



**COLLEGE OF THE
ENVIRONMENT, FORESTRY AND
NATURAL SCIENCES**

**DEPARTMENT OF
MATHEMATICS AND STATISTICS**

**HANDBOOK FOR
GRADUATE STUDENTS**

2020 - 2021

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DEPARTMENT OF MATHEMATICS AND STATISTICS GRADUATE PROGRAM POLICIES

I. ADMISSION REQUIREMENTS

In addition to completing the application form online at: <http://nau.edu/GradCol/Admissions/Application/> and submitting transcripts of record to the Northern Arizona University Graduate College, applicants also need to submit to the Department of Mathematics and Statistics the following: (1) names and email addresses of three persons able to assess their likelihood of success in a graduate program in mathematics, mathematics education, or statistics, (2) a brief description (course title, texts used, grade) of all mathematics and statistics courses taken at the level of calculus and above, (3) a letter of intent, and (4) curriculum vita (optional).

For regular admission to graduate programs in the Department of Mathematics and Statistics, applicants should have completed a bachelor's degree and the following requirements of the specific graduate degree program:

- For the M.S. program in Mathematics, a candidate must have completed at least 27 semester hours of undergraduate mathematics coursework at the level of calculus and above with a grade of *C* or better, and have at least a 3.0 grade point average in these courses. The 27 hours must include coursework in linear algebra, real analysis (advanced calculus), and abstract algebra.

Please note that the Community College option is only available if there is sufficient interest since courses MAT 596 and 597 cannot be offered unless there is sufficient enrollment.

- For the M.S. program in Statistics, a candidate must have completed at least 23 semester hours of undergraduate mathematics and statistics coursework at the level of calculus and above with a grade of *C* or better, and have at least a 3.0 grade point average in these courses. The 23 hours must include coursework in multivariable calculus, linear algebra, real analysis (advanced calculus), and mathematical statistics.
- For the M.S. program in Mathematics Education, a candidate must have completed at least 23 semester hours of undergraduate mathematics and statistics coursework at the level of calculus and above with a grade of *C* or better and have at least a 3.0 grade point averages in these courses. These 23 credit hours cannot include the teaching methods courses (such as MAT 401, 402) and must include: calculus II, applied statistics, foundations of mathematics and at least 9 hours of upper division coursework (including foundations of mathematics). It is highly recommended that the 23 credit hours include modern geometry, abstract algebra and introduction to analysis since these topics will be expanded upon in MAT 506, MAT 504, and MAT 505, respectively. Candidates must have at least 2 years of mathematics teaching experience or have successfully completed 6 credit hours of undergraduate mathematics teaching methods coursework. Although the majority of courses in this program are delivered online, there are essential face-to-face components embedded in the curriculum. Since certain courses in the program require candidates to implement and reflect on standards-based instructional practices, applicants to the program must be teaching mathematics in the classroom at the time they take these courses.
- For the Teaching Introductory Community College Mathematics Graduate Certificate, a candidate must have completed at last 23 semester hours of undergraduate mathematics and statistics coursework at the level of calculus and above with a grade of *C* or better and have at least a 3.0 grade point averages in these courses. These 23 credit hours cannot include the teaching methods courses (such as MAT 401, 402) and must include: calculus II, applied statistics, foundations of mathematics and at least 9 hours of upper division coursework (including foundations of mathematics).
- For the Certificate in Applied Statistics program, a candidate must have earned a bachelor's degree with a minimum grade point average of 3.0. In addition, the candidate must have successfully completed an undergraduate course in statistics. Letters of recommendation are not required for this program.

Applicants must apply for admission to a specific program (M.S. Mathematics, M.S. Statistics, M.S. Mathematics Education, the Teaching Introductory Community College Mathematics Graduate Certificate or the Certificate in Applied Statistics), and must reapply to be admitted to another program. If the regular admission requirements are not met, an applicant may still be admitted but on a provisional basis, subject to some additional requirements. Regular admission is granted if the provisions are met satisfactorily.

International students whose native language is not English must present a TOEFL (Test of English as a Foreign Language), International English Language Testing System (IELTS) or Duolingo score before being considered for admission. For admission, the department requires minimum scores of 80 (TOEFL), 6.5 (IELTS) or 105 (Duolingo). To be eligible for an assistantship higher scores are required - 89 (TOEFL), 7 (IELTS), 115 (Duolingo). This does not apply to international students whose undergraduate degree was taken in English.

II. FINANCIAL AID

A number of teaching assistantships are offered each year by the Department of Mathematics and Statistics. This number varies from year to year according to budgetary limitations.

Northern Arizona University is committed to providing an excellent education to its undergraduates, and the department strives to have a quality team of graduate teaching assistants (GTAs) working as part of that commitment. The most common graduate teaching assistant appointment is for 20 hours per week (considered half-time). A half-time graduate teaching assistant is required to take 9 hours of coursework applicable towards his/her degree program each semester.

The stipend for a half-time graduate teaching assistant in the Department of Mathematics and Statistics for the 2020-2021 academic year is \$15,000. All graduate teaching assistants at the university whose appointment is at least 10 hours per week receive an out-of-state tuition waiver, and a waiver of resident tuition each semester of their appointment. Graduate assistants who work 20 hours per week also receive a waiver of the student health insurance premium. All graduate assistants are expected to pay other applicable fees. The schedule of tuition and fees for the Fall 2020 semester is available at http://nau.edu/SDAS/Tuition-Fees/Fall_Tuition/

In filling teaching assistant positions, first preference is given to continuing students with the necessary skills and commitment required for good teaching, and who are making satisfactory progress toward their degree. Assistantships for incoming students are usually available, and primary consideration is given to those who are considered the strongest academically; a secondary consideration is teaching experience. The department may also take into account a balance among its various graduate programs.

Subject to available funding and satisfactory progress toward completing the degree plan, a student who is offered an assistantship may expect four semesters of support as a graduate teaching assistant. However this requires satisfactory progress in their program of study – the completion of 9 hours of coursework in his/her program each semester with a grade point average of at least 3.0 – as well as the fulfillment of teaching duties in a professional manner. More details are given in the GTA Handbook.

In situations where a supported student is required to take provisional courses or begins the program mid-year, a semester of study beyond the normally supported four semesters may be required. In such cases, the student will be considered on a competitive basis for an additional semester of support as a graduate teaching assistant.

In addition, the Graduate College offers a limited number of waivers of the nonresident portion of tuition available to nonresidents of Arizona. Graduate program coordinators across the university make annual recommendations for these waivers. The department is permitted to make just a few such recommendations, and waivers are given totally at the discretion of the Graduate Dean. Such recommendations are made with the goal of attracting the very best applicants, especially those with undergraduate degrees obtained elsewhere. Recommendations may also be made in cases of financial need.

Teaching assistantships are generally not offered to incoming international students whose native language is not English, although financial support may be available in the form of hourly wages. To be awarded a GTA position, a student whose native language is not English must demonstrate evidence of effective communication skills in English, through a personal interview and/or a score on the Test of Spoken English (TSE) of at least 50.

The Graduate College may provide further financial support. See <http://nau.edu/Student-Orgs/Graduate-Student-Government/Funding-Opportunities/>

III. ACADEMIC INTEGRITY

All students at Northern Arizona University are expected to adhere to the [Academic Integrity Policy](#). (Policy 100601 in the Academic Catalog.)

Prior to their initial enrollment in classes, each student must complete academic dishonesty training by taking the course *Academic Integrity @NAU for Students* available in their list of courses on Bb Learn. On completion of this training course each student must can take a picture of the certificate they earn and should send this to the Graduate Coordinator at math.grad@nau.edu.

The Department of Mathematics & Statistics applies a zero tolerance interpretation of the Academic Integrity Policy. First offenders should not expect a friendly warning from their instructor.

IV. ADVISERS

Once a student has been admitted to a graduate program in the Department of Mathematics and Statistics, and the student has indicated their intent to enroll in classes the Graduate Operations Committee will formally assign the student an adviser, with this assignment recorded in the student's department file. Any change of adviser must be approved by the Graduate Operations Committee and so recorded. Such a change will occur, in particular, if the student decides on, and is admitted to the Thesis Option whereupon the student's thesis director will become the student's new adviser.

Each graduate student should confer with their adviser at least once a semester ahead of signing up for classes, which is done online through <https://nau.edu/louie/>. As well as fulfilling the normal advising duties (providing course and program information, graduation papers, career advice, etc.), the student's adviser also has a role to play in a number of ways as outlined in the sections below.

V. TRANSFER CREDIT

Graduate students may obtain transfer credit for graduate coursework completed at other colleges and universities. To obtain such credit the Graduate College form "Petition for Transfer Credit" must be filled out (<http://nau.edu/gradcol/policies-and-forms/forms>) signed by the student's adviser and submitted to the Graduate Operations Committee, along with catalog copy and transcripts for the courses in question. The Graduate Operations Committee must approve this petition before it is forwarded to the Graduate College for the final approval. Note that the number of units that may be transferred from other institutions cannot exceed twenty-five percent of the total minimum units of credit required for the Master's Degree or graduate certificate. See the current Academic Catalog for additional details: <https://policy.nau.edu/policy/results.aspx?type=g>

VI. COURSE SUBSTITUTION

It may be necessary for a graduate student to substitute a course for one that is required in his/her program. The student's adviser and the Graduate Operations Committee must approve all such course substitutions in writing. By Graduate College policy no more than two 400-level courses may be applied toward a master's degree program. Department policy on course substitution varies by program and is applied on a case-by-case basis.

VII. RETENTION

Graduate College policy requires that a graduate student (i) maintain a 3.0 grade point average for all graduate courses taken, and for all courses required in their plan; (ii) earn no more than six credits with a grade of C, and (iii) earn no course grades of D or F.

A graduate student with a grade point average below 3.0, or who earns a grade of C or below, is placed on academic probation and must complete an [Academic Improvement Plan \(AIP\)](#). Admission to a program may be denied or revoked for any graduate student who receives unsatisfactory grades. If you have more than 6 units of graduate work with a grade of C or below, you cannot continue in your master's plan, regardless of your grade point average.

A student who is admitted provisionally to a Department of Mathematics and Statistics graduate program will be asked to meet certain requirements before their admission status is changed to regular standing. A provisional student who fails to meet such requirements will not be allowed to continue in their graduate program. In these circumstances, a graduate teaching assistantship would be terminated due to unsatisfactory academic performance.

Students are expected to make continued satisfactory progress toward their degree. Normally, a student who is admitted with regular standing, but whose grade point average falls below a 3.0 because of a single C grade will be allowed to continue in the program under probationary status for one semester. In rare circumstances, this probationary period may be extended for a second semester, but only if there is a reasonable expectation that the student will be able to meet the requirements of the degree. In any case, if a student's grade point average falls below a 3.0 to a greater extent than a single C, the student will normally not be allowed to continue in their graduate program.

Grade point average requirements are also in place for admission to the thesis option, and have a bearing on the awarding of graduate teaching assistantships. A graduate teaching assistant may have their assistantship terminated due to unsatisfactory progress toward their degree.

VIII. COMPREHENSIVE ORAL EXAMINATION (NON-THESIS OPTION)

The Comprehensive Examination Committee shall normally consist of 3 members. The Committee and topics to be covered shall be selected by the student's assigned graduate adviser in the program, and approved by the Graduate Operations Committee. Where possible, the committee membership should be restricted to those faculty members under whom the student has completed or is in the process of completing coursework in their program. The Chair of the Committee shall be the student's assigned graduate adviser or a member designated by the adviser should he/she not be a member of the Committee.

The Comprehensive Examination will take place on the NAU Flagstaff campus and the student being examined must be physically present on campus, and is responsible for any and all costs associated with

his/her travel to Flagstaff for the examination.

To be eligible to take the Comprehensive Examination, a student must:

- a) Have a cumulative grade point average of 3.0 or better for all courses completed in their program;
- b) Have no more than 9 hours of required coursework remaining, and anticipate completing this coursework in the current semester or session; and
- c) Be formally registered in graduate coursework at NAU at the time of the exam.

A student will be tested over three courses, selected with the guidance of the student's adviser and approved by both the adviser and the Graduate Operations Committee. The *Comprehensive Oral Examination Approval* form may be found on the Graduate Forms page at:

<https://nau.edu/CEFNS/NatSci/Math/Student-Resources/Forms/>

By Graduate College policy, this form must be submitted by the graduate student and his/her adviser **AT LEAST 2 MONTHS** before the date the exam is being requested. Early in your study for the exam you should consult each of the members of your committee for guidance in preparing for your exam. You should allow yourself a period of six to eight weeks of intensive study to prepare for the exam. Note: If the oral exam includes courses that are currently in progress, then the exam may not take place until after the 12th week of instruction (after the 4th week of instruction in the summer).

Depending upon the program:

- For the M.S. program in mathematics, the three courses selected must include at least one required course.
- For the M.S. program in statistics, the examination should cover both theoretical and applied coursework.
- For the M.S. program in mathematics education, please see the Final Portfolio & Oral Exam Description document (<http://nau.edu/cefns/natsci/math/student-resources/forms/>)

Each examination typically lasts 2 hours with 30-45 minutes allowed per course. At the end of the exam a discussion of the committee members shall occur, with a vote taken following the discussion. The committee members vote to pass or fail a student based on their performance on the examination as a whole. If a two-thirds majority is not obtained to pass, then the student fails the examination. The student may retake the oral exam on the same set of course work after a period of four weeks have passed. Should the student fail the exam a second time, or fail to retake the examination within a six month period, then their enrollment in the program will be terminated.

The Chair of the Comprehensive Exam Committee will promptly convey the result (pass/fail) of the exam to the Chair of the Graduate Operations Committee and the Department Chair.

IX. THESIS OPTION

The Thesis Option is available only to students pursuing the M.S. in Mathematics. To be eligible for the Thesis Option, the student should have a minimum grade point average of 3.3 at the time of their initial enrollment in MAT 699: Thesis.

A student interested in pursuing the Thesis Option should first seek a department faculty member willing to serve as the students' thesis director who, together with the student, will decide on a research topic. It is

the policy of the Department of Mathematics and Statistics that thesis committees be chaired by faculty in a professorial rank. That is, lecturers are not permitted to direct theses. Once this is done, the student and his/her thesis director must submit a research plan to the Graduate Operations Committee together with the names of the three-member Research Committee (which is to include the thesis director and at least one other faculty member from the Department of Mathematics and Statistics). Before submission to the Graduate Operations Committee, all three members of the Research Committee should approve the research plan. The thesis director will become the student's new adviser and an Adviser Change form will be submitted to the department office.

A student can only enroll for MAT 699 once the Graduate Operations Committee has approved his/her research plan. A student interested in pursuing this option should therefore meet with a faculty member to discuss possible thesis topics in the semester prior to the planned start of the research project, and should submit a research plan to the Graduate Operations Committee for approval at least one week prior to the start of the semester in which the research will begin. At least 6 credit hours of MAT 699 are required to fulfill the requirements of the Thesis Option, and the research is to be carried out over at least two semesters (or one semester and the 10-week summer session). In the event that a student's research diverges substantially from the initial plan, the student must submit a revised research plan to the Graduate Operations Committee for their approval. This should be done no later than the start of the second semester in which the student enrolls for MAT 699. The *Thesis Approval Form* may be found on the department's [Helpful Forms](#) page.

Once the research work is completed, the thesis must be written according to Graduate College regulations as described in the Format Manual. See the Graduate College link for [formatting and procedures requirements](#). In particular, the Graduate College's format editor should give the thesis an initial format check at least a few weeks in advance of the thesis defense.

The Department has resources to assist thesis students to produce their thesis in the correct format using LaTeX; students should ask their thesis adviser for more information.

Before the thesis defense is scheduled, the student must first give copies of his/her thesis to the members of his/her Research Committee. This committee will verify that the objectives of the student's research plan have been met and that the work is of an appropriate standard. Only once it is agreed that the student is ready to defend, and following an initial format check, may the defense be scheduled.

On the completion of the written thesis, the student is required to give a public presentation of their work on the NAU campus. This presentation must occur within the month prior to the formal thesis defense.

The student's Research Committee must all be present at the thesis defense, and are free to ask questions on any material contained in the student's thesis. The defense is closed to all but the student and the Research Committee.

X. GRADUATE STUDENT GRIEVANCE PROCEDURE

The Department of Mathematics and Statistics endeavors to maintain a congenial and responsive atmosphere for its students conducive with the educational purposes of the department and university. From time to time, misunderstandings and disagreements may arise during the course of a student's enrollment. In such cases the department utilizes procedures established by Northern Arizona University for handling student grievances and appeals.

- Students wishing to appeal a grade should follow the university policy at [Grade Appeals](#).
- Students with grievances related to academic issues other than grades should follow the Graduate College Academic Appeals Process: <https://policy.nau.edu/policy/policy.aspx?num=100103>
- Violations of the Safe Working and Learning Environment policy should be reported to the Center for University Access and Inclusion: <http://nau.edu/diversity-nau/>

These grievance procedures are available only for those matters for which the department or university has the ability to provide a remedy to the student.

XI. COLLOQUIUMS & SEMINARS

Attendance of colloquiums and seminars is part of the graduate school experience, and all on-campus graduate students are expected to attend these from time to time. The schedule of talks is available at <http://naumathstat.github.io/seminars/>.

The department has a weekly colloquium every Tuesday at 4:00 pm. These are talks covering a broad range of mathematics, statistics, or mathematics education topics usually given by department faculty and occasionally by visitors. In addition to the colloquium, the department usually runs a few seminars each semester. These weekly seminars go into more depth in a particular area of mathematics or statistics. Recently weekly seminars have been given in Algebra, Combinatorics, Geometry and Topology (ACGT), and in Applied Mathematics.

XII. COMPUTER RESOURCES

The Department of Mathematics and Statistics operates a computer lab in room 222 of the Adel Mathematics Building. The lab is equipped with (36) Dell computers and a laser printer and can be scheduled for class-time use by instructors of department courses. During the Fall and Spring semesters, room 222 has open hours throughout the day and is available for graduate student use. Mathematics and statistics software on the computers is regularly updated.

There are numerous student computer labs across campus with both Macintosh and PC computers. Upon admission, students receive a university e-mail account. Students are expected to regularly check this account for official department and university announcements. For more information about university computing, visit the Information Technology Services (ITS) website <https://in.nau.edu/its/> or call the ITS Service Desk at (928) 523-3335.

XIII. SCHEDULE OF GRADUATE COURSES

Graduate students need to carefully plan their schedule of coursework in consultation with their adviser as not every course is offered every year.

The [Course Rotation Schedule](#) for graduate courses in each Master's program is updated regularly. Note that The Master of Science programs in Mathematics and Statistics are typically four-semester programs (no summer courses are available), while the M.S. Mathematics Education program is year-round.

XIV. DEPARTMENT OF MATHEMATICS AND STATISTICS FACULTY

Chair: Terry Crites, Ph.D. (University of Missouri) Mathematics education

Brian Beaudrie, Ed.D. (Montana State University) Mathematics education

Ellie Blair, M.A. (University of Colorado-Boulder) Undergraduate mathematics

Terence Blows, Ph.D. (University College of Wales, Aberystwyth) Ordinary differential equations

Barbara Boschmans, Ed.D. (Northern Arizona University) Mathematics; Technology education

Brent Burch, Ph.D. (Colorado State University) Statistics; mixed linear models, variance components

Robert Buscaglia, Ph. D. (Arizona State University) Statistics

Ye Chen, Ph. D. (West Virginia University) Mathematical biology and graph theory

Christina C., M.S. (Northern Arizona University) Undergraduate mathematics

Robert Daugherty, M.E., M.S. (Northern Arizona University) Statistics

David Deville, Ph.D. (University of Arkansas) Mathematics and mathematics education

Dana Ernst, Ph.D (University of Colorado-Boulder) Algebraic combinatorics; Inquiry-based learning

Matthew Fahy, M.S. (Northern Arizona University) Undergraduate mathematics

Michael Falk, Ph.D. (University of Wisconsin) Topology, algebra and combinatorics

Nellie Gopaul, M.S. (University of Arizona) Statistics

Shannon Guerrero, Ph.D. (University of California-Davis) Mathematics education

Angie Hodge, Ph.D. (Purdue University) Mathematics education

Jeffrey Hovermill, Ph.D. (University of Colorado-Boulder) Mathematics education

Guenther Huck, Ph.D. (University of Frankfurt) Low dimensional topology and combinatorial group theory

Monika Keindl, M.A., M.S. (Arizona State University) Number theory, statistics

Katie Louchart, M.S. (Northern Arizona University) Undergraduate mathematics

Sudipta Mallik, Ph.D. (University of Wyoming) Algebraic graph theory, combinatorial matrix theory, and numerical linear algebra

Shanna Manny M.Ed. (Northern Arizona University) Undergraduate mathematics

Gina Nabours, M.A.T. (James Madison University) Undergraduate mathematics

John Neuberger, Ph.D. (University of North Texas) Nonlinear differential equations and numerical analysis

Rachel Neville, Ph. D. ((Colorado State University) topological data analysis and dynamics

Amy Rushall, M.M. (University of Tennessee-Knoxville) Undergraduate mathematics

Jeffrey Rushall, M.A. (University of Texas-Austin) Number theory; Undergraduate education

Roy St. Laurent, Ph.D. (University of Minnesota) Statistics; nonlinear regression; diagnostics

Nándor Sieben, Ph.D. (Arizona State University) Operator algebras, game theory and combinatorics

Derek Sonderegger, Ph.D. (Colorado State University-Fort Collins) Statistics; fiducial inference

James Swift, Ph.D. (University of California-Berkeley) Dynamical systems

Jin Wang, Ph.D. (University of Texas-Dallas) Statistics

Sarah Watson, M.S. (University of Arkansas) Undergraduate mathematics

Xiangming Wu Ph.D. (West Virginia University) Undergraduate mathematics education

Bahattin Yildiz, Ph.D. (California Institute of Technology) Coding theory and combinatorics

Yan Ling Zhou, M.S. (Kennesaw State University) Statistics