final Defense	Final Semester (7th or 8th semester expected)	Final Semester (8th or 9th semester)	
Submit Advisor & AST Approved Dissertation to Committee	10 days prior to defense	10 days prior to defense	
Final Defense and Submit approved dissertation to the Graduate College	Final Semester	Final Semester	

6.4 Graduation Requirements

The Ph.D. graduation requirements are given below:

1. **Course Credit Requirement:** For students entering the program with an M.S. degree, a total of 42 credits after the M.S. degree, of which 15 credits are toward dissertation work, and 27 credits are toward coursework. For students entering the program with a B.S. degree, a total of 66 credits after the B.S. degree, of which 21 credits are toward dissertation work, and 45 credits are toward coursework.

2. **Seminar Requirement:** Students must register for and complete the Doctoral Seminar class (AST 992; 1 credit) at least three semesters except for students who enter the Ph.D. program without an MS degree. These students with the BS degree must register and complete the Doctoral Seminar class in at least six semesters. A requirement for passing the seminar course is that a student makes at least one presentation on their research progress each year.

3. **Conference Presentation Requirement:** All AST students are encouraged to make conference presentations of their dissertation research activities at local, national and international meetings in their respective field. The AST program requires students to give at least two conference presentations of their dissertation activities. Students are encouraged to give an average of at least one conference presentation per year. Conference presentations offer an opportunity for students to bring their work before experts in the field to get peer reviewed feedback. Attending conferences is also important for networking and building the student's reputation as a researcher in their respective field. Many students have been known to get job offers as a result of active participation in their professional societies. Thus, students are encouraged to join the professional society/ies in their field. If students are not sure about which society to join, they are encouraged to speak with their advisor/major professor to get recommendations.

4. **Publication Requirements:** All AST students are strongly encouraged to publish as many technical papers as possible in peer-reviewed journals. Students are encouraged to consider the impact factor of the journals in which they might publish and strive to publish in high impact factor journals (http://www.citefactor.org/journal-impact-factor-list-2014.html). At a minimum, an AST student is required to publish at least two journal manuscripts from his/her dissertation research in high-caliber peer-reviewed professional journal(s) before scheduling the final oral defense. Publishing takes time and timely dissemination of research results is critical to the scientific enterprise. The student's dissertation proposal timeline should factor in time for the publication process, including choice of journal and turnaround time. Publication of original research from the dissertation is a performance indicator for doctoral programs, including the AST Ph.D. Program. We track publications through several mechanisms, including direct email to the program director and executive assistant, the individual development plan (IDP) – updates should be sent at least annually, committee meeting reports and by searching scientific literature databases.

    a. **Tips for timely publication of dissertation work (not an exhaustive list):**

        i. Meet with your advisor to discuss journals to target for publishing your work (e.g., journals of your professional society or journals you generally read to stay current with the literature).
        ii. Meet with your advisor (and any collaborators/co-investigators) before the study begins to discuss authorship. Do not share any aspect of the work with others that has not been approved by your advisor.
        iii. Consider joining the main professional society in your field and publishing your work in those journals.
        iv. Present at conference(s) to engage with experts in the field. Some societies accept conference papers which may have the potential to lead to a peer-reviewed publication.
        v. Outline your manuscript before the study is completed and add results and discuss them as you progress with the study.
        vi. Start writing early in your matriculation and dedicate time to writing on a regular basis.

b. Authorship Guidance in alignment with the Office of Research Compliance and Ethics
    i. For doctoral students, the dissertation committee is responsible for encouraging and advising students and reviewing manuscripts based on the thesis or dissertation research for publication in their field journals per the university's Thesis, Dissertation and Comprehensive Exam policy. The advisor is the dissertation committee chair and is typically the primary person who helps the student publish their dissertation work. This does not prevent a student from publishing manuscripts with other faculty researchers on campus. Students wishing to publish dissertation research alone would be problematic for the university because the corresponding author should be an agent of the university and willing to accept full responsibility for research conducted under the university's purview. Students expecting to meet AST program publication requirements will need to have an agent/employee of the university who is a research faculty member as a co-author. That employee must be willing to take responsibility for any matters related to the work on behalf of the university.
    ii. Please refer to the authorship guidance from the Office of Research Integrity. https://ori.hhs.gov/content/Chapter-9-Authorship-and-Publication-Authorship
    iii.

5. **Qualifying Examination:** The purpose of the qualifying exam is to provide students an opportunity to demonstrate the likelihood of them going on to produce a scholarly doctoral dissertation, helping to identify a student's strengths and weaknesses so that a career development plan can be developed to facilitate student success. Only students with unconditional status and in good academic standing may take the Qualifying Examination. At the end of their second semester in the program, students must pass with a score of 80% or higher on a written exam that requires them to demonstrate proficiency with fundamental statistics and experimental design skills, technical writing skills, and journal article review skills. Students must take the examination when it is offered, typically the first Wednesday after the semester ends. A no-show will be considered failure of the exam. A student who does not pass and wants to retake the Qualifying Examination must apply to retake the Qualifying Examination by the posted deadline. No student is permitted to take the Qualifying Examination more than twice. A student not recommended for re-examination or who fails the exam on a second attempt will be dismissed from the doctoral program. Students may not take dissertation credits if they haven't passed the Qualifying Exam and number of credit hours by the second semester, before 36 credit hours are attempted.
    a. **Consequence of Delayed or Missed Qualifying Examination:** The expectation is that the students will participate in the exam as scheduled, i.e., at the end of the second semester. In the case of unforeseen circumstances – documentation is required, e.g., accident, medical/family emergency, loss of internet connection (only relevant if the university is on a mandated remote learning scheme or if prior approval is granted by the AST Program Director ahead of time) or other that cannot be resolved within 15 minutes. If the matter can be resolved in 15 minutes, the exam can resume. If the matter cannot be resolved in 15 minutes, the exam must be rescheduled as approved by a majority vote of the dissertation committee (or the examination committee, to include the Graduate Faculty representative for prelims and dissertation defenses). The committee has the discretion to extend the 15 minutes, but a "waiting period" for the exam to commence/resume should not exceed 30 minutes. Failure to show without providing approved documentation will result in failure of the exam. ****Note, an in-person oral defense is strongly recommended for the Oral Exam Portion of the Qualifying Examination.****
    b. Format of the Qualifying Exam: The AST Qualifying Examination has three parts.

        i. **Part 1:** The Written Exam (Part 1) will be given in person on the **Wednesday after the semester ends, 9:00 AM - 1:00 PM in Gibbs Hall Room 307 (or other location as announced)**.

        ii. **Part 2:** The 45-minute Oral Exam (Part 2) will be arranged by research advisors and must take place within the two-week timeframe immediately following Part 1. Dates are announced near the beginning of each semester.

        iii. **Part 3:** The Individual Development Plan (Part 3) is due within the two week period immediately following Part 1.

    c. For Part 2, the QE Oral Exam Committee consists of the student's dissertation committee. Therefore, **at least four (4) weeks ahead of the oral exam, the Report of Dissertation Committee Composition (RDCC) Form must be completed**, with all signatures (except for the Graduate Faculty Representative) **and emailed to the AST PhD Program email address: ast@ncat.edu** (you may copy Dr. Waterman, AST Program Director and Ms. Mayberry/AST Executive Assistant). Committees must be comprised of at least four members, and all must be members of the graduate faculty, and at least two, including the advisor/committee chair, must be a full member. It

is important to meet this deadline to ensure that your research advisor has been officially declared so that I may communicate the requirements for the 45-minute Oral Exam to them directly and in a timely manner. If you do not have an advisor, you must come to agreement with a full member of the graduate faculty to serve as your advisor (and submit required paperwork, i.e., Plan of Study) before this deadline. If you do not form a dissertation committee ahead of the Qualifying Exam Part 2 Oral Exam, an Examination Committee consisting of the advisor and at least two graduate faculty members from the concentration will be appointed to administer the oral exam.

d. The AST Director offers a **Qualifying Exam Q&A session about one month prior to the exam**. The Zoom meeting time and link will be shared via email and the session will be recorded in case a student or advisor is not able to attend. There are QE resources (i.e., study guide, sample questions, relevant material from AST 830, past Q&A presentations and recordings) available in the AST Blackboard Organization.

e. Visit the Graduate College website and AST Blackboard Organization for QE resources and recordings.

6. **Preliminary Examination:** The Preliminary Oral Examination is conducted by the student's dissertation committee and is a defense of the student's dissertation proposal. Passing this exam satisfies requirements for Ph.D. Candidacy. The student must prepare a written doctoral research proposal with a thorough literature review, experimental plan (with methods "proposed" and written in future tense), timeline (with specific time-bound objectives (i.e., include Month and year)), and some preliminary results (these can be written in past tense). With the approval of the advisor/dissertation committee chair, the student should submit the Research Clearance Letter request form, along with their abstract and methodology to the Office of Research Compliance and Ethics to obtain a Research Clearance Letter. Plan ahead because the Office of Research Compliance and Ethics generally requires 7-10 business days for processing. Once this written proposal has been approved by the student's research advisor and the department chairperson, it may be sent to the Dissertation Committee and an oral exam scheduled. Generally, the dissertation committee should receive the written proposal at least two weeks in advance of the oral exam. The dissertation proposal defense is mutually scheduled by the department, research advisor, and student and is open to all students and faculty. The Dissertation Committee decides the outcome of the defense and informs the student of this outcome within 24 hours. A no-show will be considered failure of the exam. Failure on the examination may result in dismissal from the doctoral program. The student's Advisory Committee may permit one re-examination. At least one full semester must elapse before the re-examination. Failure on the second attempt will result in dismissal from the doctoral program.
    a. **Proposal format.** Students should meet with their advisor to discuss the format of the research proposal. Some ideas include NSF or NIH proposal formats, or a "modified" version of the thesis/dissertation template provided by the Graduate College (preliminary pages are not needed, but organizational format can be adopted). See AST Blackboard Org for detailed, step-by-step instructions.
    b. **Research Clearance Letter** must be obtained ahead of time and submitted at the time of scheduling the Preliminary Exam/Proposal Defense. Must be submitted to the Office of Research Compliance and Ethics.
    c. **Scheduling Oral Defenses (Preliminary Exam/Dissertation).** Scheduling takes time. Pleases plan ahead and contact your committee members as early in the semester as possible to get on their schedule. The AST Program announces oral defense deadlines each semester. Although a dissertation defense can happen at any time during the academic year when the university is open for business, there are deadlines that coincide with commencement. In general oral defenses should take place prior to the end the semester during the academic year. As a general rule, this falls on the day prior to the Graduate Commencement Ceremony. In the past, this date was the last day of the semester, when final grades are due. Summer oral defenses can happen when the entire committee (including the graduate faculty representative) agrees on the oral defense date prior to the end of the academic year. All members of the committee must be present for the Preliminary Exam/Proposal Defense and the Final Dissertation Defense. Note, 9-month faculty are not required to work during the summer months, unless they are on contract with the university, e.g., to teach a course. Therefore, committees may not be available to participate in reading of the dissertation and the oral defense of it. Please plan ahead if it is likely that you will finish degree/program/dissertation requirements and schedule your final dissertation defense over the summer. Tips for reducing scheduling challenges include, but not limited to checking the academic calendar and faculty course schedules in Aggie Access for potential conflicts before emailing faculty, and avoiding holidays, breaks and high-demand times such as the first/last week of classes, first/last week of registration period, final exams week, and midterm/final grades due dates. The advisor and dissertation committee must approve a student's research progress and readiness before students are permitted to schedule an oral defense. The student and advisor must also ensure that the student meets AST program requirements before submitting oral defense paperwork. Please contact the AST Office if you have questions about your eligibility for an oral defense.

i. The scheduling paperwork should be submitted to the AST Office at least 5-6 weeks ahead of the planned Oral Defense, forms are due to the Graduate College four (4) weeks ahead of the planned exam
ii. All dissertation committee members, including the Graduate College appointed graduate faculty representative, must be involved in scheduling of oral defenses and all committee members must be present during the entire oral defense. It is not acceptable to select a date and "tell" the graduate faculty representative when the exam will be held. They are an appointed member of the dissertation committee and represent the Graduate College in an official capacity during oral defense of the written proposal and dissertation.

d. **Consequence of Delayed or Missed Preliminary Examination:** The expectation is that the students will participate in the exam as scheduled, and agreed upon by the student and entire committee, including the Graduate College appointed graduate faculty representative. In the case of unforeseen circumstances – documentation is required, e.g., accident, medical/family emergency, loss of internet connection (only relevant if the university is on a mandated remote learning scheme or if prior approval is granted by the AST Program Director ahead of time) or other that cannot be resolved within 15 minutes. If the matter can be resolved in 15 minutes, the exam can resume. If the matter cannot be resolved in 15 minutes, the exam must be rescheduled as approved by a majority vote of the dissertation committee (or the examination committee, to include the Graduate Faculty representative for prelims and dissertation defenses). The committee has the discretion to extend the 15 minutes, but a "waiting period" for the exam to commence/resume should not exceed 30 minutes. Failure to show without providing approved documentation will result in failure of the exam. Rescheduling will be at the discretion of the Major Professor/Committee Chair & Committee. ****Note, an in-person oral defense is strongly recommended for the Oral Defense of the Proposal.****

e. Visit the Graduate College website and AST Blackboard Organization for detailed, step-by-step instructions.

f. **Admission to Doctoral Candidacy:** In 2023, the CoST AST Program hosted its inaugural PhD Candidacy Ceremony to mark admission to doctoral candidacy during Graduate Student Appreciation Week. The purpose of the Candidacy Ceremony is to celebrate and honor our students' hard work, perseverance and admission to candidacy*. The ceremony is meant to encourage completion of successful completion of key performance indicators and timely degree completions. We offer this ceremony once per academic year during Graduate Student Appreciation week (first week of April), allowing us to capture each student. For students that complete their Preliminary Exam after the current year's ceremony and end up defending their dissertation & graduating prior to the next ceremony will still be able to receive a certificate and honor cord (which can be worn with their regalia at graduation). They will need to contact our office prior to graduation to receive the certificate and honor cord. **An AST PhD Candidate is a PhD student in good academic standing that has completed all required coursework and passed the Qualifying Exam and Preliminary Exam/Proposal Defense.*

g.

7. **Dissertation Defense:** The dissertation defense is conducted by the student's dissertation committee and is an oral defense of the student's final dissertation and is scheduled after the student had published two technical papers in peer-reviewed journals, and the dissertation is completed. Copies of the dissertation must be presented by the candidate to his or her research advisor/major professor for review prior to releasing it to the committee. Upon approval of the advisor, the candidate must provide a copy of the dissertation to the examining committee, including the Graduate College Representative, no later than 10 days prior to the scheduled defense of the dissertation. The final oral examination may be held no earlier than one semester (or four months) after admission to candidacy. The results of the defense must be submitted by department to the Graduate College within 24 hours. A no-show will be considered failure of the exam. Failure on the examination may result in dismissal from the program. The student's Advisory Committee may permit one re-examination. At least one full semester must elapse before the re-examination. Failure on the second attempt will result in dismissal from the program.
    a. Visit the Graduate College website and AST Blackboard Organization for detailed, step-by-step instructions. You may also contact the AST Office with specific questions about preparing for the dissertation defense.
    b. **Scheduling Oral Defenses (Preliminary Exam/Dissertation).** Scheduling takes time. Pleases plan ahead and contact your committee members as early in the semester as possible to get on their schedule. The AST Program announces oral defense deadlines each semester. Although a dissertation defense can happen at any time during the academic year when the university is open for business, there are deadlines that coincide with commencement. In general oral defenses should take place prior to the end the semester during the academic year. As a general rule, this falls on the day prior to the Graduate Commencement Ceremony. In the past, this date was the last day of the semester, when final grades are due. Summer oral defenses can happen when the entire committee (including the graduate faculty representative) agrees on the oral defense date prior to the end of the academic year. All members of the committee must be present for the Preliminary Exam/Proposal Defense and the Final Dissertation Defense. Note, 9-month faculty are not required to work during the summer months, unless they are on contract with the university, e.g., to teach a course. Therefore, committees may not be available to participate in reading of the

dissertation and the oral defense of it. Please plan ahead if it is likely that you will finish degree/program/dissertation requirements and schedule your final dissertation defense over the summer. Tips for reducing scheduling challenges include, but not limited to checking the academic calendar and faculty course schedules in Aggie Access for potential conflicts before emailing faculty, and avoiding holidays, breaks and high-demand times such as the first/last week of classes, first/last week of registration period, final exams week, and midterm/final grades due dates. The advisor and dissertation committee must approve a student's research progress and readiness before students are permitted to schedule an oral defense. The student and advisor must also ensure that the student meets AST program requirements before submitting oral defense paperwork. Please contact the AST Office if you have questions about your eligibility for an oral defense.

i. The scheduling paperwork should be submitted to the AST Office at least 5-6 weeks ahead of the planned Oral Defense, forms are due to the Graduate College four (4) weeks ahead of the planned exam
ii. All dissertation committee members, including the Graduate College appointed graduate faculty representative, must be involved in scheduling of oral defenses and all committee members must be present during the entire oral defense. It is not acceptable to select a date and "tell" the graduate faculty representative when the exam will be held. They are an appointed member of the dissertation committee and represent the Graduate College in an official capacity during oral defense of the written proposal and dissertation.

c. **Dissertation Format** – Student in the AST Ph.D. Program must follow the Graduate College guidelines for formatting the dissertation https://www.ncat.edu/tgc/continuing-students/thesis/index.php. **Moreover, the AST Program encourages students to write the dissertation in a manuscript-style format, where each chapter represents a manuscript that the student has or will submit for publication in a peer reviewed journal.** The Introduction and Conclusions & Future Directions chapters should "sandwich" the manuscript chapters. Discuss the format with your advisor, particularly placement of tables and figures, and be sure to follow Graduate College formatting guidelines.

i. There are two options for the manuscript-style dissertation which largely depends on placement of tables and figures in relation to the major sections of text.
    1. Manuscript Style 1: Traditional manuscript style (major sections): Title Page, Abstract, Introduction, Materials and Methods, Results, Discussion, Acknowledgements, Literature Cited, Tables, Figure Legends, Figures. *This manuscript style is not generally accepted for dissertations submitted to The Graduate College. However, many journals prefer this style for submission of the manuscript. A student could theoretically write this manuscript in this way when they are writing their manuscripts for submission to a journal in their field (this would depend on author manuscript preparation guidelines. When they are at the dissertation stage, they could edit and convert their manuscript to manscript style 2 when assembling their dissertation.*
    2. **Manuscript Style** 2 (preferred, and generally aligns with Graduate College Format): Tables and Figures placed within the text near to their first mention. All major sections are the same as listed above for the traditional manuscript style. ***Manuscript Style 2 is the 'preferred' style for AST students. Preferred does not mean required.***
ii. NOTE: Ideally, students will write the dissertation as separate "manuscript chapters" that can be joined together at completion. This approach to writing makes writing the dissertation less daunting and can decrease the woes and errors that can occur with working with large text documents.

d. **Organization of the Dissertation Chapters:** The Graduate College thesis/dissertation preparation and formatting guidelines must be followed, regardless of how the document is organized. Be sure to review the most recent version of the Thesis-Dissertation Handbook and download the most recent MS Word template. AST PhD students have two options for organizing their dissertation as described below.

i. **Traditional Thesis Format (general format for STEM fields):**
    1. Preliminary pages (per thesis/dissertation template)
    2. Abstract (to whole dissertation, encompassing all chapters)
    3. Ch1 Introduction (to whole dissertation)
    4. Ch2 Lit Review (to whole dissertation...from your proposal)
    5. Ch3 Methodology - provide details of the entire dissertation project, including a clear experimental design and statistical analysis section
    6. Ch4 Results and Analysis
    7. Ch5 Conclusions and Future Research/Discussion and Future Research (to the whole dissertation)
    8. References (for the whole dissertation)
    9. Appendix - this is a good place to add supplemental figures, list of research products (publication, presentations, patents, etc.), honors, awards and other distinctions generated during the dissertation process

ii. **Manuscript Chapter Format (research-intensive format, encouraged and preferred format to facilitate publication):**

1. Preliminary pages (per thesis/dissertation template)
2. Abstract (to whole dissertation, encompassing all chapters
3. Ch1 Introduction (to whole dissertation)
4. Ch2 Lit Review (to whole dissertation...from your proposal)
5. Ch3 Manuscript - with abstract, intro, materials & methods, results, discussion and conclusion
6. Ch4 Manuscript - with abstract, intro, materials & methods, results, discussion and conclusion
7. *repeat for additional manuscripts
8. Ch5 Conclusions and Future direction (to the whole dissertation)
9. References (for the whole dissertation)
10. Appendix - this is a good place to add supplemental figures, list of research products (publication, presentations, patents, etc.), honors, awards and other distinctions generated during the dissertation process

e. **Consequence of Delayed or Missed Final Oral Defense:** The expectation is that the students will participate in the final exam as scheduled, as agreed upon by the student and entire committee, including the Graduate College appointed graduate faculty representative. In the case of unforeseen circumstances – documentation is required, e.g., accident, medical/family emergency, loss of internet connection (only relevant if the university is on a mandated remote learning scheme or if prior approval is granted by the AST Program Director ahead of time) or other that cannot be resolved within 15 minutes. If the matter can be resolved in 15 minutes, the exam can resume. If the matter cannot be resolved in 15 minutes, the exam must be rescheduled as approved by a majority vote of the dissertation committee (or the examination committee, to include the Graduate Faculty representative for prelims and dissertation defenses). The committee has the discretion to extend the 15 minutes, but a "waiting period" for the exam to commence/resume should not exceed 30 minutes. Failure to show without providing approved documentation will result in failure of the exam. Rescheduling will be at the discretion of the Major Professor/Committee Chair & Committee. ******Note, an in-person oral defense is strongly recommended for the Final Oral Defense of the dissertation.******

8. **Application for Graduation:** A candidate for graduation must file an application for graduation according to the schedule released by the Graduate College (see academic calendar). These dates generally align with registration period each semester. Failure to meet the deadline may result in a delayed graduation date for the candidate.

For students entering with a M.S. degree, the program requirements are summarized as follows:

Requirement Category	**Credits**	**Courses**
Core Courses	9	AST 830, 831, STAT 727
Qualifying Examination	0	
Concentration Courses	15	Students in a concentration need to satisfy the requirements of that concentration. The electives taken should include a progressive series of graduate courses closely related to a student's research topic. Research advisor and academic advisor (AST chair) approval is required for all elective courses.
Seminar Requirement	3	AST 992
Preliminary Examination	0	
Dissertation	15	AST 997
Dissertation Defense	0	
TOTAL	**42**	

For students entering with a B.S. degree, the program requirements are summarized as follows:

Requirement Category	***Credits***	***Courses***
Core Courses	9	AST 830, 831, STAT 727
Qualifying Examination	0	
Concentration Courses	18	Students in a concentration need to satisfy the requirements of that concentration. The electives taken should include a progressive series of graduate courses closely related to a student's research topic. Research advisor and academic advisor (AST chair) approval is required for all elective courses.
Elective Courses	18	Courses relevant to student's research area. Research advisor and academic advisor (AST chair) approval is required for all elective courses.
Seminar Requirement	6	AST 992
Preliminary Examination	0	
Dissertation	15	AST 997
Dissertation Defense	0	
TOTAL	**66**	

Note that while AST does not award an M.S. degree, B.S. to Ph.D. students may qualify to receive an intermediate M.S. degree in Chemistry, Physics, Math, or Biology by completing the Application for Award of Master's Degree to current Ph.D. Students form. If a student plans to do this, they should decide in their second semester whether they plan to get the M.S. degree using the thesis, project, or course option and complete the appropriate Plan of Graduate Study to get it approved by the proposed M.S. awarding department.

6.5 Dissertation Research: A student may not register for dissertation credits before passing Qualifying Examination. No more than 15 (21 for students entering with B.S. degree) dissertation credits are counted toward the total credit hours requirement for the degree. However, students are expected to continue taking dissertation credit hours until they graduate. To help students stay updated with literature in their concentration, some faculty advisors allow students that have completed all course requirements, including AST 997, to alternate between taking one credit of doctoral dissertation (AST 997) and doctoral seminar (AST 992), with the understanding that the student will continue working on their dissertation research regardless of enrollment. However, this arrangement must be agreed upon by the dissertation advisor.

6.6 Admission to Candidacy: A student will be admitted to candidacy upon successful completion of the Qualifying Exam and the Preliminary Oral Exam (i.e., proposal defense). A Ph.D. candidate has completed all required coursework, the qualifying and preliminary examinations and other degree requirements except for the dissertation. Candidacy is the stage in a Ph.D. student training where the student is expected to dive deeply into a novel dissertation research project and demonstrate a measure of scientific inquiry and self-discipline that is self-defined, but under the direction of their dissertation committee. This stage can be daunting for some students because the absence of structure that comes with a full course load requires self-motivation and discipline to be productive. Instead of relying on their dissertation advisor/committee to set deadlines, Ph.D. candidates are expected to establish a high-performing, self-paced routine to drive their research productivity, including regularly reading dissertation-related literature, reporting to work consistently and on time, being dependable, generation of publication quality data and writing manuscripts to publish their dissertation, contributing to their research group, helping to supervise/train junior students, arranging meetings with their dissertation committee (each semester), applying for prestigious fellowships and/or dissertation awards, etc. In essence, Ph.D. candidates should have obvious, demonstrated passion about the work they are doing. For students entering the AST Program with a MS degree, are expected to complete their Preliminary Exam by semester four, and by semester five for students enter with a BS degree. However, all students should have completed their Preliminary Exam by semester six (i.e., end of year 3). Barring extenuating circumstances, students not meeting these milestones will not be making satisfactory academic progress.

6.7 Final Oral Examination (Dissertation Defense): The Final Oral Examination is conducted by the student's dissertation committee. This examination is the final dissertation defense presentation that is scheduled after a dissertation is completed. The examination may be held no earlier than one semester (or four months) after admission to candidacy. Failure of the examination may result in dismissal from the doctoral program. The student's Advisory Committee may permit one re-examination. At least one full semester must elapse before the re-examination. Failure on the second attempt will result in dismissal from the doctoral program.

Submission of Dissertation: Upon passing the Ph.D. Final Oral Examination, the Ph.D. candidate must have the dissertation approved by each member of the student's dissertation committee. The approved dissertation must be submitted to The Graduate College by the deadline given in the academic calendar and must conform to the Graduate College's guidelines for theses and dissertations. See the AST Blackboard Organization for step-by-step details on completing the dissertation process.

6.8 Academic Advisor, Major Professor/Committee Chair, and Dissertation Committee

All students enrolled in the AST Program must have an academic and research advisor. Upon admission to the program, the Program Director acts as the student's academic advisor to assist with the selection of course for the first semester of enrollment. Generally, AST students should have a come to agreement with an advisor, also designated as the major professor, by the end of their second semester in the program. Based on a student's research interests and upon request, the AST Program Director will recommend potential research advisors for the student to contact. Students are encouraged to review faculty webpages to identify and contact potential advisors. It is then the student's responsibility to convince a potential faculty advisor of their ability to contribute to the faculty member's research program. While the AST program makes every effort during the admission process to only admit students for whom it is anticipated that research advisors will be available, due to changes over time beyond the control of the department related to funding levels and faculty workloads, the AST program cannot guarantee that a research advisor will be available for all students admitted to the program. The research advisor/Major Professor/Committee Chair must be a full member of the graduate faculty as designated by the AST Program and the Graduate College. A student that has not come to agreement with an advisor by the time they have attempted 27 credit hours (i.e., the equivalent of three full time semesters), they will be dismissed from the program.

The Dissertation Committee consists of the student's primary research advisor/Major Professor and at least three other graduate faculty committee members with the primary research advisor acting as the chair of the committee. Committee members should be chosen by the student in consultation with their research advisor/major professor based on how their expertise can contribute to quality advising of the student. One voting members of the committee may be non-N.C. A&T faculty or scientists, sometimes referred to as an "external committee member" or "external examiner" who have been granted graduate faculty status by one of the departments in the College of Science and Technology (see more details about external committee members below). The composition of the committee is approved through the Plan of Graduate Study and the Graduate College Report of Dissertation Committee Composition (RDCC) Form (http://www.ncat.edu/tgc/continuing/forms/thesis-dissertation-committee-report.pdf).

In addition to the minimum of four committee members, the Dissertation Committee must also include a Graduate College appointed Graduate Faculty Representative. Graduate College Representatives who contribute to both the preliminary exam and final dissertation defense are voting members of the committee and are allowed to sign the dissertation cover page. Graduate College Representatives who only contribute to the final dissertation defense are non-voting members and do not sign the dissertation cover page.

External Committee Members: The external examiner or committee member will need to be an affiliate member of the graduate faculty to serve on a student's committee. They will need to be appointed as an affiliate member of the graduate faculty in a department prior to being approved to serve on a student's dissertation committee. The process will involve the prospective external

committee member submitting their current CV, confirmation that he holds graduate faculty membership/or equivalent at his current institution and a justification for the request (in the form of an email from the major professor, you, and or the prospective committee member, requesting an appointment) to the relevant department at NCAT that aligns with their area of expertise, perhaps the major professor's department. Please keep in mind that these appointments may take some time and they are typically done at the beginning of the academic year, although these appointments can happen at any time. The process of appointment would require a review of the request for appointment and vote of the graduate faculty to determine whether the external examiner meets the departmental requirement for graduate faculty appointment. If approved, their name would need to be sent by the appointing department chair to Dr. Alesia Ferguson, CoST Interim Associate Dean for Undergraduate Education and Academic Affairs, and then on to the Graduate College.

Permanent Changes in Committee Members:

- Changes before Preliminary Examination. Should the student, in consultation with his/her advisor, wish to change any of the committee members, he/she must submit a revised Plan of Study with the new members, indicating that this change has been approved by the advisor and by the graduate coordinator or department chair.
- Changes after Preliminary Examination. Changes in committee membership after the preliminary exam requires signatures of both outgoing and incoming committee members and the student, as well as justification for the committee change. Approval by the Graduate College is required before holding any examinations.
- Disagreements within the committee or between the student and a committee member over the quality of a student's performance are not grounds for reconstituting the committee.
- If a committee leaves the university, they have he option to remain on the committee as an external committee member, if there is not an existing external member. If the member is no longer interested in serving on the committee, the Change to Dissertation Committee form must be completed. If the faculty that left the University cannot be reached/does not respond to requests to sign the form, there must be sufficient documentation (email messages, spread out several, e.g., 7-10, days) that every attempt was made to contact the committee member. The form with all other signatures should be sent to the AST Program Director to sign for the committee member that will leave the committee.

Please see the full policy for details on composition and membership of the advisory committee.
https://hub.ncat.edu/administration/legal/policies/thesis-dissertation-and-comprehensive-exam-final-02172020.pdf

6.9 Details about Critical Steps – From Admission to Graduation

1. Application for Admission: Complete the Graduate College online application for admission. The Graduate College forwards the completed application to the Program Director who reviews it with the assistance of the Graduate Program Committee. Successful applicants will be offered admission, and they must enter their decision (i.e., either intent to enroll or decline) into the admission portal.
2. Initial Contact: All students enrolling for the first semester of graduate study in AST must consult with the Program Director.
3. Selection of the advisor/major professor/dissertation committee chair. AST students must come to agreement with a faculty advisor within their first semester of enrolling in the program, ideally ahead of the registration period for the following semester. The advisor must be a full member of the graduate faculty. The official way to document the advisor-advisee agreement is by completing the Plan of Study.
4. Plan of Study: All graduate students are required to file a Plan of Graduate Study by the end of the second semester after admission to a program of study. However, we encourage this by middle of semester 1, prior to registration for the following semester. Failure to submit the Plan of Study will prevent the student from enrolling in classes for his/her third semester. The Plan of Study is established in consultation with the research advisor/major professor and AST program director. The Plan of Study is based on the Graduate Catalog requirements, but with research advisor and AST department chair approval may be modified to meet the specific needs of each student. Graduate Program Coordinators are a great resources for concentration specific recommendations. The Plan of Study may be amended at any time before the student applies for graduation with the approval of the research advisor and AST program director. Responsibility for meeting all academic requirements for the AST program rests with the student.
5. Selection of Dissertation Committee: After selecting a research advisor/major professor , the student must confer with him/her for assistance in the formation of a Dissertation Committee. The student and/or the advisor should invite prospective members of the dissertation committee to serve in writing via email. The invitation at minimum should include the name of the AST student, advisor, proposed dissertation topic (could be a short paragraph or abstract of the intended research project), and the expected contributions of the proposed committee members. Once established, the committee as a whole is responsible for recommending any changes in its composition. The committee consists of the research advisor/major professor (committee chair) and at least three additional faculty members with research interests related to the field of study of the student.
6. Complete Qualifying Exam: Take the Qualifying Exam that is scheduled by the AST Program and pass the exam.
7. Complete Preliminary Exam/Proposal Defense: Schedule with Program Director and Dissertation Committee Members, take the Preliminary Exam, and pass the exam.

8. Complete Coursework and Other requirements: The student is required to complete the coursework as listed in his/her approved Plan of Graduate Study.
9. Complete and Defend Dissertation Research: The dissertation final defense before the advisory committee must be successfully completed, and a written dissertation that complies with Graduate College formatting requirements must be prepared to the satisfaction of the committee. The time between proposal defense and final defense will usually be about two years and should be no less than 180 days.
10. Presentations: All AST students are required to give at least two conference presentations.
11. Publication: All AST students are required to publish at least two technical papers in peer-reviewed journals.
12. Graduation: Students must apply for graduation in accordance with the deadlines established by the Graduate College.

6.10 Dissertation Research Requirements

The steps in completing dissertation requirements are given below:

1. With the consent and advice of his/her research advisor, the student selects a tentative research topic.
2. In consultation with the research advisor, the student selects Dissertation Committee members.
3. The student prepares a written dissertation proposal outlining the proposed work. Dissertation proposals are expected to review the state-of-the-art and should clearly indicate that a substantial literature search has been completed. A dissertation proposal will not be considered complete without a list of relevant, reviewed references. The proposal should include some preliminary results but does not need to have results for all research objectives.
4. The student contacts all members of the dissertation committee, including the Graduate College Representative to schedule the proposal defense /Preliminary Examination (PE). All committee members (including the Graduate College Representative) must agree to the examination time (usually two hours).
5. The research advisor and AST department chair approve the proposal and it is submitted to the Dissertation Committee members at least two weeks before the scheduled proposal defense/Preliminary Examination date.
6. The proposal defense/Preliminary Examination is held and is open to one or two other AST students with an upcoming PE. The student presents his/her proposal (about 45 minutes) and answers questions from the committee. The committee decides if the topic is or is not suitable and makes suggestions on scope, solutions, and so forth. The student (and guest students if applicable) is asked to leave the room and the committee decides on a pass, fail, or retest, and the student is informed of the decision. The student is called back to the room and immediately given feedback and the results of their proposal defense.
7. Upon passing the proposal defense/Preliminary Examination (and the Qualifying Examination beforehand) the student advances to candidacy.
8. The research advisor directs the dissertation research and initial writing. Other committee members are also available for guidance and advice. The advisor and student should schedule at least one annual committee meeting for progress review. Students enrolled in AST 997 Doctoral Dissertation are required to meet with their committee at least once during that semester. A report of committee meeting should be submitted to the AST Office by the student within two weeks of the meeting.
9. The research advisor approves the initial typed draft of the dissertation.
10. The student must publish at least two technical paper manuscripts in a peer-reviewed journal before scheduling the final defense.
11. The student must contact each individual committee member to schedule the oral examination at least 4-6 weeks ahead of the planned defense date. All members of the committee, including the Graduate College Representative, must agree to and attend the dissertation defense.
12. The candidate submits copies of the dissertation to the committee members at least 10 days prior to the scheduled date of the final oral examination.
13. The committee members read the draft and submit suggestions for changes and/or additions to the candidate.
14. The oral examination/dissertation defense is open to other students and faculty members and begins with a seminar-style presentation by the candidate of the dissertation work (about 45 minutes), followed by questions from the general audience. This is considered an open session.
15. At the conclusion of the open session, the general audience leaves. The closed session consists of the candidate and the committee. The closed session will consist of questions by the research advisor and committee members.
16. At the conclusion of the closed session, the candidate leaves the room, the committee decides on a pass, fail, or retest, and the candidate is informed of the decision. In the case of a retest, the student must again appear for an oral examination no sooner than one semester (four months) following the original examination. This procedure may be repeated at the option of the committee.
17. In consultation with the research advisor, the student makes the changes and/or additions and prepares the final draft.
18. Please consult with the Graduate College for details on dissertation format and publication (https://www.N.C. A&T.edu/tgc/continuing-students/thesis/index.php).

VI. Optional Internships & Cooperative Education Program (Co-op) Activities

The AST PhD Program does not require internships or Co-op activities as part of the degree requirements. However, we understand that practical industry experience is an important aspect of student training. Therefore, any student wishing to participate in an internship or co-op must get a recommendation from their advisor, and the recommendation must explain how the internship is connected to the students dissertation training and the impact the internship will have on the student. For U.S. citizens, you should register with HandShake and contact Pamela Basheer in Career Services to complete the necessary paperwork after you have secured an internship, and provide copies of the paperwork to the AST Office for program records. International student should complete the F-1 Curricular Practical Training (CPT) form with the Office of International Affairs. Dissertation timelines and graduation should not be postponed in order to participate in internships. The OIA allows students to complete a maximum of two internships per degree. However, the AST program can determine whether or not to approve an internship/Co-op. The OIA does not recommend approving extending Form I-20 for a student that conducts an internship. Thus, an internship should not interfere with the student's matriculation time. This should be factored during the time of preparing the student's Plan of Study or completion of the Student Compass to ensure that adequate time is devoted to completing program requirements in a timely manner.

VII. University Awards

Three Minute Thesis Competition (as stated on the Graduate College Website): The Three Minute Thesis (3MT) Competition asks graduate students to present their master's thesis or doctoral dissertation research to a general audience in just three minutes and with one PowerPoint slide. The 3MT competition is part of the Graduate College's professional development effort. Graduate students who participate in the 3MT competition will work on critical communication skills that will serve them beyond their degree. Students will also have the opportunity to win prize money (up to $500)! https://www.ncat.edu/tgc/continuing-students/3mt-competition-at-nc-a-and-t.php.
The Three Minute Thesis (3MT®) is an academic research and communication competition developed by The University of Queensland (UQ), Australia. See https://threeminutethesis.uq.edu.au/ for more information.

Outstanding Graduate Student Awards (Relevant to Ph.D. students) – Each year (usually in February) the Graduate College solicits nominations and application for several categories. Student work with their advisor to put together a competitive application package. The AST Program Director/Chair will provide a letter of support for competitive packages. Please plan ahead to ensure that the Program Director has sufficient time to review your materials and provide a letter.

Award categories are as follows:

- Outstanding Dissertation Award
- Outstanding Senior Graduate Research Assistant Award
- Outstanding Junior Graduate Research Assistant Award
- Outstanding Senior Graduate Teaching Assistant Award
- Outstanding Junior Graduate Teaching Assistant Award
- Rising Star Award
- https://www.ncat.edu/tgc/continuing-students/grad-awards-2020.php

VIII. Other Policies, Processes and Procedures

Requesting AST Director's Signature on documents

Send completed forms that they need the AST Director's/Dr. Waterman's signature to the AST email address – ast@ncat.edu – and copy the AST Executive Assistant/Ms. Mayberry. Requests need to be submitted a minimum of 5-7 business days before needed, or as early as possible. Urgent requests should be accompanied by an appropriate justification. When signed forms are ready, the documents will be return to the student by the AM

Switching Advisors – Plan of Study (POS) process

An AST PhD student should reach agreement with a full member of the graduate faculty to serve as his/her dissertation advisor during their first semester in the program. If a student is unable to come to agreement with an advisor during the first semester, they must come to agreement near the beginning of the second semester in the program. The Graduate Coordinator or Department Chair approves and submits the advisor and committee names on the student's revised Plan of Study by the end of the third semester to the

Graduate College for final approval. An AST student who is unable to reach agreement with any qualified faculty member to serve as his/her advisor by the time he/she has attempted 27 credit hours will be dismissed from the program. In this case, the student may submit a new application for admission to another program at North Carolina A&T State University or may transfer to another institution.

"Requests to Transfer" to the AST PhD Program

To quickly address the matter of a student who is eager to join a group: we do not "transfer students" per se. A student would need to apply and be admitted to our program, even if they are a current student, although the process is slightly different for current students at the university. MS students must apply through the Graduate College, they cannot be admitted to our program through the Change of Program process. However, if they are currently in another PhD Program on campus (such as the College of Ag), I would need to first meet with the student, their current advisor, graduate program coordinator and department chair before considering a Change of Program request. If the student is in good academic standing, the student would need to contact my office to express their interest in the Change of Program process. This would require a review of their admission packet by one of our admissions committees.

Change of Program (COP) Process

A student would need to apply and be admitted to our program, even if they are a current student, although the process is slightly different for current students at the university. MS students must apply through the Graduate College, they cannot be admitted to our program through the Change of Program process. However, if they are currently in another PhD Program on campus (such as the College of Ag), I would need to first meet with the student, their current advisor, graduate program coordinator and department chair before considering a Change of Program request. If the student is in good academic standing, the student would need to contact my office to express their interest in the Change of Program process. This would require a review of their admission packet by one of our admissions committees. The student will need to write a letter of request and justification to support the request for a change of program. In addition to the student's letter of justification, the student must apply and be admitted, just like any prospective student/applicant. Submit Change of Program form, signed by current advisor & POS with new advisor. Admissions materials will be sent to admission committee for identified on the COP form. Committee will also make a decision on whether the applicant will retake the QE at that time. If a student has already attempted the QE twice and they are required to retake the QE of as a condition of being permitted to Change Programs, that student's request will be denied and the student will need to remain in their current concentration or pursue a different concentration. If a student has only attempted the QE one time, and retaking the QE is a condition of the COP, that student will have one opportunity to retake the QE. If they do not pass the QE the student will be dismissed from the program. This COP form will not be signed by the AST Program Director if the student's background and academic preparation does not align with the required STEM degree or closely related degree for the area. Changing advisors does not necessitate a need to change programs, the first step to seek a new advisor in the same concentration area.

Guidance on how to handle requests for students to join your lab/team. As a courtesy to colleagues, faculty members should consider reaching out to the former advisor if a student comes to them asking to join their lab. In the event that abuse or harassment of any kind is suspected, please contact the AST Director right away. The next steps would be to report incidents of abuse or harassment to the Title IX office.

Work schedule & related expectations – the advisor should make work schedule and related expectations clear to the student before they agree to be their advisor. We have a Student Compass that is designed to help with discussing and agreeing on the aspects of the student's training, including hours per week the student is expected to engage with the advisor, their research materials and other members of the research group. Full time students are expected to be fully engaged in the AST program, their advisor's department and their research project during normal business hours, and additional times as needed due to the nature of the research project. Part time students are also expected to be reasonably and meaningfully engaged with their advisor during normal business hours and/or the agreed upon work schedule for completion of dissertation research and related activities. If a student is enrolled full time and being supported by their advisor/the university, they must establish a work schedule with their advisor for the time they are expected to be present to perform research and related activities. If the student is self-supporting, they are still expected to engage with their advisor and research materials in a meaningful way. Regardless of how the student is supported, they are expected to engage with their advisor during normal business hours and/or other agreed upon times as needed for completion of their project. Because our program is in-person, these interactions should primarily be on campus, but can include other locations as the advisor deems necessary for the project.

Extension of Form I-20 Requests

According to United States federal regulations, if you are in F-1 student status and are unable to meet AST program requirements by the completion date on the Form I-20, you may be granted an extension if the you have continually maintained satisfactory academic

progress and if the delays to your degree completion are caused by compelling, documented academic or medical reasons. Form I-20 will not be automatically renewed. Form I-20 will not be extended due to internships or co-ops. If a student needs to request an I-20 extension the following must be submitted to the AST Program Director approximately 60-90 days prior to the expiration of the form I-20. This will allow sufficient time to review and respond to requests prior to the 30-60 days requirement to submit to the Office of International Affairs.

- Required materials for requesting a Form I-20 extension:
- Completed OIA advisor recommendation form
- Advisor's letter of justification (that fully explains why a student needs more time – provide detailed explanation of acceptable academic reasons for extension)
- Proposed timeline of completion
- List of dissertation research products (conference presentations and awards; you can send your updated CV with these highlighted)

Enrollment, Leave of Absence, Withdrawals and Related Policies and Procedures

Continuous Enrollment and Leave of Absence: According to the Enrollment, Residence, Leave and Withdrawal Policy, all graduate students are expected to maintain continuous enrollment each semester (except summer terms) until they complete degree requirements for their respective program. However, under extenuating circumstances, a student in good academic standing may request a leave of absence from his/her program of study. Requests for a medical leave of absence must be submitted to the AST Program Director/Chair in writing using the Leave of Absence request form along with proper documentation to support the request Doctoral candidates must meet with their dissertation committee chair/major professor and get their signature of approval prior to submitting the form to Dr. Waterman. Upon approval by the AST Program Director, the form will be routed to the Dean of The Graduate College for review and approval.

The request should be made at least one month prior to the semester involved. The request should be endorsed by the student's graduate advisory committee, program coordinator, AST Program Director/department chair, and the Graduate College. The time that the student spends on an approved leave of absence will be included in the maximum time allowed to complete the degree.

Withdrawal from the University: A student who wishes or is asked to leave the University at any time during the semester shall complete and file official withdrawal forms. The forms must be completed and submitted to the Office of the Registrar. A student may be asked to provide documentation of circumstances that resulted in the withdrawal request.

For AST students, the student is required to meet with their dissertation committee chair/major professor and/or the unit that provided financial support to the student to be cleared of any dissertation research and financial responsibility. Students withdrawing from the university may be required to return none, a portion or all of the financial assistance received during the term of withdrawal. The matter of returning financial resources (e.g., financial aid/scholarship, research travel expenses related that have not been spent, but travel pending, salary, etc.) must be discussed with the advisor/major professor, sponsoring department/unit on campus. The sponsoring unit's representative must sign off on the withdrawal form prior to the student meeting with the AST Program Director/department chair for the Exit Interview. The student must next meet with the AST Program Director. Failure to execute and file these forms in a timely manner will result in a student incurring the penalty of receiving an "F" for each course in which he or she was enrolled during the semester in question.

Retroactive Withdrawal from the University: For AST students, retroactive withdrawal requests will be considered in accordance with the Retroactive Withdrawal from the University Policy. In general, retroactive withdrawal requests will be considered for documented circumstances. Students are required to provide documentation of the circumstances that resulted in the retroactive withdrawal, including documentation of circumstances that prevented the student from withdrawing by the published deadline in the academic calendar. The completed retroactive withdrawal form (signed by the required units on campus) and documentation must be submitted to the AST Program Director/department chair for consideration. The student must meet with the required units on campus (e.g, if they received financial assistance they must meet with the sponsoring individual/unit) to be cleared prior to submission of the Retroactive Withdrawal form and Exit Interview meeting with the AST Program Director/department chair. Upon approval, the AST Program Director will forward the approved form to the Dean of The Graduate College for consideration.

A student who was unable to initiate the process for withdrawal from the University by the last day to withdraw as published in the academic calendar may request a retroactive withdrawal. Requests for a retroactive withdrawal shall be considered on a case-by-case basis, and shall be based on the following:

A. serious illness or documented medical condition;
B. death of an immediate family member;
C. involuntary call to active military duty;
D. documented change in conditions of employment;
E. newly documented learning disability;
F. other emergency circumstances, legal requirements, or extraordinary situations.

Written requests must be submitted prior to the end of the semester immediately following the semester for which the retroactive withdrawal is being requested. Before Sebastian Health Center or the Counseling Services approves a retroactive withdrawal, the health care provider shall consult (with the student's consent and without providing medical details) with the school/college dean in the student's field of study for the dean's input.

Except under extraordinary circumstances or to comply with legal requirements, for retroactive withdrawals subsequent to the effective date of this policy, students are limited to one (1) retroactive withdrawal during their academic career.

APPENDIX

Appendix A: AST Graduate Faculty (requires OneID login)

Only approved members of the graduate faculty may serve on dissertation committees, this includes persons external to the university. Prior to selection of committee members, please check the most recent list of graduate faculty members (released by the Graduate College, annually). If the faculty member you wish to add to your committee is not a member, your advisor must work with their respective department to have the faculty member added through their established process and in accordance with university policy governing Graduate Faculty Membership Classifications.
https://hub.ncat.edu/administration/legal/policies/sec2-acad-affairs/graduate-faculty-membership-classifications_final.pdf

List of Graduate Faculty (See Graduate College website for most recent list; requires OneID login) --

https://hub.ncat.edu/policies/graduate/graduate-college-forms.php

Appendix B: AST Course Descriptions

AST 801	**History/Philosophy STEM Ed**	**Credit 3(3-0)**

This course introduces students to the field of STEM education while broadening their views of the interrelationships between teaching and research. The history of STEM education is explored through archival research and historical documents. Philosophies of education and the philosophies that have guided STEM as a profession are investigated and critiqued.

AST 802	**Theories Develop STEM Thinking**	**Credit 3(3-0)**

This course aims to construct answers to the following three questions: How to theories of human learning, development, and epistemology help us think about STEM? How do they relate to STEM education? How do they inform research methods and practice in STEM education? Must be enrolled in one of the following Levels: Graduate. (F;S;SS)

AST 803	**STEM Education Methods**	**Credit 3(3-0)**

Students will learn how to teach in an active learning STEM environment where both classroom and laboratory instruction are intertwined. Classroom techniques, such as lectures, cooperative groups, mastery, and problem based learning, will be studied, in addition to class preparation issues, such as accreditation. Students will study motivation, learning theories and cycles, and personality types.

AST 804	**Cognitive Devices in STEM Learning Environments**	**Credit 3(3-0)**

Students in this course will be able to evaluate various learning technologies relative to specific learning goals and outcomes and will design a technological tool to support thinking, learning, and/or teaching about concepts in STEM. Students will also be able to identify assessment methods that indicate cognitive change in learners as a measure of the effectiveness of a device/tool in context of an activity.

AST 812	**Environmental Chemistry Credit**	**Credit 3(3-0)**

This course presents the chemical aspects of applied environmental science. Topics covered include the sources, reactions, transport, and fates of chemical species in water, soil, and air along with the analytical techniques used to study the chemicals. Prerequisites: Graduate standing and consent of instructor.

AST 813	**Sustainable Energy Systems**	**Credit 3(3-0)**

The course will cover the thermodynamic, mass and energy balance, economic, and environmental considerations of sustainable energy systems. Alternative energy technologies and conventional energy technologies will be compared. Prerequisites: Graduate standing and consent of instructor.

AST 814	**Life Cycle Analysis**	**Credit 3(2-2)**

The course introduces the life cycle assessment (LCA) process with the aid of an LCA software package. Topics covered include life cycle goal and scope definition, inventory analysis, impact assessment, and reporting and interpretation. Prerequisites: Graduate standing and consent of instructor.

AST 821	**Environmental & Energy Economics I**	**Credit 3(2-2)**

This course presents theories of natural resource utilization and allocation. Topics covered include externalities, public goods, environmental quality, planning natural resource use and environmental quality, evolution of energy industries, and current energy and environmental regulatory systems. Prerequisites: Doctoral Standing and consent of instructor.

AST 822	**Environmental & Energy Economics II**	**Credit 3(3-0)**

This course presents interrelationships of natural resource use and the environment. Topics covered include applied welfare and benefit-cost analysis, externalities and pollution abatement, and quantitative methodologies for analyzing energy, natural resource, and environmental problems. Prerequisites: AST 711.

AST 830	**Foundations of Scientific Research**	**Credit 3(3-0)**

This course provides students the foundation needed to successfully design and communicate their dissertation research. Students will improve their ability to perform a literature search, read and understand scientific journal articles, develop clear hypotheses about issues for which there is no answer in the literature, design experiments to test hypotheses, and present them clearly in writing and orally. Prerequisites: Graduate Standing and consent of instructor.

AST 831	**Math & Computational Modeling**	**Credit 3(3-0)**

This course explores how to mathematically model a system, select an appropriate numerical method, implement computer simulations, and assess the ensuing results. Topics include nonlinear, 2D, and 3D models; nonrectangular domains; systems of partial differential equations; and large algebraic problems requiring high-performance computing. Prerequisites: Graduate Standing and consent of instructor.

AST 841	**Biomaterials Characterization**	**Credit 3(3-0)**

This course presents the analytical and spectroscopic techniques and tools available for examining molecular and macroscopic structural features of naturally occurring materials with emphasis on the lignocellulosic substrate. Topics covered will provide an appreciation for the fundamental principles behind the available techniques. Prerequisites: Graduate standing and consent of instructor.

AST 842	**Biomass Thermal Conversion Processes**	**Credit 3(3-0)**

This course presents the available chemical and thermal methods and processes that are available to convert biomass into commodity chemicals and energy as part of a biorefinery concept. Topics covered include the conversion of biomass to specific end products or to complex mixtures of materials such as syngas and pyrolysis oils. Prerequisites: Graduate standing and consent of instructor.

AST 843	**Biomass Biological Conversion Processes**	**Credit 3(3-0)**

This course presents the available biological conversion methods and processes that are available to convert biomass into commodity chemicals and energy as part of a biorefinery concept. Topics covered will highlight the challenges of bioconversions in terms of cost, dewatering, and limited thermal and pH ranges. Prerequisites: Graduate standing and consent of instructor.

AST 844	**Environmental and Policy Studies of Biomass Use**	**Credit 3(3-0)**

This course presents the ways in which biomass technological principles impinge upon policy issues. Topics covered include lifecycle analysis, management issues, public policy development, and principles of green engineering and sustainability. Prerequisites: Graduate standing and consent of instructor.

AST 850	**Physical Meteorology**	**Credit 3(3-0)**

This course presents physical principles related to atmospheric environmental systems, processes, and measurements. Topics covered include atmospheric thermodynamics, atmospheric radiation transfer, and cloud microphysical processes. Prerequisites: Graduate standing and consent of instructor.

AST 851	**AST 851. Dynamic Meteorology**	**Credit 3(3-0)**

This course presents classical and physical hydrodynamics. Topics covered include perturbation theory, scale analysis of dynamic equations, atmospheric boundary layers, atmospheric wave motions, the general circulation model, dynamics of tropical convections, middle atmosphere dynamics, atmospheric instabilities, and numerical weather forecasting. Prerequisites: Graduate standing and consent of instructor.

AST 852	**Climatology**	**Credit 3(3-0)**

This course presents physical and chemical principles that influence climate. Topics covered include earth climate history and present-day climate, climate equilibrium, earth energy budget, climate in middle and high latitudes, climate change detection, and future climate scenarios. Prerequisites: Graduate standing and consent of instructor.

AST 853	**Numerical Weather Prediction**	**Credit 3(3-0)**

This course presents the physical and mathematical basis for numerical weather prediction with computer experiments to demonstrate principles and techniques. Topics covered include derivation of sets of prediction equations consistent with scale analysis and dynamical constraints, atmospheric waves and filtered equations, numerical methods and computational instabilities, filtered and primitive equation models, and National Weather Service operational models. Prerequisites: Graduate standing and consent of instructor.

AST 854	**Foundations of Scientific Research**	**Credit 3(3-0)**

This course presents advanced analysis of synoptic weather systems, such as extratropical cyclones and their associated fronts and jet streams. Topics covered include the quasigeostrophic theory, isentropic analysis, potential vorticity dynamics, baoclinic instability, fronts and frontogenesis, and cyclones and cyclogenesis. Prerequisites: Graduate standing and consent of instructor.

AST 855	**Principles of Air Quality**	**Credit 3(3-0)**

This course presents the chemical interactions, transport, and monitoring of trace gas, aerosol, and particulate pollutants in the atmosphere. Topics covered include geochemical cycles, biogeochemical cycles, climate effects, health effects, regulations, and air quality meteorology. Prerequisites: Graduate standing and consent of instructor.

AST 856	**Atmospheric Aerosols Credit**	**Credit 3(3-0)**

This course presents the physics and chemistry of particles and droplets in the atmosphere. Topics covered include optical properties and particle absorption and scattering, solutions of radiative transfer equation in multiple scattering atmospheres, statistics of size distributions, and physical chemistry of atmospheric aerosols. Prerequisites: Graduate standing and consent of instructor.

AST 857	**Advanced Remote Sensing**	**Credit 3(3-0)**

This course presents principles of remote sensing with emphasis on atmospheric science applications. Topics covered include satellite and radar remote sensing, principles of atmospheric radiative transfer, descriptions of important satellite platforms, orbits and sensors, the retrieval of atmospheric variables from active and passive systems, and basic principles of interpretation. Prerequisites: Graduate standing and consent of instructor.

AST 858	**Tropical Meteorology Credit**	**Credit 3(3-0)**

This course presents the dynamics of circulations, convection, and wave activity in the tropics. Topics covered include various theories of tropical cyclone formations, large scale circulation systems of the tropical atmosphere, El Niňo Southern Oscillations, and wave disturbances in the tropics such as African easterly waves, Rosby waves, Kelvin waves, and waves in the intraseasonal range. Prerequisites: Graduate standing and consent of instructor.

AST 859	**Advanced Mesoscale Analysis Credit**	**Credit 3(3-0)**

This course presents mesoscale atmospheric phenomena and processes attributed to instabilities, topographic forcing, and/or air mass boundaries. Topics covered include mesoscale instabilities, boundary layer convection, mesoscale convective systems, and orographic mesoscale flows. Prerequisites: Graduate standing and consent of instructor.

AST 885	**Doctoral Special Topics Credit**	**Credit 3(2-4)**

This course allows the introduction of new topics on a trial basis at the doctoral level. The topic of the course will be determined prior to registration. Prerequisites: Graduate standing and consent of instructor.

AST 984	**Laboratory Internship**	**Credit 3(0-6)**

This course allows a student to explore various research areas first-hand by performing multiple projects in different laboratories under the mentorship of members of the graduate faculty. It should be taken before a student passes the qualifying exam. Grading is satisfactory/unsatisfactory evaluation only. Prerequisites: Doctoral standing and consent of instructor.

AST 985	**Doctoral Supervised Practicum**	**Credit 3(0-6)**

This course represents the supervised internship for the doctoral student that satisfies the 3 credits of required professional development. Oral and written presentations on the experience will be provided to the faculty. Grading is satisfactory/unsatisfactory evaluation only. Prerequisites: Doctoral standing and consent of instructor.

AST 992	**Doctoral Seminar**	**Credit 1(1-6)**

This course includes presentations delivered by the doctoral students, faculty, and invited speakers on topics related to energy and environmental issues and research. Grading is satisfactory/unsatisfactory evaluation only. May be repeated. Prerequisite: Doctoral standing

AST 983	**Doctoral Supervised Teaching**	**Credit 3(2-2)**

This course represents the supervised teaching for the doctoral student that satisfies required professional development. This course introduces the doctoral student to classroom or laboratory teaching under the supervision of a faculty mentor. Doctoral students who serve as teaching assistants or as instructors are required to take this course during the first semester they teach. Grading is satisfactory/unsatisfactory only. Prerequisites: Doctoral standing.

AST 994	**Doctoral Supervised Research**	**Credit 3(3-9) - Variable**

This course is supervised research under the mentorship of a member of the graduate faculty before a student passes the preliminary exam. This research should lead to the identification of a dissertation topic and written research proposal. Grading is satisfactory/unsatisfactory only. Prerequisites: Doctoral standing.

AST 997	**Doctoral Dissertation**	**Credit 1(1-15) - Variable**

This course represents the supervised research leading to the dissertation for the doctoral student. Doctoral dissertation research will be conducted under the supervision of the dissertation committee chairperson and include regular meetings with the dissertation committee to evaluate progress on the dissertation. Grading is satisfactory/unsatisfactory only. Prerequisite: Doctoral standing.

AST 999	**Continuation/Residency**	**Credit 1(1-3) - Variable**

Meets requirement for continuous enrollment during final term prior to graduation when all course credit requirements (including dissertation) have been completed. This course is non-graded, may receive a grade of S/U, and credit for this course does not count toward the degree. May be repeated twice. Prerequisites: Doctoral standing.

Appendix C: Guidelines for Students Seeking a Dissertation Topic

1. First consider the concentration area of Applied Science & Technology that you find most interesting and the courses you have taken and your past research/work experiences. Thus, to find a topic that you are interested in working on, first pick the area of study you like most.

2. Check the appropriate technical journals. The required AST 830 Research Proposal Writing Course is provided to help with this process. Often, authors point out unanswered questions in their articles. Such questions can become the basis for your research. Seek the assistance of faculty for any of these steps.

3. After completing the above process, visit with the professors who normally teach courses in your area of interest or have ongoing research projects in this area. Bring a list of the literature you have reviewed, as well as any ideas you may have come across for possible topics. Sometimes, a professor may have a topic in mind for a dissertation, and is waiting for a graduate student to express an interest. But you cannot count on this situation.

4. Faculty members with funded research projects have resources that support work within their area of expertise and they are generally obligated to fulfill the objectives of the funded study. While their research funding may include support for graduate research assistants, including dissertation projects, there may be less flexibility in the dissertation topics. Therefore, it is expected that the graduate student will align their topic/project with that of the faculty member and not expect the faculty member to align their research program with the student's dissertation topic.

5. You have the responsibility of identifying a topic, while the professors provide advice to help you determine a topic of interest. During this process, keep the following in mind:
   a. You must find the topic;
   b. No faculty member is required to direct your dissertation; it is solely the decision of the faculty to serve as advisor based on his/her research interests and prior commitments;
   c. You are responsible for your dissertation and its progress; faculty do not (and should not) do your research, do not write your dissertation, do not take the responsibility for your mistakes, nor are they responsible for seeing that you finish your degree by your personal deadline;
   d. The date of completion is a function of how many hours you work on your dissertation, the quality of work you put into it, and how well your research progresses; research has uncertainty, and that is why it is research, and your advisor cannot determine how long it will take you to finish your degree.

6. Ph.D. students should consider topics related to their M.S. thesis work, if appropriate.

Appendix D: Guidelines for Establishing and Changing Dissertation Committee Composition

This situation should normally not arise. However, these guidelines are stated in the event of such an unlikely situation. A student who wants to change his/her dissertation advisor and/or the composition of his/her committee should follow these guidelines:

1. **Advisory Committee Composition:** The advisory committee for a doctoral dissertation is composed of at least four members of the Graduate Faculty. At least three committee members must be Full or Associate members of the graduate faculty. The student's advisor serves as chair of the committee and is a full member of the graduate faculty. The Advisory Committee is selected by the student in consultation with his/her advisor. The members of the committee must be approved by the graduate coordinator or department chair. The Graduate College verifies the eligibility of faculty to serve on advisory committees when the Plan of Study is submitted. The Graduate College will appoint an additional external committee member for all doctoral dissertation committees. The Graduate College faculty representative serves on the doctoral dissertation committee with all the rights and responsibilities of any other member. In addition, the Graduate College faculty representative also represents the Graduate College to (i) protect the interest of the University by ensuring that the dissertation meets the highest academic standards, (ii) provide assurance that appropriate procedures are followed; and (iii) provide an 'outside' point of view by sharing expertise with a new perspective or theoretical vantage that might not otherwise be available.

2. **Committee Members from Other Institutions:** At most one of the required committee members may be selected from an external institution. If such a committee member is from another university, he/she must have graduate faculty status at his/her home institution; the program coordinator or department chair will provide evidence to the Graduate College before the appointment is approved. If the external committee member is from a non-academic organization, the appointment will be considered, and if appropriate, approved by the Graduate College after receiving a request and copy of the CV from the program coordinator or department chair. In all cases, it should be made clear to that person that he or she will be expected to participate in the comprehensive oral examinations.

3. **Changes in Committee:** Once established, the committee shall be responsible for recommending changes in its composition. A student may petition the committee providing reasons and justification for any desired changes in its composition. When necessary, the student may be required to appear in person before the committee to make arguments in favor of their position. The committee shall do everything necessary to ensure that the student's concern is heard fairly; when necessary, individual committee members may be excused from the proceedings to avoid a possible conflict of interest. The research advisor will communicate the committee's decision to the student in a timely manner. If the change of committee members is permitted, the student may seek a replacement member. In the event the research advisor is involved in the dispute, a member of the committee will be appointed to make this decision, to avert any conflict of interest.

4. **Solicitation of individual faculty members as replacements in the Committee:** It shall be the duty of all AST faculty members prior to committing to a solicitation by a student to serve as either a research advisor or committee member, to ensure that the solicitation is for the formation of a new committee. In cases where the solicitations are for replacement of committee members, the faculty member should verify and ensure that the case has been properly channeled through the student's research advisor and other committee members and that a decision has been made for replacement before engaging in any significant dialogue with the student.

5. If a replacement is sought for the research advisor/major professor, a new research topic that is in line with the new advisor's research interests and expertise may be required. In the event that the student desires to maintain the same topic, it shall be his/her responsibility to convince the committee that a change of research advisor is justifiable. However, the student should not expect a new research advisor to advise a student on a research project that was approved by a previous research advisor/committee. The student should work with the new advisor to form a new committee, which may be composed of some members from the original committee, if appropriate for the new research topic.

6. **Requirements for the student in the event of a change:** If a change is approved by the student's committee and replacement is made, the student will be required to present his/her dissertation proposal for the approval of the new committee, even if a proposal defense, i.e., Preliminary Examination, has been previously completed. If the student's dissertation project is largely derived from the previous research advisor's funded research, the student must gain permission to use all or a part of the work. For the sake of professional courtesy and to ensure a smooth transition, each faculty member who is contacted by a student to serve as a replacement in the committee should confer with the student's current research advisor and/or colleague to be replaced and ensure that there are no conflicts of interest issues.

Appendix E: List of Required Forms and Other Forms

The forms below are available at the Graduate College website. Download the forms you need. Complete your information. Download the completed form (get appropriate signatures) and email to the AST Executive Assistant. When you are completing forms, always check The Graduate College website to ensure that you are using the current/updated form.

From Graduate College Forms (https://hub.N.C. A&T.edu/policies/graduate/graduate-college-forms.php):

- Plan of Study
- Report of Dissertation Committee
- Request to Schedule Thesis/Dissertation Defense
- Request to Conduct Remote Thesis/Dissertation
- Change of Name form
- Change of Program form
- Request for Transfer of External Credits
- In-State Residency Information https://ncresidency.cfnc.org/residencyInfo/

Appendix F: Qualifying Examination (QE) Guidelines and Logistics

1. **Exam Date:** The QE is offered twice per year, at the end of the Fall and Spring semesters. Both the Written (Part 1) and Oral (Part 2) components are offered within the three-week period following finals week (not counting winter break). The Individual Development Plan (Part 3) must be submitted to the AST Director by the deadline for completing Part 2. All components of the QE -- Parts 1 (written), 2 (Oral) and 3 (IDP) must be completed by the deadlines established by the AST Program Director.

2. **Eligibility for the Qualifying Exam:** Students are required to take the QE after completing approximately 20 credit hours as a Ph.D. student and usually after completing two semesters (for full-time students). Only students in good academic standing may take the Qualifying Examination. It is strongly recommended, but not mandatory, that the core courses (AST 830, AST 831, and MATH 721, or approved substitutes) and at least one semester AST 992 be completed in the first year.

3. **Format of the Qualifying Examination (QE):** The QE is four (4) hours in duration. The exam will consist of three weighted parts:

    a. Part 1, a written exam, consisting of a fundamental statistics assessment, foundational background in concentration and technical writing skills, administered by the AST Program Director, accounting for 40% of the QE. Students are encouraged to start preparing for the QE early (i.e., in their first semester). For fundamental statistics concepts, students may wish to acquire AP/College Statistics review materials for a comprehensive review of post-undergraduate level statistics materials. There are some online resources, e.g., AP® Statistics | College Statistics | Khan Academy that students may wish to consider.

    b. Part 2, an oral exam given by the exam committee (described below), accounting for 50% of the QE, will assess the student's basic knowledge in the concentration area and research topic area. Students will be given reading material (book chapter, primary and/or review article) at least 1-2 weeks ahead of the oral exam date and must prepare a chalk talk (i.e., summary presentation using a white board without prepared visual aids) to present the material in a cohesive manner. The student will be asked a series of questions about the reading material. This part of the exam may be given in person or remotely.

    c. Part 3, completion of an Individual Development Plan (IDP), accounting for 10% of the overall QE, and complete by the student in consultation with the research advisor/Major Professor and committee members, as appropriate.

4. **Exam Location for Part 1:** The exam will be given in Gibbs Hall Room 307 (or as announced by AST Program Director). If given remotely (synchronously), you may use your own computer (or one on campus that you have access to). Please note, the QE is given in person and only given remotely when the university has shifted to campus-wide remote instruction. If that is the case, your video camera must be on at all times and you may not work with others. Once the exam starts you may not leave your testing site until you submit both sections of the exam.

    a. Materials permitted for use on Part 1: As this exam is a closed-book, students are not permitted to use any materials on the exam except the AST Software Image, a single-sided, one-page Notes Sheet that must be approved by the AST Program Director at least 3-5 business days ahead of the exam. The QE Study Guide, sample questions, homework, course exam questions and solutions are not allowed. Access to computers is permitted for use of MS Excel, MS Word, SAS, R, SPSS and calculator only; the internet or no other network resources may be accessed.

5. **Exam Committee for the Oral Exam (Part 2):** Students are required to complete the Graduate College (GC) Dissertation Committee form, except for the GC Faculty Representative, by midway through their second semester in the program. The QE Oral Exam committee will consist of the research advisor and at least two other Dissertation Committee members. If a student does not yet have a research advisor, an examining committee will be formed from three faculty members in concentration-relevant CoST department(s).

    a. Material permitted for use on Part 2: The student is permitted to have the article, book chapter and reading material handy during the oral exam. The student is encouraged to use a white board or digital white board in Zoom, MS Teams, Blackboard Collaborate or another digital whiteboard. The student should not use a prepared PowerPoint presentation or text document.

6. **Exam Evaluation:** The minimum passing score is an average of 80% on the QE rubrics (weighted 40% for the written exam, 50% for oral exam, and 10% for IDP). Additionally, to pass, none of the scores on any of the three parts (written, oral, IDP) can be below 60%. Students who fail the QE may take it once more the next semester that is offered. Student may take the QE no more than two times. Failure to pass the QE on **the second try will result in dismissal from the AST Program.**

7. **Preparing for the Exam:** Please see the following appendices for details and rubrics to help prepare. Each semester, a Study Guide and samples questions will be provided to help students prepare for the exam.

8. **Changes to the Exam:** All students taking the exam in the same academic year will receive the same exam format; therefore, any changes in the exam format will be published at least one year in advance, i.e., the format of the exam must be released prior to administering it to the Fall cohort and the Spring cohort must have the same format. It is possible that a student retaking the QE may have a different format. If no new format is published, the format from the most recent publication will be used.

Appendix G: Qualifying Exam Preparation Guide (Effective AY 2022-23) – Part 1 of 3

AST Qualifying Exam - Part 1 of 3: Written Exam Logistics, Study Guide & Sample Questions

Below is a comprehensive summary of the **Qualifying Exam (QE) Written Part 1 (40% of QE Grade)**. After completion of all three parts of the QE, the director will compute the overall score and share the results with the student and their advisor in writing. Let the director know if there is any aspect that has not been addressed.

1) Covers Basic Statistics, Technical Writing Skills and Concentration Knowledge
2) Part 1 (Written) is usually given the **Wednesday after Final Exams Week from 9:00 AM - 1:00 PM** (Gibbs Hall room 307, AST computer network image). Students must report to the exam room with their student ID (Aggie One card), approved Notes Sheet (previously approved by the director) and a USB drive at least 5-10 minutes prior to the exam for check-in. No other resources are permitted in the exam room.
3) It is your responsibility to let Dr. Waterman and Ms. Mayberry know if you are not able to logon to the AST software image either virtually (directions below) or in the Gibbs 307 lab. With the AST image, work saved locally will be lost when you logoff (IT confirmed this and recommended that you use a USB drive). Currently, you need to either e-mail files you want to save or save them to a USB drive (recommended). Logon instructions are listed below.

1. https://aggiesanywhere.N.C. A&T.edu
2. Username: (**same as e-mail, @N.C. A&T.edu not needed**)
3. Password: (**same as e-mail**)
4. Domain: **N.C. A&T**
5. Select **Login**
6. Select **AST_Dept_Ext**
7. Login again
8. Exit DesktopOK
9. Work saved locally will be lost when you logoff.
   Currently, you need to either e-mail files you want to save or save them to a flash drive (recommended).
10. When done **Log off**

If students want to practice in Gibbs 307, contact Ms. Mayberry in Gibbs 302E to let students into the room (she has a schedule of room availability, please be flexible). Ahead of the QE, Dr. Waterman/Ms. Mayberry request that IT checks computers and confirms that all software licenses are updated. Let Dr. Waterman/Ms. Mayberry know if students find any of the thin clients not working (send them the number that is on the thin client, please copy Ms. Mayberry if student emails Dr. Waterman directly).

4) Currently EXCEL, R, SAS, and SPSS are running on the AST network. The understanding is that access to EXCEL and R will meet the needs for everyone on the QE. Alert Dr. Waterman/Ms. Mayberry if this is incorrect. Students are responsible for practicing with the software that you plan to use and let the director know of any problems. For MS Excel, you should always check whether the Data Analysis Add-Ins are active:
1) Go to Data menu, see if Data Analysis option is showing on far right.
2) If not, go to File – Options – Add-Ins – Manage (Excel Add-ins) – Go
3) Check boxes for Analysis ToolPak and Analysis ToolPak – VBA, Ok

5) **Statistics question content scope:** Study guide and sample questions (but no solutions) are attached. The study guide has practice questions that will walk the student through how to perform statistical operations using MS Excel as all of the required data analysis can be completed using this tool. For fundamental statistics concepts, students may wish to acquire AP/College Statistics review materials for a comprehensive review of post-undergraduate level statistics materials. There are some online resources, e.g., AP® Statistics | College Statistics | Khan Academy; that students may wish to consider. Another optional source that can be used for additional practice is Chapters 6-9 in OpenIntro Statistics: https://www.openintro.org/book/os/.

6) **Statistics resources acceptable to use on the exam:** Students are not allowed to use the Study Guide, practice questions, or other resources while taking the QE. However, students may prepare one-page (single-side) notes sheet to use. This must be sent to Dr. Waterman (at least 3-5 days) in advance of the exam for approval to use on the exam.

7) Statistics problem grading: To receive full credit for problems, the student must provide a clear discussion of how the results are interpreted, i.e. what do the results mean practically. Be prepared for two types of problems on the exam: (1) ones similar to the sample problems in the study guide (accompanied by written responses as indicated), and (2) short multiple-choice questions that test your understanding of fundamental statistics concepts. Technical writing portions must be organized, logical, and written in college-level English.

8) **Concentration Exam Questions**: Effective AY 2022-23 we instituted a concentration-specific component to the QE composed of questions meant to assess students' foundational knowledge in the discipline after completing two semesters of coursework. These questions will be based on topics from coursework with emphasis on basic foundational principles from the respective concentrations. Questions are generated by graduate faculty within the respective concentrations, particularly faculty members that taught the concentration specific courses taken by the student. These questions will be included in Part 1: Written.

Please let the Dr. Waterman/AST Director know if students have any urgent questions, or join a Q&A session. If the student is unable to attend, please feel free to send the director (copy the Executive Assistant) questions ahead of time so they can be answered during the session.

Appendix H: Qualifying Exam Preparation Guide (Effective AY 2022-23) – Part 2 of 3

AST Qualifying Exam– Part 2 of 3 -- Oral Exam Component

Student Name: **Date:**

Oral Exam Focus – Focused on determining whether students have the quantitative and critical thinking skills needed to be successful in their chosen AST Ph.D. program concentration. Individuals with strong skills understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats (using words, tables, graphs, flow charts, chemical equations, mathematical equations, etc., as appropriate).

Oral Exam Logistics -- (50% of total QE score, 45-min exam with an additional 15 min committee discussion to generate a consensus rubric score)

1) At least a week before the exam, the student's research advisor provides the student and the rest of the faculty on the oral exam committee with the journal article(s), review article, or book chapter that will provide the foundation for the topic(s) that can be covered during the exam. To provide consistency in the expectations for all AST students, the total length of materials for which the student is responsible should be approximately 12-20 pages.

2) At the oral exam, the student will present an in-person or virtual "chalk talk", i.e., summary discussion of key points from the article without using any packaged presentation graphics. The name "chalk talk" comes from the expectation that one won't use a packaged PowerPoint show but will rather write on a board (in-person or virtual whiteboard). A chalk talk is an illustrated performance in which the speaker draws pictures to emphasize lecture points. This presentation format is required in some job interviews.

   The length of the student presentation should be approximately 30 minutes in length, followed by an additional 10-15 minutes of questions from the oral exam committee, for a total of 45-minutes. After the 45-minute exam, the student will be asked to leave the room or be placed in a breakout room if virtual. During the closed session, i.e., the remaining time 10-15 minutes, the oral exam committee should discuss and evaluate the student's performance during the oral exam and complete the comprehensive rubric, to include written feedback of strengths and weaknesses of the presentation (signed by the oral exam committee members). The rubric must be submitted to the AST Program Director by the advisor within 48 business hours of the oral exam. The oral exam results (passed or not) and general feedback should be communicated to the student immediately after the closed session. The feedback on the areas of improvement should become part of the student's Individual Development Plan (IDP),

   While there is not a video of exactly what the AST Qualifying Exam chalk talk format will look like, here are some videos that should be helpful in understanding the expectations:

   a) Examples of using a virtual whiteboard in real-time to present concepts, which for the AST oral exam would be the key concepts in the article provided.
   https://www.youtube.com/watch?v=-HQ4t8JX1TY&list=PL324604EAA66EA2F2
   https://www.youtube.com/watch?v=o3Hq4gXuKB0
   https://www.youtube.com/watch?v=uJXOCpDhuSQ&list=PL4xAk5aclnUgrmghoS2NWI_ZktPSZKFwa
   https://www.youtube.com/watch?v=ZDdnOz49Bec&list=PL4xAk5aclnUgrmghoS2NWI_ZktPSZKFwa

   b) Example of a ~45 minute chalk talk for a faculty job interview. While the content in this video is different in being a broad research program rather than the narrower content of a single journal article, the video presents an example of the types of student-faculty interactions desired for the AST Oral Exam. https://www.youtube.com/watch?v=ttwqJ6EUZ9U

Overall Assessment: All assessment of the student performance should be a single consensus of the oral exam committee, not individual faculty evaluations. The assessment of the overall performance of the candidate should be based on the below criteria. The advisor should complete the consensus rubric and submit it to the AST Program Director within 48 business hours of the oral exam. Use the rubric (at the end of this document) and enter the overall scores in the space indicated below. Provide written feedback by completing the highlighted sections below.

Overall score out of 100% =

Note: Below 80% is failing for the overall Qualifying Exam, but a student may get below 80% on the oral exam and pass the exam if the average of all parts of the exam is at least 80%. Note that students who fail the exam the first time they take it may take the exam again the next semester. Students who fail the exam twice are then out of the program.

Summary Statement of Strengths (the more specific the better):

Summary Statement of Weaknesses (the more specific the better):

Additional Comments and Suggestions that can become part of the student's Individual Development Plan (the more specific the better): Additional courses student should take, topics to study further, skills to develop further and activities that might help with the development, etc.

Names and Signatures of the Oral Exam Committee Members:

CRITERIA	4 – Excellent (90-100%)	3 – Good (80-89%)	2 – Fair (70-79%)	1 – Poor (Below 70%)
Representation: *Ability to convert relevant information into various analytical forms (e.g., equations, graphs, diagrams, tables, flow charts, words)*	Skillfully converts relevant information into an insightful analytical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired analytical portrayal.	Completes conversion of information but resulting analytical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting analytical portrayal is inappropriate or inaccurate.
Calculation:	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.
Assumptions: *Ability to make and evaluate important assumptions in estimation, modeling, and data analysis*	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
Transfer:	Makes explicit references to previous learning and applies in an innovative (new and creative) way that knowledge and those skills to demonstrate comprehension and performance in novel situations.	Makes references to previous learning and shows evidence of applying that knowledge and those skills to demonstrate comprehension and performance in novel situations.	Makes references to previous learning and attempts to apply that knowledge and those skills to demonstrate comprehension and performance in novel situations.	Makes vague references to previous learning but does not apply knowledge and skills to demonstrate comprehension and performance in novel situations.
Communication: *Expressing quantitative evidence in support of the argument or purpose of the work in terms of what evidence is used and how it is formatted, presented, and contextualized*	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

Qualifying Exam, Part 2 -- Oral Exam Instructions and Rubric, v2, rev. 08.20.2021

For each of the below 5 criteria that apply, indicate at which level the student performed. Ignore criteria that do not apply to a given student exam. Note that there should be general consistency between the percent ranges selected below and the total grade provided on page 1.

Appendix I: Qualifying Exam Preparation Guide (Effective AY 2022-23) – Part 1 of 3

Part 3 of 3: The Individual Development Plan, IDP (Part 3, 10% of QE Grade) is usually due within three weeks of Part 1.

Despite its open-endedness, it is extremely important for the presenter to think carefully about the content and structure of the chalk talk. Think ahead about what you will write and draw where and the overall appearance of your scrawls; think about what writings need to stay up during the whole talk and what can be erased. Oral exam committee members will interrupt frequently to ask questions during the talk.

IDP Instructions: AST Ph.D. students are required to complete and submit the IDP at the time of their Qualifying Examination (i.e., at end of second semester). Please work with your research advisor to complete this document. It is worth 10% of the qualifying examination. Please be sure to use the attached guidelines as you complete this document. For full credit, it needs to be thoughtful and detailed. While students and advisors can start working on the IDP now, this initial IDP must address any areas of improvement identified in the Part 2 - Oral Exam. Therefore, the IDP must be updated following the oral exam, and prior to submission to the program director.

Applied Science and Technology Ph.D. Program INDIVIDUAL DEVELOPMENT PLAN (IDP) GUIDELINES

Purpose: Creating an Individual Development Plan (IDP) will help you prepare for your future, regardless of your career choice. The IDP is a tool to help you identify your strengths and any gaps in your knowledge, skills and/or experience. The IDP is a 'living document' which you should revisit and update on a regular basis to stay on track for achieving your career goals.

General guidelines for completing and maintaining the IDP: The IDP is tool for communication between the student and their advisor/mentor. Students should create a draft using the AST IDP template and share this document with their faculty advisor ahead of meeting with them to discuss career goals and provide feedback. First year AST Ph.D. students must complete and submit their initial IDP document as part of the Qualifying Exam (QE), typically administered at the conclusion of the second semester (due dates are announced by the AST Program Director each semester) and the final IDP should be submitted to the AST Program director prior to graduation (final semester). The student should update Part 3 of the IDP on a regular basis and also maintain a portfolio of the products and documentation as evidence for each criterion. Changes and modifications to the IDP should be discussed with the advisor/mentor ahead of time. Students and advisors are encouraged to revisit, assess and update the IDP annually, and an ideal time to do this is at the conclusion of the Fall and Spring semesters when the required Graduate Student Evaluations are completed.

Follow the instructions below to complete the required parts of the IDP.

PART 1. SOAR Analysis guidelines and instructions. Complete the SOAR Analysis matrix by responding to the list of questions in each box of the matrix. Be honest with yourself and seek the opinion of your advisor and a trusted colleague to help complete this section. Responses must be a bulleted list, not a paragraph. The SOAR analysis approach will allow you to take inventory of your **strengths**, particularly those that make you unique and more qualified at something than others might be. The **opportunities** box is a way of identifying and reframing any weaknesses or threats that have the potential to derail your success. This is where you might identify and reframe any gaps in your knowledge, skills and/or experience as opportunities to address and mitigate deficiencies. The **aspirations** box is where you communicate what you want to achieve in the future, i.e., your career goal(s) and what actions can inspire you to succeed. **Results** is where you will indicate the measurable milestones toward achieving your goals. Measuring and tracking these will provide a sense of accomplishment and increase momentum towards success.

PART 2. CAREER GOALS guidelines and instructions. List at least three (3) career goals/jobs, in order of preference that you might apply for after earning your Ph.D. Then respond to the prompts that follow. Use the SOAR Analysis matrix from Part 1 to help complete this section. Get input from your advisor and list realistic goals that align with AST Program requirements and expectations, and also those of your advisor/mentor. The last several prompts of this section focus on plans for skills improvement; the opportunities box in the SOAR matric may be helpful here. Honestly reflect on your current skills and abilities and compare them to requirements for the career/job goals you listed in Part 1 (aspirations box) and list of careers at the beginning of Part 2. Ask your mentor and perhaps a trusted colleague for their opinion and set goals that align with what's required for your degree

program. The examples can be deleted after you have entered your response.

Adapted from UNL graduate student IDP Guidelines. v1, 10.07.2021

PART 3. CAREER PROGRESS REVIEW guidelines and instructions. Compete each of tables by entering the requested information. You are encouraged to keep a portfolio of the products (or related documentation) listed here as evidence of your achievements. For an effective IDP, it is essential to track your achievement, development and set new goals. This section should be updated regularly, e.g., after receiving notification of a scholarship or fellowship award, giving a conference presentation, attending a professional development workshop or publishing a manuscript. The examples can be deleted after you have entered your response.

PART 4. PLANS FOR THE NEXT YEAR guidelines and instructions. Complete this section by responding to the prompts. These goals should align with requirements for your program, expectation of your advisor as well as your professional development goals. It is a good idea to create deadlines for starting and completing your goals. Development should be seen as a life-long task as there is always room for improvement. Tracking and setting goals, and meeting with an accountability partner (e.g., your mentor and/or a trusted colleague) on a regular basis will help achievement of your goals more realistic. The examples can be deleted after you have entered your response.

Applied Science and Technology Ph.D. Program
INDIVIDUAL DEVELOPMENT PLAN (IDP)

Student Name:
Term & Year Entered Program:
Date Submitted:

Research Advisor:

Instructions: AST Ph.D. students are required to complete and submit the IDP at the time of their Qualifying Examination (i.e., at end of second semester). Please work with your research advisor to complete this document. It is worth 10% of the qualifying examination. Students are strongly encouraged to revisit and make relevant revisions to this document on an annual basis to ensure that they are staying on track/adjusting to meet the objectives necessary to obtain their career goals. *Use the IDP guidelines document for detailed instructions on how to complete and maintain your IDP.*

PART 1. SOAR. ANALYSIS

Strengths	**Opportunities**
What you do well, including skills, resources, capabilities, assets, previous training and accomplishments. In a bulleted list, answer the following: • What makes you unique? • What qualities do you have that make you marketable? • What do you excel at? • What are your greatest accomplishments?	What you can leverage for success. In a bulleted list, answer the following: • What challenges do you have that can be reframed as opportunities? • What new or existing partnerships can improve my likelihood of success? • What gaps in my academic preparation and research training need to be filled? • What soft skills do I need to develop? • What local or global job market needs align with my strengths?I
Aspirations	**Results**
Express what you want to achieve in the future. Include actions that enhance current strengths, lessen weaknesses and inspire you to succeed. In a bulleted list, answer the following: • What do you want to achieve in the future? • What are you passionate about? • What actions must you take to lessen the impact of your weaknesses? • What actions must you take to enhance and maximize your strengths?	Measurable products and outcomes that demonstrate you have achieved your goals and aspirations. In a bulleted list, answer the following: • What academic products/measures will indicate you are on track to achieve your goals? • What research related products/measures will indicate that you are on track to achieve your goals? • How will you know when you have achieved your goals?

PART 2. CAREER GOALS

Current career goal(s):

1.
2.
3.

List of Long-range Goals (In 5-10 years) – e.g., obtain a chemical engineering faculty position, start own business in the solar energy industry, etc.

List of Short-range Goals (Next 3-4 years) – e.g., publish 4 journal articles, make 5 conference presentations, obtain a prestigious fellowship award from the NSF or DoD, intern with the Department of Energy, etc.

List of Current Network of Mentors/Useful Contacts – e.g., current or previous advisor/mentor, a potential postdoc advisor you met at a professional conference/meeting, alumni of your doctoral program that is working in career similar to your career aspirations, etc.

Plan for Developing Enhanced Network of Mentors/Contacts – e.g., find someone from USDA or NSF to add to my dissertation committee, identify a contact from a potential at a networking meeting or professional conference, etc.

Plan for Improving Written and Verbal Communication Skills – e.g., take a scientific writing course, create drafts of manuscripts and have them evaluated at the university writing center, attend writing workshops, utilize resources that help improve writing skills, join the local chapter of Toastmasters, present regularly in my research group, take a short course on technical writing, etc.

Plan for Improving Research Skills – e.g., participate in a workshop on a new analytical technique, read and summarize a journal article per week, observe others completing a new technique and take notes, etc.

Plan for Improving Analytical and Computer Skills – e.g., learn to type without looking at keyboard; learn how to use EndNote software package, participate in workshops to learn how to use MS Office products or SAS, SPSS, watch video tutorials on how to apply statistical models (e.g., t-test, analysis of variance, correlation analysis, linear regression, etc.)

PART 3. CAREER PROGRESS REVIEW

Honors/Awards - List any Student honors, awards, scholarships, and/or fellowships you have received, include both external and A&T awards

Honors/Awards	*Date (Month/Year or Semester)*

Journal Publications

Authors (Last Name, First Initial)	*Article Title*	*Journal Name*	*Volume (Issue#) or Submitted/Accepted Status*	*Year*

Conference Proceedings Papers (Since first semester of enrollment at A&T)

Authors (Last Name, First Initial)	*Article Title*	*Name of Conference*	*Location (City, State)*	*Date (Mo/Day/Yr - Mo/Day/Yr)*

Conference Presentations

Authors (Last Name, First Initial)	*Presentation Title (oral or poster)*	*Name of Conference*	*Location (City, State)*	*Presentation Date (Month/Day/Year)*

NC A&T Seminar Presentations

Presentation Title	*Hosting Department/Program*	*Presentation Date (Month/Day/Year)*

Attendance at Meetings and Conferences

Name of Conference Attended	*Location (City, State)*	*Date (Mo/Day/Yr - Mo/Day/Yr)*

Internships

Semester, Year	*Company/Organization*	*Location (City, State)*

Patents -

Teaching Activity - Course Lectures or Lab Sections (department, course name, date) -

Oversight of graduate, undergraduate, or high school students (name, academic level, project title) -

Committee or other service activity (indicate if you held an office) -

Other professional activities not identified above -

PART 4. PLANS FOR THE NEXT YEAR (XXXX - _XXXX) (enter academic year, e.g., 2023-2024)
Academic/Program related goals (bulleted list) – e.g., completion of coursework (see Plan of Study), take qualifying exam, complete literature review for dissertation proposal, develop research proposal, preliminary exam, meet with dissertation committee, etc.

Research project goals (bulleted list) – e.g., generate preliminary results for objective 1 of my proposal, learn how to use a critical piece of equipment, submit an abstract or conference paper, etc.

Anticipated publications (with your mentor's guidance, include target journals) -

Anticipated professional conference/meeting or workshop attendance – (with your mentor's guidance, identify one or two)

Funding received or other funding applications planned – (doctoral students are encouraged to seek their own funding by applying for prestigious fellowships offered by NSF, DoD, DoE, etc. Seek your mentor's help to identify funding opportunities and develop a proposal.)

Other training and professional development goals – (these should align with and support areas of improvement.)

Appendix J: AST Student Compass

The Compass is an expectations document between AST students and their advisor that clearly explains the expectations of the student to include requirements for meeting critical milestones for satisfactory academic progress towards degree completion.

North Carolina Agricultural and Technical State University

College of Science and Technology

Graduate Student Compass: An Expectations Document Between Graduate Students and Their Supervising Professors

Graduate/Predoctoral training entails both formal education in advanced scientific knowledge and theory as well as research training under the supervision of one or more investigators who are qualified to fulfillthe responsibilities of a mentor. A positive mentoring relationship between the predoctoral student and the supervising professor is a vital component of the student's preparation for a successful biomedical career.

Individuals who pursue a STEM graduate degree are expected to take responsibility for their own scientific and professional development. Faculty who advise students are expected to fulfill the responsibilities of a mentor, including the provision of scientific training, guidance, instruction in the responsible conduct of research and research ethics, and financial support.

This compass offers a set of guiding principles intended to promote and support the development of apositive mentoring relationship between the graduate/predoctoral student and his/her supervising professor(s).For Ph.D. students, this compass should also include the completed program-specific individualized **Milestone Agreement Form**. As mandated by the University of North Carolina System, the individualized Compass and Milestone Agreement Form should be in an electronic form consistent with Family Educational Rights and Privacy Act (FERPA) and provided by the program for the purpose of informing students about the milestones that they are expected to reach to earn a Ph.D.

Within four (4) weeks of formally selecting a supervising professor, students should have discussed with their mentor each of the topics listed on pages 2 – 4 and submitted the form to the Graduate Program Coordinator. To tailor an individualized compass best suited for each student and mentor, specific commitments by both the student and the mentor, detailed processes, additions and specifications should either be added in the space below each topic or in an addendum as deemed appropriate.

With their signature, both the mentor and the student confirm that all topics listed have been discussed and they are committed to uphold the principles agreed upon in this individualized compass. Once approved by Graduate Program Coordinator/Department Chair, the compass will be placed in the student's file held in the program/departmental office.

It is understood that various aspects of the student's pursuit of their degree can change over time and, therefore, the compass should be reviewed regularly (at least once a year) and modified as needed. The Milestone Agreement Form is to be updated annually.

DEFINING STUDENT AND MENTOR RESPONSIBILITIES AND EXPECTATIONS

Frequency and Methods of Communication between Mentor and Student (How often will studentand mentor meet? How should updates or changes in expectations and issues be communicated?)

Research/Training Related and Professional Development of the Student (What is the student'sproject? Is there a specific person that will oversee training other than the PI and to what degree willthe student assist with other projects in the lab? When are regular laboratory/team meetings held? How should the student prepare for those meetings? What constitutes professional development? Has the student completed the individual development plan, IDP?)

Common Laboratory Responsibilities (Which tasks and duties are shared among all lab members, including the student?)

Notebooks and Data Management (What is the policy of the laboratory related to the storage of data and laboratory notebooks?)

Work Hours/Attendance in the Laboratory (How many hours per week is the student expected towork in the laboratory?

Authorship Policies (What is the policy that constitutes authorship in the lab? How is the order of authors determined in a manuscript or abstract?)

Manuscripts expected for Graduation (Are there specific expectations for the number of manuscripts (published, submitted and/or in preparation), and the student's authorship position (e.g. first) on these manuscripts, required for the student to graduate?)

Intellectual Policy Issues: Disclosure, Data Ownership, Patent Rights and Publishing Research Discoveries (What is the policy for patents that come out of the student's work?)

Selection of a Thesis/Dissertation Topic and Committee (What is the process for determining the subject/topic of the thesis/dissertation and the composition of the thesis committee?)

Preliminary Exam and Thesis/Dissertation Defense Scheduling (What milestones must be met to schedule the preliminary exam? What are the requirements to schedule a dissertation defense?)

Attendance of Professional and Scientific Meetings (Under which conditions can a student travel to a Regional, National, or International scientific meeting? For example, only if the student or student's work is presenting? Who covers the cost and what will be covered?)

Career and Professional Development / Job Search and Placement / Individualized Career Development Plan (What is the career choice of the student and what arrangements can be made to allow the student to participate in courses, workshops, etc. for their particular interests without compromising their research training? For Ph.D. students, this is an ideal space to make connections with the student's Individual Development Plan, IDP)

Time off for Illness or University Holidays and Vacation Policy (What is the laboratory policy for sick days, vacations, holidays, and personal days?)

Conflict Resolution and Student Complaint Policies (refer to Graduate Student Catalogue) (How are conflicts resolved in the laboratory? What is the process for reporting challenges/conflicts with lab personnel?)

Additional Topics (Include any additional information not addressed above)

Milestone Agreement Form

(insert the approved Milestone Agreement for the student's program,
example included for AST Ph.D. program)

Milestones Agreement Form
Applied Science and Technology (AST) Ph.D. Program
College of Science and Technology, North Carolina A&T State University

This form is provided for the purpose of informing students about the academic milestones that they will be expected to reach in order to earn their Ph.D. degree as well as when they are expected to complete these milestones. Students are expected to reach each milestone within the specified timeperiod in order to make satisfactory progress through the program. Students who are not making satisfactory progress may lose funding, be placed on academic probation, or be dismissed from the program.

Academic Advising

Upon entering the AST Ph.D. program, all students will be assigned an advisor based on the procedures outlined in the Thesis, Dissertation and Comprehensive Exam policy. The advisor will be a member of the Graduate Faculty. After the student reaches agreement with a faculty advisor, the Plan of Study form, indicating the advisor, must be completed and submitted.

Academic advising includes the following elements that are designed to ensure that students remain in good academic standing and make satisfactory progress through the program. Advisors are responsible for the following:

- Ensuring that annual *(or more frequent if program desires to make more frequent reviews a requirement)* reviews between student and advisor and/or supervising committee occur. The results of this review will be included in the AST program's annual doctoral progress report.
- Providing suggestions on course selection
- Reviewing the student's degree Plan of Study to determine if the student is making progress consistent with the expectations of the program and reaching milestones according to the timeline provided on this form; working with the advisor, AST program director and studentto determine if modifications are necessary
- Clarifying the timetable for completing any remaining course requirements, examinations,and other requirements
- Providing the student with assistance in understanding the requirements for successful completion of dissertation
- Providing the student with assistance in assembling a dissertation committee
- Providing the student with experiences and information that will optimize the student's career opportunities and success

Requirements for all Students in the AST Ph.D. Program

Milestones	**Expected Time of Achievement** ***(M: Post-MS; B: Post-BS)***
Plan of Study completed and approved	1st or 2nd Semester
Review of student's progress with *advisor / AST Program Director*	Annually *(or every semester, as determined by program)*
Dissertation Committee appointed and approved by Graduate School	2nd Semester
Successful completion of oral and written qualifying exam	End of 2nd semester
Coursework successfully completed	Post-MS: 3-4 semesters Post-BS: 5-6 semesters
Research protocols approval by Office of Research Compliance & Ethics i.e., obtain Research Clearance Letter	M: 3rd – 4th sem. | B: 5th – 6th sem.
Dissertation proposal completed and approved (Prelims)	M: 3rd – 4th sem. | B: 5th – 6th sem.
Student admitted to doctoral candidacy (after passing Prelims)	M: End of 4th sem. | B: End of 6th sem.
Dissertation research conducted	M: semester 4-8 | B: semester 6-10
Dissertation completed*, written dissertation successfully defended, and approved by Dissertation Committee	Final Semester M: semester 7-8 | B: semester 8-10
Student completes and files all paperwork required for graduation	Final Semester M: semester 7-8 | B: semester 8-10
Dissertation accepted by Graduate School	Final Semester M: semester 7-8 | B: semester 8-10
Exit interview completed	Final Semester M: semester 7-8 | B: semester 8-10

**Each doctoral student is expected to publish at least two manuscripts and make at least two conference presentations from their dissertation work in high-impact, peer-reviewed journals and conferences, respectively, in their respective field prior to defending the dissertation.*

Degree Completion Checklist for Students

- Maintain active student status by registering for courses every fall and spring semester
- Complete *Milestones Agreement Form* with your advisor no later than the last class day of the Spring semester, annually, and submit to the AST Program Director
- Complete all required coursework
- Successfully complete required qualifying exam
- Form your dissertation committee in consultation with your advisor/dissertation Chair
- Have your committee approved by the AST program and Graduate College
- Prepare and successfully present your dissertation proposal (i.e., Preliminary Examination)
- Advancement to Candidacy (i.e., pass the Preliminary Examination)
- Enroll in required dissertation hours and complete your dissertation*
- Successfully complete your defense of your dissertation
- Submit required documentation to the Graduate College for degree completion and graduation

I have read this form and have had the opportunity to discuss the information contained in it with my advisor. I understand the academic milestones that I am expected to reach in order to successfully complete the AST Ph.D. program, as well as the expected timeline for completing these milestones.

Student's Signature Date Advisor's Signature Date

We have discussed all the above topics and made the mutually agreed upon additions, specifications and changes.

We acknowledge our joint intention to re-evaluate the compass, the agreed upon milestones and the degree completion date at least once a year throughout the student's period of academic standing.

_____

Student's Name (Printed)

_____

Signature of Student Date

_____

Supervising Professor's Name (Printed)

_____

Signature of Supervising Professor Date

_____

Graduate Program Coordinator/Dept. Chair Name (Printed)

_____

Signature of Program Coordinator/Dept. Chair Date

This compass has been adapted from the UTA/UT System Health Institutions Compact Between GraduateStudents and Their Research Advisors and the AAMC's Compact Between Biomedical Graduate Students and Their Research Advisors (December 2008, 2013).

Appendix K: AST Curriculum Guide

AST Ph.D. Curriculum Guide Effective 2024-2025

Applied Science and Technology, Ph.D.

College of Science and Technology
Program Director: Jenora Waterman **Email:** jdwaterm@ncat.edu **Phone**: 336-285-2329

The mission of the Applied Science & Technology Ph.D. program is to prepare students for high-level science and technology careers in industry, research, and government. Graduates will be able to conceive, develop, and conduct original research that applies physical, mathematical, and technological methods to provide solutions to a broad range of emerging local, national, and global problems related to Atmospheric, Environmental and Energy Science; Applied Physics; Bioscience; Applied Chemistry; Data Science and Analytics; Applied Engineering Technology; Information Technology; Technology Management; Geospatial Sciences; and STEM Education.

Admission Requirements

- B.S. degree in a science, technology, engineering, math (STEM) or related discipline with a GPA≥3.25/4.0 or a M.S. degree in a science, technology, engineering, math (STEM) or related discipline with a GPA≥3.0/4.0 from a college or university recognized by a regional or general accrediting agency
- GRE verbal and quantitative scores, no minimum score requirement

Program Outcomes

- Communication Skills – Students completing the Applied Science & Technology Ph.D. program will exhibit effective oral communication skills in terms of customizing presentations to the audience, displaying information, and delivering the presentations.
- Critical Thinking Skills - Students completing the Applied Science & Technology Ph.D. program will effectively use quantitative and qualitative analytical problem-solving skills in terms of defining hypotheses/research questions, reviewing research literature, developing a research plan, identifying the broader impacts of research, and developing a research timetable.
- Disciplinary Expertise - Students completing the Applied Science & Technology Ph.D. program will demonstrate discipline specific expertise in terms of the scientific method, applying technical knowledge to answer research questions, experimental plans and data analysis, analytical methods, and research ethics.
- Research/Creative Engagement - Students completing the Applied Science & Technology Ph.D. program will demonstrate ability to engage productively in the review and conduct of disciplinary research in terms of making conference presentations and publishing refereed journal publications.

Degree Requirements

Total credit hours: 66 (post B.S.), 42 (post M.S.)

- Core courses (9 credits):
  - AST 830 Foundations of Scientific Research
  - AST 831 Math and Computational Modeling (or other graduate analytical modeling course that builds upon a student's previous background)
  - STAT 727 Multivariate Statistical Analysis, STAT 705 Applied Statistics for Biological & Behavioral Sciences or STAT 708 Linear Models for Data Science (or other graduate statistics course that builds upon a student's previous background)
- AST 992 Doctoral Seminar: 6 credits post B.S., 3 credits post M.S.
- AST 997 Doctoral Dissertation: 21 credits post B.S., 15 credits post M.S.
- Pass qualifying exam, preliminary exam, and dissertation defense
- In consultation with advisor, take 18 credit hours (15 credits post M.S.) of foundation and elective courses to build expertise and research specialization within one of the following concentrations:
  - Applied Chemistry
  - Applied Physics
  - Atmospheric, Environmental and Energy Science
  - Bioscience
  - Data Science and Analytics
  - Information Technology
  - Technology Management
  - STEM Education
  - General – no specified concentration
- In consultation with advisor, take 12 credit hours (post B.S.) of additional courses relevant to research area

Concentration Courses
For each program concentration, students will typically take courses that are included in the following lists with additional courses possible with approval of research adviser and program director:

Applied Chemistry
The Applied Chemistry Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

Applied Chemistry Foundation Courses (6 credit hours) The purpose of the Foundation requirements is to provide a framework for foundational concepts:

CHEM 611 Advanced Inorganic Chemistry
CHEM 827 Organic Structural Spectroscopy

Applied Chemistry Expertise & Research Specialization (12 credit hours; 9 credit hours post M.S.):
Students are required to complete a coherent sequence of graduate courses in Applied Chemistry. The purpose of this requirement is to provide depth of understanding of Chemistry concepts, in particular, concepts that may be the focus of research activities.

CHEM	611	Advanced Inorganic Chemistry
CHEM	621	Intermediate Organic Chemistry
CHEM	624	Qualitative Organic Chemistry
CHEM	631	Electroanalytical Chemistry
CHEM	641	Instrumentation of the Modern Sciences
CHEM	642	Techniques in X-ray Crystallography
CHEM	643	Introduction to Quantum Mechanics
CHEM	651	General Biochemistry
CHEM	652	General Biochemistry Lab
CHEM	673	Introduction to Computational Chemistry
CHEM	674	Computational Methods/Protein Modeling Drug Design
CHEM	716	Selected Topics in Inorganic Chemistry
CHEM	722	Advanced Organic Chemistry
CHEM	732	Advanced Analytical Chemistry
CHEM	743	Chemical Thermodynamics
AST	812	Environmental Chemistry
BMEN	711	Biomaterials and Biocompatibility
ECEN	701	Electronic Ceramics
NANO	701	Simulation Modeling Methods in Nanoscience and Nanoengineering
NANO	702	Fundamentals of Nanoengineering Physical Principles
NANO	703	Fundamentals of Nanoengineering Chemical and Biochemical Principles
NANO	704	Fundamentals of Nanomaterials
NANO	705	Nano Safety
NANO	711	Introduction to Nanoprocessing
NANO	721	Nanobioelectronics
NANO	731	Introduction to Nanomodeling and Applications
NANO	811	Polymeric Materials Engineering
NANO	812	Process Modeling in Composites
NANO	821	Advanced Nanosystems
NANO	851	Computational Nano Modeling Lab
NANO	852	Nanoelectronics Laboratory
NANO	853	Nano-Bio Electronics Lab
NANO	854	Nanomaterials Laboratory
NAN	601	Nanochemistry
CHEM	811	Physical Methods for Inorganic Chemistry
CHEM	812	Inorganic Chemical Kinetics and Mechanisms
CHEM	818	Introduction to Soft Matter
CHEM	823	Integrative Medicinal Chemistry
CHEM	827	Organic Structural Spectroscopy
CHEM	833	Biosensors and Bioanalytical Technologies

CHEM	841	Advanced Mass Spectrometry Instrumentation
CHEM	856	Protein Structure and Function
CHEM	885	Special Topics
NAN	615	Intro Spectroscopy Methods in Nanoscience
NAN	630	Advances in Nano-biosensors
NAN	705	Macromolecular and Supramolecular Chemistry Nanoscience
NAN	730	Nanoscale Reactions
NAN	771	Computational Quantum Nanochemistry

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

Applied Physics
The Applied Physics Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

Applied Physics Foundation Courses (12 credit hours) The purpose of the Foundation requirements is to provide a framework for foundational concepts:

PHYS 600 Classical Mechanics
PHYS 615 Fundamentals of Electromagnetic Theory
PHYS 620 Quantum Mechanics I
PHYS 630 Statistical Mechanics

Applied Physics Expertise & Research Specialization (6 credit hours; 3 credit hours post M.S.):
Students are required to complete a coherent sequence of graduate courses in Applied Physics. The purpose of this requirement is to provide depth of understanding of Physics concepts, in particular, concepts that may be the focus of research activities.

PHYS	600	Classical Mechanics
PHYS	605	Mathematical Methods
PHYS	615	Fundamentals of Electromagnetic Theory
PHYS	620	Quantum Mechanics I
PHYS	630	Statistical Mechanics
PHYS	715	Advanced Electromagnetic Theory
PHYS	720	Quantum Mechanics II
PHYS	730	Optical Properties of Matter
PHYS	737	Physics of Solids
PHYS	738	Nuclear Physics
PHYS	745	Computational Physics
PHYS	746	Methods in Radiation Detection and Measurement
PHYS	843	Experimental Methods
PHYS	850	Quantitative Analysis in Biophysics
PHYS	885	Special Topics
NAN	603	Nanophysics

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

Atmospheric, Environmental and Energy Science
The Atmospheric, Environmental and Energy Science Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

Atmospheric, Environmental and Energy Science Foundation Courses (12 credit hours) The purpose of the Foundation requirements is to provide a framework for foundational concepts:

AST 850 Physical Meteorology
AST 851 Dynamic Meteorology
AST 852 Climatology

AST 854 Advanced Synoptic Weather Analysis

Atmospheric, Environmental and Energy Science Expertise & Research Specialization (6 credit hours; 3 credit hours post M.S.):
Students are required to complete a coherent sequence of graduate courses in Atmospheric, Environmental and Energy Science. The purpose of this requirement is to provide depth of understanding of Atmospheric, Environmental and Energy Science concepts, in particular, concepts that may be the focus of research activities.

AST 812 Environmental Chemistry
AST 813 Sustainable Energy Systems
AST 814 Life Cycle Analysis
AST 821 Environmental Energy Econometrics I
AST 841 Biomaterials Characterization
AST 842 Biomass Thermal Conversion Processes
AST 843 Biomass Biological Conversion Processes
AST 844 Environmental and Policy Studies of Biomass Use
AST 850 Physical Meteorology
AST 851 Dynamic Meteorology
AST 852 Climatology
AST 853 Numerical Weather Prediction
AST 854 Advanced Synoptic Weather Analysis
AST 855 Principles of Air Quality
AST 856 Atmospheric Aerosols
AST 857 Advanced Remote Sensing
AST 858 Tropical Meteorology
AST 859 Advanced Mesoscale Analysis
AST 885 Special Topics
NANO 761 Introduction to Nano Energy
NANO 861 Advanced Nano Energy Systems
CM 704 Special Topics in Renewable Energy Technology
CM 679 Environmental Issues in Construction Management
EPT 687 Electrical Power Generation using Nuclear Technology
EHS 600 Environmental and Occupational Toxicology
EHS 613 Industrial Hygiene Ventilation
EHS 704 Environmental and Occupational Epidemiology
EHS 708 Environmental and Occupational Safety and Health Management
EHS 711 Current Issues in Environmental and Occupational Health
EHS 885 Special Topics

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

Bioscience
The Bioscience Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

Bioscience Foundation Courses (9 credit hours) The purpose of the Foundation requirements is to provide a framework for foundational concepts:
BIOL 730 Evolutionary Medicine
BIOL 749 Recent Advances in Cell biology
BIOL 855 Systems Biology

Bioscience Expertise & Research Specialization (9 credit hours; 6 credit hours post M.S.):
Students are required to complete a coherent sequence of graduate courses in Bioscience. The purpose of this requirement is to provide depth of understanding of Bioscience concepts, in particular, concepts that may be the focus of research activities.

BIOL 615 Principles of Virology
BIOL 630 Molecular Genetics
BIOL 640 Introduction to Bioinformatics and Genomic Research

BIOL	651	Principles and Practice of Immunology
BIOL	700	Environmental Biology
BIOL	703	Experimental Methods Biology
BIOL	704	Cell and Molecular Biology
BIOL	720	Environmental Influences on Human Diseases
BIOL	749	Recent Advances in Cell Biology
BIOL	762	Molecular Pathogenesis of Cancer
AST	843	Biomass Biological Conversion Processes
ANSC	771	Bioinformatics Genome Analysis
ANSC	782	Cellular Pathobiology
BMEN	713	Biotechnology Entrepreneurship
BIOL	830	Advanced Techniques in Integrative Biosciences
BIOL	831	Cellular and Molecular Biology of Disease
BIOL	832	Microbial Pathogenesis
BIOL	833	Recent Advances in Immunology
BIOL	834	General Physiology I
BIOL	835	General Physiology II
BIOL	855	Advances in Systems Biology
BIOL	885	Special Topics
STAT	705	Applied Statistics for Biological and Behavioral Sciences
STAT	824	Biostatistics Health Analytics
NAN	602	Nanobiology
NAN	620	Immunology Nanoscience
NAN	625	Molecular Biology in Nanosciences
NAN	626	Introduction to Stem Cell Biology and Ethics
NAN	745	Nanoimaging
NAN	750	Nanomedicine

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

Data Science and Analytics
The Data Science and Analytics Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

Data Science and Analytics Foundation Courses (12 credit hours) The purpose of the Foundation requirements is to provide a framework for foundational concepts:
STAT 707 Introduction to Data Science
STAT 708 Linear Models for Data Science
STAT 709 Statistical Foundations of Data Analytics
DAAN 704 Predictive Analytics & Machine Learning or MATH 782 Statistical Data Analytics & Visualization

Data Science and Analytics Expertise & Research Specialization (6 credit hours; 3 credit hours post M.S.):
Students are required to complete a coherent sequence of graduate courses in Data Science and Analytics. The purpose of this requirement is to provide depth of understanding of Data Science and Analytics concepts, in particular, concepts that may be the focus of research activities.

STAT 703 Probability Theory & Application
STAT 704 Theory and Methods of Statistics
STAT 705 Applied Statistics for Biological & Behavioral Sciences
STAT 710 Statistical Deep Learning
STAT 711 Statistical Computing and Algorithm Design & Analysis
STAT 712 Bayesian Statistics
STAT 713 Sampling Survey Methods
STAT 716 Design and Analysis of Educational Experiments
STAT 722 Nonparametric Statistics
STAT 723 Categorical Data Analysis
STAT 727 Multivariate Statistical Analysis
STAT 777 Statistical Consulting Practice

STAT 808 Advanced Regression Methods for Data Science
STAT 810 Causal Inference and Learning
STAT 823 Time Series & Business Analytics
STAT 824 Biostatistics & Health Analytics
DAAN 703 Database Management and Visualization
DAAN 705 Data Privacy, Ethics and Security
DAAN 784 MS Practicum in Data Analytics
MATH 603 Introduction to Real Analysis
MATH 607 Theory of Numbers
MATH 612 Advanced Linear Algebra
MATH 631 Linear & Non-Linear Programming
MATH 633 Stochastic Process
MATH 650 Ordinary Differential Equation
MATH 651 Partial Differential Equations
MATH 652 Methods of Applied Mathematics
MATH 665 Principles of Optimizations
MATH 675 Graph Theory
MATH 685 Special Topics in Applied Mathematics
MATH 690 Scientific Programming for Mathematical Scientists
MATH 691 Special Topics in Applied Mathematics
MATH 700 Theory Function of Real Variables I
MATH 701 Theory Function of Real Variables II
MATH 709 Discrete and Combinatoric Mathematics for Data Science
MATH 711 Theory Function of Complex Variables
MATH 712 Numerical Linear Algebra
MATH 717 Special Topics in Algebra
MATH 720 Special Topics in Analysis
MATH 723 Advanced Topics Applied Mathematics
MATH 731 Advanced Numerical Methods
MATH 733 Advanced Probability & Stochastic Processes
MATH 751 Solution Methods for Integral Equations
MATH 752 Calculus of Variations & Control Theory
MATH 761 Interdisciplinary Computational Science Project I
MATH 762 Interdisciplinary Computational Science Project II
MATH 765 Optimization Theory & Applications
MATH 781 Mathematics & Computational Modeling
MATH 782 Statistical Data Analytics and Visualization
MATH 885 Special Topics in Data Science & Analytics
CST 764 Advanced Big Data Analytics
COMP 751 Data Analytics Tools and Techniques
COMP 765 Data Mining
NAN 605 Mathematical Methods

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

Information Technology
The Information Technology Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

Information Technology Foundation Courses (12 credit hours) The purpose of the Foundation requirements is to provide a framework for foundational concepts:
CST 605 Principles of Computer Networking or CST 625 Computer Database Management
CST 700 Project Management for IT Professionals
CST 702 Statistical Methods
CST 750 Computer System Security

Information Technology Expertise & Research Specialization (6 credit hours; 3 credit hours post M.S.):

Students are required to complete a coherent sequence of graduate courses in Information Technology. The purpose of this requirement is to provide depth of understanding of Information Technology concepts, in particular, concepts that may be the focus of research activities.

CST 625 Computer Database Management

CST	700	Project Management for IT Professionals
CST	702	Statistical Methods
CST	714	Reconfigurable Computing
CST	717	Health Informatics System Architecture
CST	725	Wide Area Networks
CST	729	Data Warehousing
CST	731	Knowledge Discovery Systems
CST	732	Text Mining
CST	733	Data Visualizations
CST	735	Telecom Management Issues
CST	745	Network Services for the Enterprise
CST	750	Computer System Security
CST	752	Advanced Computer Forensics
CST	755	Enterprise Management Systems
CST	760	Intermediate Enterprise Systems
CST	764	Advanced Big Data Analytics
CST	765	Advanced Enterprise System Operation
CST	770	Survey of Virtualization Technology
CST	850	Advanced Wireless Communication Systems
CST	855	Advanced Optical Communication Systems
CST	885	Special Topics
COMP	727	Secure Software Engineering
COMP	823	Secure Social Computing
CSE	703	Data Structure Software Principles & Programming
CSE	806	Computational System Theory

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

STEM Education
The STEM Education Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

STEM Education Foundation Courses (6 credit hours; 3 credit hours post M.S.)
The purpose of the Foundation requirements is to provide a bridge into this interdisciplinary field by integrating STEM and education concepts:

AST	801	History and Philosophy of STEM Education
AST	802	Theories of Development and STEM Thinking
AST	803	STEM Education Methods

STEM Expertise (3 credit hours)
Students are required to complete a coherent sequence of graduate courses in a STEM field other than STEM Education. The purpose of this requirement is to provide depth of understanding of STEM concepts, in particular, STEM concepts that may be the focus of STEM Education research activities.

STEM Education Research Specialization (3 credit hours)
The purpose of the Specialization requirement is to develop depth of knowledge in one area of STEM Education.

AST	804	Cognitive Devices in STEM Learning Environments
TECH	719	Technology Education: Design in Construction
TECH	720	Technology Education: Design in Manufacturing
TECH	722	Technology Education: Design in Transportation
TECH	730	Diversity Issues in Education and Industry
TECH	762	Evaluation of Technological Education Programs

TECH 763 Technology Education for Elementary Grades
TECH 765 Evaluation of Training in Industrial Settings
TECH 772 Curriculum Development in Technology Education
LEST 860 Qualitative Research
LEST 862 Quantitative Research
LEST 864 Ethnographic Methods in Social Science Research
LEST 865 Mixed Methods Research
ADED 708 Instructional Methods in Adult Education
ADED 719 Assessment and Evaluation
ADED 722 Diverse Perspectives in Adult Education
ADED 776 Principles of College Teaching
CUIN 724 Problems and Trends in Teaching Science
CUIN 727 Workshop Method of Teaching Math
CUIN 753 Teaching Engineering and Technology in Middle School
CUIN 784 Current Research in Secondary Education
AGED 703 Scientific Methods in Education Research I
AGED 704 Foundations and Philosophy of Agricultural Education
AGED 711 Advanced Teaching & Assessment Methodology
AGED 751 Agricultural Education Across the Curriculum
AGED 752 Special Populations in Agricultural Education

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

Technology Management
The Technology Management Ph.D. concentration course requirements (18 credit hours; 15 credit hours post M.S.) are:

Technology Management Foundations (9 credit hours) The purpose of the Foundation requirements is to provide a framework for foundational concepts:

AET 701 Technology Management Principles
AET 810 Project Management Essentials
AET 820 Managing R&D Processes

Technology Management Expertise & Research Specialization (9 credit hours; 6 credit hours post M.S.):
Students are required to complete a coherent sequence of graduate courses in Technology Management. The purpose of this requirement is to provide depth of understanding of Technology Management concepts, in particular, concepts that may be the focus of research activities.

AET 700 Graduate Seminar
AET 702 Technology Management Strategies
AET 703 Technology Management Analytics
AET 704 Technology Management Research
AET 705 Design of Experiments
AET 710 Manufacturing Materials
AET 715 Tool Technology
AET 716 Glass Processing
AET 720 Industrial Economics
AET 721 Industrial Operational Management
AET 722 Six Sigma Advanced Topics
AET 735 Manufacturing Organization and Management
AET 745 Managing New Product Development
AET 755 Production Management and Control
AET 760 Advanced CNC Machines
AET 770 Managing Total Quality Systems
AET 772 Strategic Concepts in Quality
AET 775 Decision Modeling and Analysis
AET 780 Reliability Testing and Analysis

AET 784 Internship
AET 830 Internet of Things Technology
AET 840 Industrial Fire Protection
AET 885 Special Topics
CM 679 Environmental Issues in Construction Management
CM 708 Construction Cost Estimating and Project Controls
CM 710 Advanced Construction Practices & Organization
CM 715 Productivity & Methods Improvement in Construction
CM 720 Contracts Administration
CM 762 International Construction Management
CM 764 Risk Management in Construction
CM 780 Trends in CM of International Projects
CM 786 Construction Trends & Analysis
LAND 781 Management in Construction
ECEN 885 Advanced Robotic Systems
INEN 833 Supply Chain System Engineering
INEN 861 Nano Micro and Bio Manufacturing

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

General
The general (i.e., no concentration specified) track is for students who are interested in pursuing an area that is not one of our defined PhD concentrations. The curriculum will therefore vary per student and will be designed through the Plan of Study process in collaboration with your primary advisor, graduate coordinator and AST program director.

Qualifying Examination courses:
The Qualifying Examination will be based on first-year courses (equivalent to 18-20 credit hours), including Foundation Courses.

Dissertation Research
A student may not register for dissertation credits before passing the Qualifying Examination.

Qualifying Examination
The Qualifying Examination with both written and oral components is given to assess the student's competence in a broad range of relevant subject areas. Only students with unconditional status and in good academic standing may take the Qualifying Examination. No student is permitted to take the Qualifying Examination more than twice. A student not recommended for re-examination or who fails the exam on a second attempt may be dismissed from the doctoral program.

Preliminary Oral Examination
The Preliminary Oral Examination is conducted by the student's dissertation committee and is a written and oral defense of the student's dissertation proposal. Failure on the examination may result in dismissal from the doctoral program. The student's Dissertation Committee may permit one re-examination. At least one full semester must elapse before the re-examination. Failure on the second attempt will result in dismissal from the doctoral program.

Admission to Candidacy
Student will be admitted to candidacy upon successful completion of the Qualifying Exam and the Preliminary Exam. After admission to candidacy and before Final Oral Examination, a student may be dismissed from the doctoral program if the student's dissertation committee determines that the student is not making satisfactory progress.

Final Oral Examination
The Final Oral Examination is conducted by the student's dissertation committee. This examination is the final dissertation defense presentation that is scheduled after a dissertation is completed. The examination may be held no earlier than one semester (or four months) after admission to candidacy. Failure on the examination may result in dismissal from the doctoral program. The student's Dissertation Committee may permit one re-examination. At least one full semester must elapse before the re-examination. Failure on the second attempt will result in dismissal from the doctoral program.

Submission of Dissertation

Upon passing the Ph.D. Final Oral Examination, the Ph.D. student must have the dissertation approved by each member of the student's Dissertation Committee. The approved dissertation must be submitted to The Graduate College by the deadline given in the academic calendar and must conform to the Graduate College's guidelines for theses and dissertations.

Please refer to the AST Student Handbook for full description of program guidelines, policies, requirements and expectations.

Appendix L: Example Schedule of Courses (First Two Years)

AST PhD -- Example Course Sequence for First 2 Years for Post-MS Students
Courses based on AST Program Curriculum Effective 2024-2025

Program Director: Jenora Waterman, Ph.D. **Email:** jdwaterm@ncat.edu **Phone:** 336-285-2329
Executive Assistant: Connie Mayberry **Email:** clmayberry@ncat.edu **Phone:** 336-285-2334

Year 1 Schedule

Fall		**Spring**	
AST 831 Math and Computational Modeling	3	AST 830 Foundations of Scientific Research	3
STAT 727 Multivariate Statistical Analysis (or STAT 705, 708 or 808)	3	Concentration Elective (Foundation Course)*	3
AST 992 Doctoral Seminar	1	AST 992 Doctoral Seminar	1
Concentration Elective (Foundation Course)*	3	Concentration Elective*	3
		Qualifying Exam (QE, at end of second semester)	0
Total	**10**		**10**

*Concentration electives (including Foundation Courses) should be selected based on discussion with your advisor and Graduate Program Coordinator in your concentration. Failure to take AST Core and Concentration Electives/Foundation Courses in the first year will result in a student not making satisfactory progress. Do not take AST 997 until you have completed your coursework (can overlap in last semester of coursework).

Year 2 Schedule

Fall		**Spring**	
Concentration Elective*	3	AST 997 Doctoral Dissertation*	9
Concentration Elective*	3		
AST 992 Doctoral Seminar	1		
AST 997 Doctoral Dissertation** or Other course if did not pass QE	3		
Total	**10**		**9**

*Concentration electives should be selected based on discussion with your advisor and Graduate Program Coordinator in your concentration
** BS to PhD students should continue taking a full load of course work (i.e., at least 9 credit hours/semester) until they have completed the coursework, then take AST 997 dissertation as recommended by your advisor.

Year 3 to Completion

- **Continue taking AST 997 until you have completed the required 15 credits,** will need 3 more credits of AST 997 (e.g., take one/semester) if you follow the example course sequence above (post-MS).
- **After completing required coursework and dissertation credits, take 1 credit of AST 997/semester until you complete dissertation process.** Keep in mind that your dissertation advisor may require you to complete additional coursework beyond what's listed in your Plan of Study in order for you to strengthen your background and expertise in your chosen concentration and research area.
- Students should follow their advisor and AST Program-approved Plan of Study when registering for courses. All course substitutions must be approved by your advisor and AST Program Director prior to registration.
- **Post-MS credit hour distribution:** MS to PhD students are required to complete 42 credit hours beyond the MS degree (27 credits of coursework (including 3 credits of AST 992) + 15 credits of dissertation).
- **Post-BS credit hour distribution:** BS to PhD students are required to complete 66 credit hours beyond the BS degree (45 credits of coursework (including 6 credits of AST 992) + 21 credits of dissertation).

AST PhD -- Example Course Sequence for First 2 Years for Post-BS Students
Courses based on AST Program Curriculum Effective 2024-2025

Program Director: Jenora Waterman, Ph.D. **Email:** jdwaterm@ncat.edu **Phone:** 336-285-2329
Executive Assistant: Connie Mayberry **Email:** clmayberry@ncat.edu **Phone:** 336-285-2334

Year 1 Schedule

Fall		**Spring**	
AST 831 Math and Computational Modeling	3	AST 830 Foundations of Scientific Research	3
STAT 727 Multivariate Statistical Analysis (or STAT 705, 708 or 808)	3	Concentration Elective (Foundation Course)*	3
AST 992 Doctoral Seminar	1	AST 992 Doctoral Seminar	1
Concentration Elective (Foundation Course)*	3	Concentration Elective (Foundation Course)*	3
		Qualifying Exam (QE, at end of second semester)	0
Total	**10**		**10**

*Concentration electives (including Foundation Courses) should be selected based on discussion with your advisor and Graduate Program Coordinator in your concentration. Failure to take AST Core and Concentration Electives/Foundation Courses in the first year will result in a student not making satisfactory progress. Do not take AST 997 until you have completed your coursework (can overlap in last semester of coursework).

Year 2 Schedule

Fall		**Spring**	
Concentration Elective*	3	Concentration Elective*	3
Concentration Elective*	3	Concentration Elective*	3
AST 992 Doctoral Seminar	1	AST 992 Doctoral Seminar	1
Concentration Elective* (or Other course if did not pass QE)	3	Concentration Elective*	3
Total	**10**		**10**

*Concentration electives should be selected based on discussion with your advisor and Graduate Program Coordinator in your concentration
** BS to PhD students should continue taking a full load of course work (i.e., at least 9 credit hours/semester) until they have completed the coursework, then take AST 997 dissertation as recommended by your advisor.

Year 3 to Completion

- **Continue taking required coursework until you have completed the required 45 credits,** will be 5 more credits (i.e., one 3-credit hour course and 2 credits of AST 992) if you follow course sequence above. **Then take AST 997 Doctoral Dissertation until you have completed the required 21 credits.**
- **After completing required coursework and AST 997 dissertation credits, take 1 credit of AST 997/semester until you complete dissertation process.** Keep in mind that your dissertation advisor may require you to complete additional coursework beyond what's listed in your Plan of Study in order for you to strengthen your background and expertise in your chosen concentration and research area.
- Students should follow their advisor and AST Program-approved Plan of Study when registering for courses. All course substitutions must be approved by your advisor and AST Program Director prior to registration.
- **Post-BS credit hour distribution:** BS to PhD students are required to complete 66 credit hours beyond the BS degree (45 credits of coursework (including 6 credits of AST 992) + 21 credits of dissertation).
- **Post-MS credit hour distribution:** MS to PhD students are required to complete 42 credit hours beyond the MS degree (27 credits of coursework (including 3 credits of AST 992) + 15 credits of dissertation).

Appendix M: Preliminary Examination Rubric

EVALUATION RUBRIC: PRELIMINARY EXAM
Applied Science and Technology (AST) Department (Original: August 31, 2015)

This form must be completed by every voting member of an AST Preliminary Exam Committee and will be shared with the candidate and kept in the candidate's departmental file.

Candidate Name: Date:
Title of Dissertation:

CRITERIA	**Needs Significant Improvement**	**Needs Improvement**	**Acceptable**	**Very Good**	**Excellent**
1. **Problem Definition:** States the research problem clearly, providing motivation for undertaking the research					
2. **Literature and Previous Work:** Demonstrates sound knowledge of literature in the area, and of prior work on the specific research problem					
3. **Impact of Proposed Research:** Demonstrates the potential value of solution to the research problem in advancing knowledge within the area of study					
4. **Solution Plan:** Provides a sound plan for applying state-of-the-field research methods/tools to solving the defined problem and shows a good understanding of how to use methods/tools effectively					
5. **Expected Results:** Provides a sound plan for analyzing and interpreting research results/data					
6. **Quality of Written and Oral Communication:** Communicates research proposal clearly and professionally in both (a) **written** and (b) **oral** form **(a)**					
(b)					
7. **Critical Thinking:** Demonstrates capability for independent research in the area of study, preparedness in core disciplines relevant to research, and ability to complete the proposed research					
8. **Broader Impact:** Demonstrates awareness of broader implications of the proposed research. Broader implications may include social, economic, technical, ethical, business, etc. aspects.					
9. **Timetable:** Research plan timetable is detailed and reasonable					
10. **Journal Articles:** Topics for at least two articles are identified and appropriate					

Overall Assessment: The assessment of the overall performance of the candidate based on items 1–10 above.

	Does NOT PASS Preliminary Exam	**PASSES Preliminary Exam**			
OVERALL, my rating of the PERFORMANCE	*Needs Significant Improvement*	*Needs Improvement*	*Acceptable*	*Very Good*	*Excellent*

Comments: Additional courses student should take? Additional expertise needed on committee? Other concerns about research being successful and leading to publishable results? Etc.?

Name of the Examining Committee Member: _____

Signature of the Examining Committee Member: _____

Appendix N: Dissertation Defense Rubric

EVALUATION RUBRIC: DISSERTATION DEFENSE
Applied Science and Technology (AST) PhD Program (Updated: August 30, 2021)

This form must be completed by every voting member of an AST Dissertation Committee and will be kept in the candidate's departmental file.

Candidate Name:_____ Date: _____
Title of Dissertation: _____

CRITERIA	**Poor (1)**	**Fair (2)**	**Good (3)**	**Very Good (4)**	**Excellent (5)**
1. **Problem Definition:** States the research problem clearly, providing motivation for undertaking the research					
2. **Literature and Previous Work:** Demonstrates sound knowledge of literature in the area, and of prior work on the specific research problem					
3. **Impact of Proposed Research:** Demonstrates the value of solution to the research problem in advancing knowledge within the area of study					
4. **Methodology:** Applied state-of-the-field research methods/tools to solving the defined problem and shows a good understanding of how to use methods/tools effectively					
5. **Results:** Research results/data properly analyzed and interpreted					
6. **Quality of Written and Oral Communication:** Communicates research clearly and professionally in both (a) **written** and (b) **oral** form **(a)**					
(b)					
7. **Critical Thinking:** Demonstrates capability for independent research in the area of study and preparedness in core disciplines relevant to research					
8. **Broader Impact:** Demonstrates awareness of broader implications of the proposed research. Broader implications may include social, economic, technical, ethical, business, etc. aspects.					
9. **Scholarly Outcomes:** Number and quality of refereed publications and conference presentations					

Overall Assessment: The assessment of the overall performance of the candidate based on items 1–10 above.

	Does NOT PASS Dissertation Defense	**PASSES Dissertation Defense**			
OVERALL, my rating of the PERFORMANCE	*Work Not Likely to Result in at Least Two Refereed Publications*	*Fair*	*Good*	*Very Good*	*Excellent*

SLO 1 COMMUNICATION - Rubric item #6:
SLO 2 CRITICAL THINKING - Rubric items #1,5,7:
SLO 3 DISCIPLINARY EXPERTISE - Rubric items #3,8:
SLO 4 RESEARCH/CREATIVITY - Rubric items #2,4,9:

Comments:

Name of the Examining Committee Member: _____

Signature of the Examining Committee Member: _____

Appendix O: AST Student Committee Meeting Report form

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

AST PHD STUDENT COMMITTEE MEETING REPORT

This report should be completed by PhD students who have had their doctoral committee approved by the Graduate College.

As a part of AST 997, AST PhD students are expected to meet with their dissertation committee and submit a Committee Meeting Report. As a requirement, it is mandatory once per semester (fall ***and*** spring, therefore twice annually), *but it may be necessary to meet more often to facilitate satisfactory academic progress.*

The committee meeting will allow the student to share research progress updates, achievements, and challenges. It will also allow the committee to provide thoughtful and reflective feedback encouraging academic growth. It will then be the responsibility of the students to work with their advisor to devise and implement a plan to address committee feedback prior to the next full committee meeting.

It is the PhD student's responsibility to initiate scheduling of these meetings. Failure to have regular committee meetings and submit committee meeting reports to the AST PhD Program Office may result in ineligibility for internal awards or candidacy.

Instructions:

Prior to the meeting:

(1) ***Students*** will complete sections A, B, and C of this form
(2) ***Students*** will write a research abstract (1-page max) overviewing completed work since the last full committee meeting (this document will be used by the committee to evaluate abilities/progress in scientific writing)
(3) ***Students*** will send a copy of the completed form sections (A, B, and C) and their research abstract to their committee 1-week prior to the meeting
(4) ***The committee*** will review the 1-page research abstract and record constructive comments/feedback evaluating the quality of the scientific writing (comments will be submitted to both the student and to the AST PhD Program Office by the student with the final report).

The meeting (45-60 mins max):

(5) ***Students*** will present a 25–30-minute research update along with any accomplishments/progress since the last full committee meeting
(6) ***Students*** are required to bring copies of all past reports to subsequent meetings to demonstrate that committee recommendations have been addressed
(7) ***The committee*** will provide verbal feedback on both the written and oral reports

After the meeting:

(8) ***The committee*** will complete sections D and E, sign the form, and provide a written copy of the writing/oral feedback given to the student within 1-3 business days of the committee meeting for submission to the AST Office
(9) ***Students*** are required to submit this report to the AST Office within two (2) weeks of the committee meeting
(10) ***Students*** should work with their advisor to devise and implement a plan to address committee feedback

New items addressed should be indicated with the date.

Student Name:	**Date of Meeting:**
Student Banner Number (last six digits):	**Purpose of Meeting:**
PhD Year of Study:	**Proposed Month/Year of Next Meeting:**

A. PhD MILESTONES (complete table up to your current year)		
Yearly Milestones	**Due Date (write in your dates)**	**Achieved? If not (and the deadline has passed), indicate why.**
PhD Y1 Submit Plan of Study form	First Semester (within 6 weeks of start)	☐ Yes ☐ No
Submit Dissertation Committee form	Second semester (middle)	☐ Yes ☐ No
Complete Qualifying Exam	Second semester (end)	☐ Yes ☐ No
PhD Y2 Complete Literature Review	First Semester (middle)	☐ Yes ☐ No
Generate Preliminary Results		☐ Yes ☐ No
Submit proposal to advisor and AST Director	Second Semester	☐ Yes ☐ No
PhD Y3 Submit proposal to committee	First Semester (start)	☐ Yes ☐ No
Preliminary Exam/Proposal Defense approval meeting (and submit signed proposal approval form)	First semester (end)	☐ Yes ☐ No
Achieve candidacy (all coursework completed, including outside project but excluding thesis)	Second semester (end)	☐ Yes ☐ No
PhD Y4 Submit draft dissertation to committee chair	First Semester (start)	☐ Yes ☐ No
Journal Articles Published (2)	Final semester	☐ Yes ☐ No
PhD Y4+ Submit dissertation to committee	January, second Monday	☐ Yes ☐ No
Committee approval of dissertation (and submit signed oral defense form)	March, second Friday	☐ Yes ☐ No
The current committee can provide appropriate guidance and expertise to oversee this project: ☐ Yes ☐ No If no, please describe remedial measures to be taken:		

B. OTHER COURSE REQUIREMENTS

B1. Please indicate coursework completed to date and grade received. Please note that it is expected that PhD students complete all course work requirements in the first 2-3 years of their program (post MS and post BS students, respectively).

Foundations of Scientific Research (AST 830) ☐ Yes (Mark received:) ☐ No

Math and Computational Modeling (AST 831) ☐ Yes (Mark received:) ☐ No

Multivariate Statistical Analysis (STAT 727) ☐ Yes (Mark received:) ☐ No

Content course #1 (Topic & course code: _____) Mark received: ☐

Content course #2 (Topic & course code: _____) Mark received: ☐

Any extra course(s) (Topic & course code: _____) Mark received: ☐

B2. Are additional courses recommended by the committee?

☐ Yes ☐ No If yes, please itemize below:

C. OTHER ACCOMPLISHMENTS

Please briefly describe any publications and/or presentations that have occurred since the last meeting.

D. RESEARCH PROGRESS **Expectation:** The student acquires the knowledge and skills necessary to carry out independent research.	Excellent	Very good	Satisfactory	Below average*	Cannot assess – n/a
General knowledge – knowledge and understanding of general principles and fundamentals of the area of research					
Specific knowledge – knowledge and understanding of the specialized topics in the specific area of research					
Technical skills – overall competence in techniques required for the research project (i.e., experimental design, data analysis, laboratory skills)					
Analytical skills – overall competence in analyzing and interpreting the results of an experiment					
Ethical knowledge – knowledge of the ethical issues relevant to the area of research (i.e., human subjects, animal models, etc.)					
Ethical attitudes – commitment to the importance of absolute objectivity and honesty in the conduct and reporting of research					
Recent progress – progress since last committee meeting					
Overall progress – progression towards final degree completion					
*For any category not listed as excellent, please provide reasoning, feedback, and suggested action items for improvement.					
What are the specific goals for the student before the next committee meeting?					

E. LANGUAGE AND PRESENTATION SKILLS **Expectation:** The student can adequately present and defend the thesis work in a formal setting.	Excellent	Very good	Satisfactory	Below average*	Cannot assess – n/a
Presentation of research, and ability to defend and discuss the presentation in an articulate and polished manner					
Writing of report suitable for publication in a peer reviewed journal					
*For any category not listed as excellent, please provide reasoning, feedback, and suggested action items for improvement.					
If the student's written communication skills require remedial attention, indicate the remediation plans:					

Signatures on this form are required. It indicates all members' agreement to the statements therein.

Committee member name (please print clearly)	**Committee member role** (chair, co-chair, committee member)	**Signature**

*Graduate Faculty representative is not required to attend routine meetings. They are required to attend the Preliminary Exam/Proposal Defense and the final Dissertation Defense.

Signature of Student: _____

Students should keep a copy of this form for their records.
It is the student's responsibility to copy this form before submitting it to the AST Program Office.

Please deliver the original signed form to the AST PhD Program Office within 2 weeks of the meeting date (high qualify scanned version permitted in extenuating circumstances). It will be reviewed by the AST Program Director, who may contact the student and committee members to address any issues identified.

FOR AST PROGRAM OFFICE REVIEW:

Name of AST Program Director: _____

Signature of AST Program Director: _____

Date: _____

Recorded in SharePoint & spreadsheet ☐ Date: _____

This report form has been adapted from the University of Toronto Psychology PhD Student Committee Meeting Report (June 2020).