Graduate Handbook

Department of Mathematical Sciences

2018-2019

Department of Mathematical Sciences

Graduate Program Handbook

Table of Contents

Montana State University
Department of Mathematical Sciences
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The Department of Mathematical Sciences is located in Wilson Hall room 2-214. The office is open from 8:00 AM until 5:00 PM weekdays. Department office personnel are always pleased to assist students with any questions or problems.

Department of Mathematical Sciences

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The purpose of this Handbook is to answer the most frequently asked questions regarding the Department of Mathematical Sciences graduate programs. This Handbook will be updated on a regular basis to reflect policy changes in the University, The Graduate School, and the Department of Mathematical Sciences. The most current version of the Handbook can be found online at http://www.math.montana.edu/graduate/documents/Handbook%2018-19.pdf.

Because changes do occur and may not be reflected in the Handbook, please refer to The Graduate School for the most current policies and procedures. It is the student's responsibility to be up-to-date with departmental requirements for his or her degree program. These requirements may be more specific than those stipulated by The Graduate School. If you have questions about your graduate program any material in the Handbook, please contact department personnel, your graduate advisor, or members of the Graduate Program Committee.

Graduate Program Committee:

- Committee Chair and Mathematics representative: Dr. Lisa Davis
- Mathematics representatives: Dr. Jack Dockery
- Statistics Representative: Dr. John Borkowski
- Mathematics Education representative: Dr. Jennifer Luebeck

M.S. Mathematics Program Guidelines

The Master of Science degree in mathematics at Montana State University is designed to prepare students for further graduate work or for employment in academic, industrial, business, or government forums. The prerequisites for the master's degree program in mathematics consist of the following courses or their equivalent: 4 semesters of Calculus through Differential Equations, Linear Algebra and a proof based course in Advanced Calculus or Real Analysis.

M.S. Mathematics Graduate Committee and Program of Study
A student must form the M.S. graduate committee and program of study by the end of his or her second term in the program. Refer to the sections entitled "Forming a Graduate Committee" and "Programs of Study" on pages 12 - 13 for more details regarding timelines and other stipulations. Along with the graduate committee, the student constructs the Program of Study, and this program must adhere to the requirements for one of the two Plans detailed below.

M.S. Mathematics Non-Thesis Plan

This plan requires both completing the coursework and passing the written comprehensive exam. At least 30 credits of coursework are required. Of these, at least 18 credits must be numbered 500 or higher. Regardless, all of the following core courses must be completed:

M.S. Mathematics Required Courses (12 semester credits):

- M 503 Advanced Linear Algebra (every spring)
- M 504 Abstract Algebra (every spring)
- M 505 Mathematical Analysis (every fall)
- M 511 General Topology (every fall)

Additionally students must fulfill a breadth requirement by completing at least two of the following courses:

- M 441 Numerical Linear Algebra & Optimization (every fall)
- M 450 Applied Math 1 (fall odd numbered years)
- M 454 Dynamical Systems I (fall even numbered years)
- STAT 421 Probability (every fall)

Either or both of these two required courses may be replaced by the corresponding semester of the appropriate 500 level course: M 581 (numerical analysis), M 560 (applied mathematics), M 595 (dynamical systems), or STAT 501 (probability), respectively. Any other exceptions to the course requirements must be approved by the student's graduate committee and adhere to the minimum policy requirements set forth in the Graduate Catalog (Plan B). In order to complete the degree in two years, a student typically takes six credits of coursework for each of two semesters and nine credits of coursework during each of the other two semesters. Requirements for the written comprehensive exam are listed separately below.

M.S. Mathematics Thesis Plan

This plan requires completing the coursework, writing a thesis, and an oral defense of the thesis. At least 30 credits must be completed of which 10 must be thesis credits. Students must also complete both the core and breadth course requirements described in the Non-Thesis Plan. Any exceptions to the course requirements must be approved by the student's graduate committee and adhere to the minimum policy requirements set forth in the Graduate Catalog (Plan A). Thesis and oral defense requirements must be arranged with and approved by the student's graduate committee.

M.S. Mathematics Comprehensive Exam

The M.S. comprehensive exam for mathematics is a written exam administered in two disjoint 3-hour components. One on Analysis (M 505) and one on Advanced Linear Algebra (M503). Each component is graded as Ph.D. pass, M.S. pass, or fail. In order to pass the written comprehensive exam, a student must pass each component at the M.S. pass or Ph.D. pass level within two examination periods. The examinations are given in August and January with specific dates and times for each component determined by the department. Typically, the student takes the exams in August before their third semester of study.

If the student fails one or more components in the first examination period, a failure will be reported to The Graduate School. The student must then pass the remaining required components in a second examination period. If the student has not passed the remaining required components after the second examination period, a second failure of the comprehensive exam will be reported to The Graduate School, and the student will be dismissed from the program.

Minimum Registration to take an Examination

A student must be registered for a minimum of three (3) credits at Montana State University during the term in which an examination is taken. If a student wishes to take the comprehensive exam during the intersession (i.e., the time between terms), a student must receive approval from his/her committee and be registered for a minimum of three (3) credits in the term prior to the intersession or the term immediately following the intersession.

MSMME Program Guidelines

The Master of Science in Mathematics - Mathematics Education Option (MSMME) is designed for teachers of secondary-level mathematics. The goals of MSMME include deepening participants' understanding of school mathematics, increasing their pedagogical content knowledge, and providing opportunities for personal reflection and professional growth.

MSMME Program of Study

The MSMME program incorporates a streamlined curriculum aligned with Common Core and NCTM Standards, specific requirements for coursework targeted at high school mathematics, and opportunities for embedded classroom research and professional reflection. To maintain the depth and quality of their educational experience, MSMME teachers must complete required and elective courses as follows:

Four required content courses reflective of the content encountered in high school mathematics:

M 518 Statistics for Teachers
M 524 Algebra for Teachers
M 525 Analysis for Teachers
M 527 Geometry for Teachers

At least two pedagogy courses reflective of significant components of the teaching profession:

M 520 Standards-Based Mathematics for Teachers
M 521 Learning Theories in Mathematics for Teachers
M 528 Curriculum Design (MS/PhD combined course)
M 529 Assessment Models and Issues (MS/PhD combined course

Programs of study may vary individually based on approved transfer credit, choices of elective courses, and external time constraints. Advisors works with students to develop a Program of Study during the first summer on campus or soon after completing 6 hours of coursework. In order to meet MSMME program requirements teachers can expect to take online courses during the academic year as well as online and on-campus courses during at least one summer. Teachers are expected to be on campus for a 3-week session during your first summer in the program, and most return to campus for at least one more summer session.

MSMME Capstone Requirements

The MSMME program does not require a thesis or written examination. To satisfy capstone requirements, teachers build a program portfolio throughout their course of study and present a summative reflection upon completion of coursework. The presentation of the portfolio, supplemented by a written or oral report and a meeting with a faculty advisor, constitutes the oral comprehensive examination. Most programs of study also include completion of an action research project.

M.S. Statistics Program Guidelines

The Master of Science degree in statistics at Montana State University gives students a solid background in the theory of statistics and hands-on practice in the application of statistics to real problems. Students in this program prepare either for further graduate work or for academic, industrial, business, or government employment. Upon entrance, each student meets with statistics faculty to discuss career objectives and first year coursework. During the second semester in the program each student forms a Graduate Committee and, with that committee, builds an outline of the courses to be taken.

The prerequisites for the master's degree program in statistics consist of the following semester courses or their equivalent: Multivariable Calculus (M 273), Linear Algebra (M 333 or M 441), Probability (STAT 421), and Mathematical Statistics (STAT 422).

Either Plan A (thesis and 20 credits of coursework) or Plan B (31 credits of coursework) can be chosen. In either case, all courses on a graduate program must be numbered 400 or higher, and STAT courses must be numbered 431 or higher. The specific program of study depends on the student's previous training and experience. Regardless of the plan chosen, (i) at least half of the required non-thesis credits must be STAT courses (Plan A only), (ii) at least two-thirds of the required non-thesis credits must be numbered 500 or higher, and (iii) the following 14 semester core course credits are required:

Statistics M.S. Required Courses (14 semester credits)

- STAT 501-502 Intermediate Math Stat - 6 credits (prerequisite: STAT 422)
- STAT 505-506 Linear Stat Models - 6 credits (prerequisites: M 333 or STAT 441, STAT 422, & STAT 411 or STAT 511)
- STAT 510 Statistical Consulting - 1 credit, twice for a total of 2 credits

Additional requirements

1. The M.S. degree requires completion of either a thesis or a writing project.
    - Thesis (Plan A): The Plan A thesis requires at least 10 thesis credits (STAT 590) in addition to the required 20 credits of course work. The student must give an oral defense of his/her thesis.
    - Writing Project (Plan B): The Plan B writing project typically requires 1 or 2 credits of STAT 575. With permission from the student's committee, additional credits of STAT 575 (no more than 4 total) may be earned. The student must give a seminar on the writing project before graduating.
2. For either Plan A or Plan B, the student must pass an M.S. comprehensive examination.

M.S. Statistics Comprehensive Exam

The M.S. comprehensive exam for statistics is given in late August during the week before fall semester classes begin, with specific dates determined by the department. The exam consists of two components: a timed component covering material from the four core classes STAT 501, 502, 505, and 506, and a 72-hour take-home component involving data analysis. The exam is graded as one of the following: Ph.D. pass, M.S. pass, or fail. Examinees will be informed of the results within five working days of taking the exam. A second attempt at passing the M.S. comprehensive exam is allowed if the first attempt did not result in a pass. At the discretion of the student's committee, an oral exam over the M.S. coursework may be required.

Ph.D. Mathematics Program Guidelines

Described below are the Department of Mathematical Sciences requirements for the Ph.D. degree in Mathematics. These departmental requirements supplement those set out by The Graduate School. There are no foreign language requirements or qualifying exam for a Ph.D. in Mathematics.

Course Requirements

- A minimum of 60 credit hours are required, 30 can be from a Master's degree program.
- A minimum of 18 credit hours must be dissertation credits (M 690)
- A maximum of 3 credit hours graded pass/fail are allowed outside of dissertation (M 690) credits.
- The Ph.D. student's Program of Study listing their intended coursework must be approved by all committee members.

Typically, a Ph.D. student takes 18 credits of mathematics in courses numbered 500 or higher to prepare for the comprehensive examination. Students are encouraged to begin some form of doctoral reading or research (either informally or in the form of M 689 credits) with a committee member by the second year of study.

Ph.D. Mathematics Written Comprehensive Exam

The Ph.D. comprehensive examination in Mathematics consists of both a written and an oral component. The candidate must pass the written comprehensive exam before taking the oral comprehensive examination.

The written portion of the Ph.D. examination in mathematics consists of three (3) tests, chosen from the following eight areas listed below. Students entering the Mathematics Ph.D. program from the Mathematics M.S. program who pass both written components of the M.S. Comprehensive Exam at the Ph.D. level need only take two Ph.D. written comprehensive exams from the following list. Students entering the Ph.D. program from another institution may also sit for the written M.S. Comprehensive Exam immediately upon entrance to the Ph.D. program. If the student scores a Ph.D. Pass on both components of the exam in one attempt, then the student may use a Ph.D. Pass on both components to satisfy one of the three written components of the written Ph.D. comprehensive exam.

1) M 547, M 551 Real (Measure Theory) and Complex Analysis
2) M 511-512 Topology
3) M 595-596 Dynamical Systems
4) M 584-585 Functional Analysis
5) M 581-582 Numerical Solution of Partial Differential Equations
6) M 544-545 Partial Differential Equations
7) M 560-561 Applied Mathematics
8) M 547, 586 Probability

The following guidelines apply to the Ph.D. examination:

- All candidates must take and pass the test on Real and Complex Analysis.
- Students should choose their remaining tests in consultation with their advisor. One purpose of this is to ensure sufficient breadth in the choice of tests. The student's choice of tests must be approved by the student's Graduate Committee.
- At most one "nonstandard" component (not from 2-8) may be taken with the approval of the candidate's committee.
- Exams are given every August on dates determined by the department.

- All students must attempt at least one exam in August before the beginning of their second year, and must attempt three exams by August preceding their third year.
- Students have a final opportunity to complete the exams in January of their third year (after completing five semesters of coursework). Failure to pass at this time results in termination in the graduate program at the end of the third academic year.
- A student is permitted to take a maximum of three exams each exam period, and may repeat a failed exam only once, and only at the discretion of the student's supervisory committee.

Ph.D. Mathematics Oral Comprehensive Exam

After passing the Ph.D. written comprehensive exam the candidate must pass an oral comprehensive exam within 1-2 years from the date of passing the written exam, as determined by the supervisory committee. The exam date will be agreed upon by the candidate's committee. Normally the oral comprehensive exam is a thesis topic proposal where the candidate's ability to conduct research on the proposal is assessed. When this is not the case, the candidate will be informed about the nature of the oral comprehensive exam by the supervisory committee. The candidate has at most two attempts to pass the oral comprehensive examination.

Minimum Registration to take an Examination

A student must be registered for a minimum of three (3) credits at Montana State University during the term in which an examination is taken. If a student wishes to take the comprehensive exam during the intersession (i.e., the time between terms), a student must receive approval from his/her committee and be registered for a minimum of three (3) credits in the term prior to the intersession or the term immediately following the intersession.

Ph.D. Mathematics Education Program Guidelines

The Ph.D. in Mathematics with a specialization in mathematics education combines study in mathematics, mathematics education, and quantitative and qualitative research methods in education. The dissertation is a study in mathematics education. Scholarship in mathematics education examines teaching and learning, with roots in the disciplines of mathematics and educational theory and practice. It is grounded in mathematics content through the study of curriculum and mathematical practice and is generally carried out through social science research methods, including both qualitative and quantitative analysis. Mathematics education research at Montana State University adopts an applied approach, and research efforts often focus on the development and ongoing support of K-12 mathematics teachers. Research activities address issues of mathematics content and classroom practice and how these promote learners' mathematical proficiency.

Ph.D. Mathematics Education Comprehensive Exam

The Ph.D. comprehensive examination in Mathematics Education requires completion of three separate written examinations. Each is developed and administered as follows:

1. One comprehensive 4-hour component of the Ph.D. exam in Mathematics. This is administered according to the guidelines for mathematics.
2. One comprehensive exam in Topics in Mathematics Education. This exam is developed and scored by the current (or most recent) instructors of M 528 and M 529.
3. One comprehensive exam in Mathematics Education Research. This exam is collaboratively developed by the current (or most recent) instructor of M 534 and appropriate research methods faculty from the Department of Education.

Exam #2, Topics in Mathematics Education, typically consists of three multi-part questions: one based on M 528, one based on M 529, and one blending topics and issues from the two courses and other readings. These questions are often tailored to an individual student's research interests and strengths. For Exam #3, Mathematics Education Research, students are presented with a framing issue or context in which they must design a research study to answer a question related to mathematics education. They must develop an appropriate research design, describe methods of data collection and analysis, and address issues of validity and reliability.

Exam #1 is administered according to the calendar established by the Math faculty. Exams #2 and #3 each have traditional and alternative formats. Choice of format is determined by the math education faculty.

- Format A: The two 4-hour exams are given on consecutive days during the August testing period in the week prior to the beginning of the fall semester. Students write Exams #2 and #3 in Microsoft Word on a computer designated by the math education faculty and then transfer their work to an external drive provided by a faculty monitor.
- Format B: One or both of Exams #2 and #3 may be administered as a take-home research paper. Guidelines and expectations for the paper will be provided by the student's Graduate Committee, including allowable use of resources and timeframe for completion. The research paper will be due during the week prior to the start of fall semester.

Minimum Registration to take an Examination

A student must be registered for a minimum of three (3) credits at Montana State University during the term in which an examination is taken. If a student wishes to take the comprehensive exam during the intersession (i.e., the time between terms), a student must be registered for a minimum of three (3) credits in the term prior to the intersession or the term immediately following the intersession.

Statistics Ph.D. Program Guidelines

To earn a Ph.D. in Statistics, a student must pass the Ph.D. qualifying exam, pass the Ph.D. comprehensive exam, and write and defend a Ph.D. dissertation.

A Ph.D. student typically takes at least 30 credits of statistics in courses numbered 500 and higher. Credits from graduate courses taken from another department can be included in the Program of Study with the approval of the student's Ph.D. Graduate Committee. Additional course work in statistics and/or mathematics may be necessary, depending on the candidate's chosen area of specialization and background. For example, a Ph.D. student is expected to have completed all courses required for the M.S. degree in statistics and may need to make-up one or more of these courses if deficient.

Each Ph.D. student will participate in the Statistics Consulting Seminar (STAT 510) for a minimum of two semesters. Through this participation, the student will gain important experience in practical problem solving, computational statistics and statistical report writing.

Ph.D. Statistics Qualifying Exam

The Ph.D. qualifying exam in Statistics is identical to the M.S. comprehensive exam except that the exam must be passed at the Ph.D. Level (i.e., Ph.D. pass). A student who earned an M.S. in Statistics from MSU need not take the Ph.D. qualifying exam if the M.S. comprehensive exam was passed at the Ph.D. level. Other students are expected to take the Ph.D. qualifying exam during their first post-master's semester at MSU or as soon as coursework in the M.S. core has been completed. Two post-master's attempts to pass the qualifying exam are allowed.

Ph.D. Statistics Comprehensive Exam

The written part of the Ph.D. comprehensive exam in Statistics is given each August with the specific dates determined by the student's Ph.D. Committee. Once the written comprehensive examination has been passed, the student must pass the oral comprehensive examination. The student has 2 chances to pass each exam. The written part of the Ph.D. comprehensive will consist of several components. These will typically include:

- A general review/summary related to the proposed research area.
- Reading and critiquing at least one journal article related to the proposed research area.
- Performing a data analysis with a written summary. The data analysis will be related to coursework taken by the student.
- A component related to Bayesian statistics and/or other relevant coursework determined by the student's Ph.D. Graduate Committee.

The requirements associated with each component are flexible. That is, the Ph.D. Graduate Committee will determine the exact details of each component with the goal of assessing the student's potential for performing independent research in the proposed research area. The student will be given several days to submit her/his written summaries.

Minimum Registration to take an Examination

A student must be registered for a minimum of three (3) credits at Montana State University during the term in which an examination is taken. If a student wishes to take the comprehensive exam during the intersession (i.e., the time between terms), a student must receive approval from his/her committee and be registered for a minimum of three (3) credits in the term prior to the intersession or the term immediately following the intersession.

Forming a Graduate Committee

Each graduate student must have an advisor (the committee chair) and a Graduate Committee. The committee can approve the Program of Study as long as it satisfies the guidelines established by The Graduate School and the department. The committee will advise the student on selection of coursework and comprehensive exams, guide the student through research, conduct oral examinations, and certify that the student's work meets degree standards. After the Graduate Committee is formed, it is the student's responsibility to seek out his/her advisor to create a Program of Study and to meet at least once a semester to plan coursework and discuss progress toward the degree.

M.S. students must form their committees before the end of the second semester in the M.S. program. The committee is comprised of three (3) faculty members. The committee chair must hold a doctoral degree and be a tenure track (or tenured) professor in the Department of Mathematical Sciences. See The Graduate School policies and procedures for more complete requirements.

Ph.D. students must form their committees before the end of the third semester in the Ph.D. program. The committee is typically comprised of five (5) faculty members. A Graduate Representative may also sit on the committee if the student chooses to include one of which will be appointed by the Graduate School. The committee chair must have a doctoral degree and be a tenure track (or tenured) professor in the Department of Mathematical Sciences. The majority of committee members must be Department of Mathematical Sciences faculty. The first three committee members will read and assess the dissertation. Students are encouraged to discuss their interests with departmental faculty members to find an acceptable fit. Prior to registration for classes each semester, the student must meet with the chair and/or committee to plan coursework and get the PIN number needed for registration. Graduate Committee forms are available online and in the Math office. Please submit completed forms to **Program Coordinator** for processing**.**

No faculty member is required to accept more students than he or she believes can be advised successfully, and the department does not guarantee that a faculty member will be available to serve as an advisor. Each student should plan well in advance to enable him or her to find an acceptable advisor. The Ph.D. Statistics program requires a student to find an advisor to direct

his/her doctoral research within one year of qualifying for the Ph.D. program. See The Graduate School policies and procedures for a complete list of requirements.

Programs of Study

M.S. Program of Study

The M.S. Program of Study and M.S. Graduate Committee forms are filed at the same time, before the end of the student's second semester. The Program of Study is jointly developed by the student and the committee and defines the minimum requirements for the degree. Other requirements as determined by the committee may also be listed. The Program of Study must be approved by the student's Graduate Committee and the Mathematical Sciences Department Head with final approval by The Graduate School. Program of Study forms are available online or in the Math office. Please submit completed forms to **Program Coordinator** for processing**.**

A minimum of 30 credit hours is required by The Graduate School for graduation, although individual degree programs may require more. Only those courses listed on a graduate Program of Study are applicable toward degree credit requirements. A maximum of 9 credits from approved 400-level courses can be included in the Program of Study, (with an exception being 12 credits of approved 400-level credits for Math). A maximum of 9 credits of approved graduate level courses taken at other institutions can also be included in the Program of Study. Coursework more than 6 years old cannot be applied toward the degree.

Any course with a grade lower than C must be repeated. To be in good academic standing students must meet the following Grade Point Average (GPA) standards: A student must maintain a minimum 3.0 semester GPA, a minimum 3.0 GPA in the entire Program of Study and a cumulative 3.0 GPA overall. Any student who has a cumulative GPA or Program of Study GPA less than 3.0 at the end of any semester may be placed on probation or suspended from his/her degree program. Once a course on a graduate degree program has been completed, it cannot be removed. A course can be retaken to improve the grade. The student, however, should not expect the department to provide tuition waivers for a course that is retaken.

Ph.D. Program of Study

The Ph.D. Program of Study and the Ph.D. Graduate Committee forms must be filed at the same time, before the end of the third semester in the program. All students earning a Ph.D. must complete a minimum of 60 credits; they must include a minimum of 18 dissertation (690) credits. No more than 28 can be included on the Program of Study. The Ph.D. programs in Statistics and the Math Education option also require 3 doctoral reading (689) credits. A maximum of 30 credits from a previously earned Master's degree may be applied toward the 60-credit minimum. Each Ph.D. option (Mathematics, Statistics and Mathematics Education) have specific course requirements. Confirm your program with your advisor.

Any course with a grade lower than C must be repeated. To be in good academic standing students must meet the following Grade Point Average (GPA) standards: A student must maintain a minimum 3.0 semester GPA, a minimum 3.0 GPA in the entire Program of Study and a cumulative 3.0 GPA overall. Any student who has a cumulative GPA or Program of Study GPA less than 3.0 at the end of any semester may be placed on probation or suspended from his/her degree program. Once a course on a graduate degree program has been completed, it cannot be removed. A course can be retaken to improve the grade. The student, however, should not expect the department to provide tuition waivers for a course that is retaken.

Course Limitations for Ph.D. Degrees

1. Special Topics**:** Credits allowed toward degree requirements for Special Topics courses may not exceed the number defined by each degree program.
2. Individual Problems (592): No more than six credits of Individual Problems (592) courses may be included on a doctoral Program of Study.
3. Pass/Fail credits**:** A maximum of three credits (excluding dissertation) may be included on a doctoral Program of Study.
4. 400 level courses: a maximum of 9 credits are allowed on a graduate Program of Study.
5. Limit on Age of Courses**:** The age of courses on the Program of Study at the time of graduation for a doctoral degree may not exceed 10 years.
6. Undergraduate Seminars (494), Undergraduate Independent Study (492), Undergraduate Internship (498/476), Undergraduate Research/Instruction (490), Professional Development (588) and Graduate Consultation (589) courses are not allowed on a Program of Study and will not count toward requirements for the degree.
7. Courses taken while in a master's degree program at MSU, but not included on the M.S. Program of Study may be used on a second master's degree or on a doctoral degree Program of Study at a later time. Thus, it is recommended that an M.S. Program of Study include only the minimum number of credits required.

Dissertation Credit Requirements

All Ph.D. candidates are required to register for and complete a minimum of 18 dissertation credits (M 690). Although additional M 690 or STAT 690 credits may be taken to finish a dissertation, a maximum of 28 dissertation credits are applicable toward degree requirements.

Residence Credit Requirements for Ph.D.

1. A minimum of thirty (30) credits applicable to the degree must be taken from MSU.
2. A student must be registered for a minimum of three (3) credits during the semester of a comprehensive examination, a defense of dissertation, and the semester of graduation.

Policy Regarding M 690 and STAT 690 Credits

The Department of Mathematical Sciences policy is that all Ph.D. students taking 690 credits must submit a progress report at the end of each semester to keep their committee informed and to assess whether or not the student is making sufficient progress to justify continued GTA or GRA support. The report should be submitted to the student's committee chair at least two (2) weeks prior to finals week. Each Ph.D. student is responsible for maintaining contact with their committee chair throughout the semester to determine if satisfactory progress is being made.

- Failure to submit a report will result in an automatic F grade for the 690 credits.
- If a report is submitted, a grade of P or F will be determined based on whether or not sufficient progress was made. An N grade also may be assigned to students enrolled in 690 credits. This grade indicates that, though a student has made progress, he or she has not completed the course objectives successfully. The student must re-enroll in the course immediately in order to continue the course work and to complete the course objectives. The N grade does not affect the GPA.

Ph.D. students who have successfully completed the written comprehensive exam and are taking 690 credits are required to present a research seminar through the Math, Math Education, or Stat Group seminar series, or present research at a professional meeting (e.g., conference) deemed acceptable by the student's committee.

Academic Probation and Dismissal

Good Standing

If a student has a cumulative and semester GPA of 3.0 or higher and has met the provisions of admission as stated in The Graduate School admission letter, the student is in good standing.

College Probation

A student will be placed on College Probation if the semester GPA falls below a 3.0, even though the cumulative GPA remains above a 3.0. Students are placed on College Probation to indicate unsatisfactory progress for degree completion.

University Probation

A student may be placed on University Probation for any of the following:

- The student's semester and cumulative GPA or graduate program GPA have fallen below a 3.0.
- The student fails to successfully complete ("B" or better) in a majority of the courses taken in a semester.
- The student did not meet The Graduate School or academic department provisions of admission.

Dismissal (Suspension)

A student may be suspended from a degree program and The Graduate School for any of the following:

- The student's cumulative or program GPA falls below 3.0 after a prior University Probation status
- The student failed to maintain a cumulative or program GPA of 3.0 for two (not necessarily consecutive) semesters.
- The student failed to make satisfactory progress toward their degree program.
- The student did not meet the provisions of admission.

University Withdrawals

All University withdrawals by graduate students must originate in The Graduate School.

Readmission to Graduate Degree Standing

Following suspension, consideration for readmission to degree seeking status within The Graduate School may be requested after the student has completed a minimum of nine (9) semester credits in non-degree status. The student must also achieve at a 3.0 GPA in each 400-level and higher course taken during non-degree status.

Application for Advanced Degree

During the semester of intended graduation, the student must file an Application for Advanced Degree with The Graduate School. Students must also enroll in at least three (3) credits the semester they intend to complete their degree. If a student fails to meet semester deadlines, they must resubmit an Application for Advanced Degree the next semester in which they expect to graduate. The deadline for filing the application is the third Friday of the semester of completion of degree requirements. Forms are available online or in the Math office. Submit completed forms to **Program Coordinator** for processing.

One-Credit Extension

If an Application for Advanced Degree is submitted after the published deadline and the student is currently registered for three credits, the student may submit the application for graduation for the next semester to be eligible for a one-credit registration (instead of the mandatory three-credit registration). To be eligible for the one-credit extension, the student must complete all degree requirements before the first day of the subsequent semester. The student will then be certified to graduate *the following semester*. If more time is needed beyond the first day of the following semester, the student will be required to register for at least three credits to be eligible for graduation that term.

A One Credit Extension allows students additional time past the intended semester of graduation up to the first day of the following semester. Appropriate reasons to utilize the one credit extension are as follows:

- To satisfactory complete of all coursework (including "I" grade make-ups).
- Defense of thesis/dissertation past the published deadline for the intended semester.
- Satisfactory completion of all recommended corrections to the thesis or dissertation and submission of all required copies in final format to The Graduate School past the published deadline for the intended semester.
- Approval of the thesis/dissertation by the graduate Dean.
- Successful completion of all other degree requirements as determined by the department and The Graduate School, including submission of all documentation required for graduation.

To use the One Credit Extension, the student must do the following:

- Withdraw their Application for Advanced Degree for the original semester of graduation on The Graduate School website @ http://www.montana.edu/gradstudies/withdraw_app.html
- Submit a new Application for Advanced Degree for the following semester; and
- Register for 1 credit the following semester. To register for the one credit, you may be able to do this yourself or contact your department staff or chair of your committee to register you for the appropriate credit/course.

The degree will not be conferred until the end of the following semester. If all degree requirements are not met by 5:00 p.m. on the first day of the following semester, the student will be required to register for an additional two (2) credits (to meet the minimum of 3 credits) to complete graduation requirements. Students who intend to take advantage of this option should contact The Graduate School.

Minimum Registration to take an Examination

A student must be registered for a minimum of three (3) credits at Montana State University during the term in which an examination is taken. If a student wishes to take the comprehensive exam during the intersession (i.e., the time between terms), a student must receive approval from his/her committee and be registered for a minimum of three (3) credits in the term prior to the intersession or the term immediately following the intersession.

Dissertation Requirements

After the Ph.D. candidate has passed the comprehensive exam (passed both written and oral components) the student will submit a draft of the dissertation to his/her committee prior to the Final Defense. All committee members must have access to a dissertation draft at least ***four***

weeks prior to the Final Defense. The dissertation should embody the results of extended research by the candidate, be an original contribution to knowledge, and include new material worthy of publication. The dissertation must be submitted as an electronic dissertation, *in final form* to The Graduate School not later than fourteen (14) working days before the end of the term in which graduate work is completed.

Final Defense

Department policies on the Final Defense and all other administrative procedures regarding degree completion are as follows: Each member of the examining committee must be given a minimum of *four weeks before* the student's final examination to read the draft of the dissertation. The dissertation defense will be arranged by the major professor and the graduate student, and is given before the final draft of the dissertation is completed. The dissertation defense is an oral exam only, and the student is responsible for reminding all of the committee members one (1) week in advance of the event. Examinations in which any committee member has had insufficient time to prepare should not take place and may need to be rescheduled. The committee chair should discourage a student from defending if the chair (or the committee) feels the student is not adequately prepared.

Registration during the Semester of the Defense

A student must be registered for a minimum of three (3) credits at MSU during the term in which the defense is held.

Defense of Dissertation Deadlines

If a student wishes to hold their defense during the semester of graduation, the defense must be held and passed at least fourteen (14) working days before the end of the semester of graduation.

The "Open" and "Closed" Defense

A portion of the defense must be open to the public. This is usually a presentation of the student's research followed by a brief period for the audience to ask questions. Following the open portion of the defense, the committee chair will excuse all attendees other than committee members from the room. This begins the closed portion of the defense in which the student's knowledge of the subject matter will be assessed by the committee.

Advertising the Dissertation Defense

The student is responsible for submitting an announcement to the MSU calendar system; http://www.montana.edu/calendar containing the following information:

a) the name of the candidate,
b) title of the doctoral dissertation,
c) time and place of defense, and
d) the place where a copy of the dissertation may be obtained for inspection.

The defense date must be advertised at least one (1) week prior to the actual defense date. Also, the student should provide this information to the **Administrative Assistant** so that the

information can be posted within the department.

Reporting the Defense Results

The Final Defense report must be submitted to The Graduate School no later than one (1) week after the defense is held. Failure to submit the report of the defense may invalidate the examination.

Failed Defense of Dissertation

The candidate is allowed two (2) total attempts to pass the defense. If the student fails the defense, at least two (2) months must elapse before the examination can be repeated. Failure to pass a second defense will result in termination of doctoral work and dismissal from the academic program. Students who are dismissed from the program are ineligible to reapply to the same degree program in the future.

Invalid Defense of Dissertation

An examination held in the absence of the Chair(s) will be considered invalid and must be rescheduled. It is the student's responsibility to ensure that all Committee members are available when scheduling an exam. All committee members approved by The Graduate School *must be present* at the defense of dissertation. Last minute committee changes based on scheduling conflicts must be approved by The Graduate School.

Video Conferencing during Defense of Dissertation

The Graduate School allows for students to video conference with committee members using the following requirements:

- The conference must have two-way video with audio for its duration. Neither the student nor any committee member is allowed to participate in the conference via telephone (audio only).
- Initiating and implementing the conference process is the responsibility of the student and/or the department.
- The student and/or department are responsible for all costs incurred.
- If communication is broken during the examination or defense and cannot be re-established, the examination or defense must be terminated and rescheduled for completion at a later time/date.

Graduate Teaching Assistants (GTAs)

Grade Reporting Policies for GTAs

The Registrar's office requires grades to be posted in the MSU Banner system within 48 hours after a final exam. Weekends are included in these 48 hours. Each course supervisor or Student

Success Coordinator will explain the grading system used for the class you teach. Please be responsible and complete your grading on time. Your tests will be kept in your assigned test box located in the locked test room in the Math office.

Once you have completed final grade calculations you must turn in a copy of your grade sheet to **Program Coordinator.** Students come to the Math office questioning their grades and the office staff need to have a record of student quiz grades, homework and test scores to show them why they earned the grade they earned. Therefore, it is important that you **do this at the same time as you enter the grades in Banner**.

Web grading instructions from the Registrar are online and this is updated by the Registrar's Office each semester, so watch for updates via email. Forms and instructions for incomplete ("I") grades, missing grades or grade changes are in the Math Office. Incomplete grades are not to be assigned without approval of the course supervisor. Please submit completed forms to **Program Coordinator** for processing.

GTA Responsibilities

To be a Graduate Teaching Assistant you must take at least 6 credits each semester and remain in good academic standing. GTAs are required to teach one undergraduate class or assist two TEAL classes per semester. You must also hold three (3) office hours per week as well as work in the Math Learning Center (MLC) one (1) hour per week including finals week. GTAs will also be assigned duties (attend weekly course meetings, Excellence in Teaching Symposiums, seminars, proctor one common hour exam outside of their own assigned each semester, etc...). Everyone who holds a teaching appointment will also fill out an electronic schedule card that will be emailed to you, which you are to complete and then return to **Program Coordinator** in the Math Office as well as post your hours outside your office door.

GTA Evaluation

Each semester your course supervisor or Student Success Coordinator will observe and evaluate your teaching skills. Your students will also complete an evaluation of your performance as an instructor. The student evaluation will be emailed to your students and it is recommended that you put aside class time for students to take out their devices to complete the evaluations. If there are any problems, tell the **Program Coordinator** immediately. These evaluations as well as your academic performance are reviewed each semester and are part of the GTA renewal process.

GTA Offices

Graduate Teaching Assistants will be assigned to a shared office. Assigned offices are associated with teaching a MSU course and a GTA assignment. This space is shared with your fellow graduate students and should be treated as a professional space. Keep your space clean and voices to a minimum. Office environment concerns should first be brought to the attention of your office mates, then your GPC Representative, GPC Chair and/or **Program Coordinator** and finally to the Department Head if needed. For maintenance issues, speak with the **Program Coordinator**. Feel free to bring personal items from home (pictures, lamp, books, etc…) to

make the space your own. Keys may be picked up at the Plew Building once you've received email confirmation. The key works for the exterior doors of Wilson Hall, the assigned office door and the Math Office. The **Administrative Assistant** will also issue a key for each desk, should your desk lock. You are responsible for these keys. When you leave MSU you must turn in your keys as well as clean out your desk and office area and return all borrowed textbooks to **Administrative Assistant**.

GTA Conduct

The Mathematical Sciences Department expects all GTAs to be professional and to treat their undergraduate students with respect and courtesy.

Your course supervisor is there to help you. When questions arise such as cheating/academic dishonesty, grading disputes, class management issues or any other problem, contact your course supervisor or Student Success Coordinator for guidance.

Policies Regarding GTA Support

GTA Tuition Waivers

Tuition is waived for both in-state and out-of-state GTAs. Each year in February and October you will complete an online form listing the courses you plan to take in the coming summer (if any) and fall or spring semesters, preferences for the courses you wish to teach, and the number of tuition credit waivers you are requesting for the preceding semester. If you change the number of waivers, add or drop classes, you **MUST** inform **Program Coordinator,** otherwise you may have to pay for them yourself. Summer teaching assignments are not guaranteed. Priority for summer teaching assignments are assigned to those making adequate progress towards their degree.

Tuition waivers do not cover fees. Fees must be paid by the student by the 15th class day. In order for your stipend and tuition waiver paperwork to be processed by the university you must first register for courses each semester. If you do not register on time you risk losing your waivers and not being paid on time. It is your responsibility to register and to confirm your attendance. Be sure to confirm your appointment by visiting http://www.montana.edu/gradschool/grad_appts.html. If you fail to confirm your appointment, it is possible you will be responsible for your own tuition costs.

GTA Progress and Performance

When a Graduate Teaching Assistantship (GTA) is awarded it is understood that the teaching assistantship will continue to be available given satisfactory academic progress towards the degree as well as satisfactory performance of assistantship duties. Signs of unsatisfactory academic progress for GTAs might include failure to maintain a 3.0 GPA, dropping below 6 credits, withdrawing from a course, lack of progress towards examination milestones or lack of progress towards the final dissertation defense. Signs of unsatisfactory performance of

assistantship duties might include not showing up to teach your class, being chronically late or unprepared, not performing your Math Learning Center duties, receiving unsatisfactory student evaluations, or inappropriate behavior. GTA performance is reviewed at the end of each semester and GTAs will receive an annual review letter.

M.S. Timeline. For students enrolled in an M.S. program, GTA support will not exceed **3** years measured from the date the program is begun.

Ph.D. Timeline. GTA support for Ph.D. Students will continue if the student demonstrates satisfactory performance of assistantship duties and makes satisfactory progress towards completion of the following Ph.D. degree milestones:

1. Pass the Ph.D. Written Comprehensive Exam within **2.5** years of entering the Ph.D. program (**3** years for Math Education students on a non-masters Ph.D. track).

2. Pass the Ph.D. Oral Comprehensive Exam within **1-2** years from the date of passing the Ph.D. Written Comprehensive Exam, as determined by your committee.

The termination of GTA support does not necessarily constitute dismissal from the program. Students who are in good standing with the Department of Mathematical Sciences and The Graduate School may continue in the Graduate Program at their own expense.

Additional Graduate Student Information

Montana Residency

The Department of Mathematical Sciences encourages out-of-state students to establish Montana residency in order to minimize tuition waiver costs incurred by the University. The Registrar's website has all the required forms and instructions to petition to be classified as a resident; it is a full 12-month process. During that time, you may **not** enroll in more than **6** credits per semester. It is your responsibility to read all the requirements and follow guidelines in order to become a Montana resident.

Continuous Enrollment

To maintain graduate status, a student must be enrolled in 3 or more credits each fall and spring semester after completing their program of study or after passing any portion of the comprehensive exam. These may include thesis or dissertation credits.

University Health Insurance

Montana State University requires students that are enrolled in at least six (6) credits to purchase University Health Insurance or purchase their own on the open market. Contact Student Health Services for information about signing up for university insurance or waiving the requirement.

Conferences and Travel

Graduate students who are funded for travel or will be participating in conferences must to see **Business Operations Manager** before leaving to be sure you have completed the necessary forms. There are required forms before travel arrangements have been made and for reimbursement after travel.

Office Procedures

Mailboxes

Graduate students are assigned mailboxes located in the Math Office. Please check your box daily to keep informed on any departmental business or other messages. Your undergraduate students are **NOT** allowed to put materials in your box. Please make other arrangements for collecting tests and assignments. Do not have your students bring papers to the Math Office to be put in your box, but rather request your students use the drop box located on the outside, north wall of the main Math Office.

Bulletin Board and White Board

Notices regarding seminars, special events, employment opportunities and other activities are posted on the bulletin board in the Math office coffee room and on the Graduate Bulletin Board in the hallway by the Hurst Conference Room. Teaching assignments and Math Learning Center schedules are posted on the white board in the coffee room.

Coffee Room

You must clean up after yourself and dispose of your trash. Be thoughtful and courteous as many people use this kitchen area. Both coffee and tea is provided by the department at no cost to you. Do not leave an empty coffee pot; if you use the last of the coffee then make another pot. The refrigerator and microwave are also available for your use. If you make a mess in either of the appliances, clean it up. The refrigerator is cleaned out on a monthly basis. Be sure not to leave your items in the refrigerator for an extended period of time, otherwise they will be disposed of. Dish and all.

Copy Machines and Fax

Graduate students may use the department's copy machine for teaching-related activities only. You will be assigned a code for the copier. The copy machine also scans and emails scanned

documents. A fax machine is also available in the Math office. Please keep the copy room clean and orderly.

Contact Information

The Math Office maintains a list of contact information for all faculty, staff, and students. It is your responsibility to inform **Administrative Assistant** of your most up-to-date address and phone numbers. You will be assigned an email address when you arrive and all departmental email will be sent to that address. DO NOT forward your work email to your personal email address. Check your email on a daily basis and respond accordingly. You will be held responsible for missed emails.

Catalog Course Descriptions

M - Mathematics

M 441. Numerical Linear Algebra & Optimization. 3 Credits. (3 Lec) F
PREREQUISITE: M 221 and M 273Q. Numerical solution of nonlinear equations. Numerical solutions of linear systems and eigenvalue problems. Least squares, data smoothing, and optimization techniques.

M 442. Numerical Solution of Differential Equations. 3 Credits. (3 Lec) S
PREREQUISITE: M 221 and M 274. Senior capstone course. Numerical integration, numerical solutions of initial and boundary value problems in ordinary differential equations. Numerical solutions of partial differential equations.

M 450. Applied Mathematics I. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: M 273Q and M 274. An introduction to modern methods in applied mathematics. Topics include introductions to dimensional analysis and scaling, perturbation and WKB methods, boundary layers, calculus of variations, stability, and bifurcation analysis.

M 451. Applied Mathematics II. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: M 450. This is the second semester of a course that introduces modern methods in applied mathematics. Topics involve methods for linear and nonlinear partial differential equations, including introductions to Green's functions, Fourier analysis, shock waves, conservation laws, maximum and minimum principles, and integral equations.

M 454. Introduction of Dynamical Systems I. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: M 273Q and M 274. Existence and uniqueness of solutions to ordinary differential equations, linearization, phase portraits, stability theory, and the analysis of specific examples.

M 455. Introduction to Dynamical Systems II. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: M 454. Gradient systems, Poincare'-Bendixson theory, Poincare' maps, structural stability and chaotic systems.

M 472. Introduction to Complex Analysis. 3 Credits. (3 Lec)S
PREREQUISITE: M 273Q and M 274. An introduction to the techniques of complex analysis that are frequently used by scientists and engineers. Topics include complex numbers, analytic functions, Taylor and Laurent expansions, Cauchy's theorem, and evaluation of integrals by residues.

M 476. Introduction to Topology. 3 Credits. (3 Lec) F
Alternate Odd Years PREREQUISITES: M 221 and M 242 or consent of instructor. Provides an intuitive and rigorous introduction to this important and broad-ranging discipline of modern mathematics. Students will learn to recognize those properties which are topological, i.e., stable under small perturbation. Course participants will compute and see the utility of various topological invariants which arise in a variety of fields from data science, to particle physics, to advanced mathematics.

M 501. Intermediate Probability & Statistics. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 422 or M 384. Families of probability distributions, distributions of functions of random variables, limiting distributions, order statistics. Cross-listed with STAT 501.

M 502. Intermediate Mathematical Statistics. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 501 or M 501. Estimation, likelihood inference, statistical hypothesis tests, sufficient statistics,

exponential families, Bayesian statistics. Cross-listed with STAT 502.

M 503. Advanced Linear Algebra. 3 Credits. (3 Lec) S
PREREQUISITE: M 333 or consent of instructor. Topics include abstract vector spaces, diagonalization, Schur's Lemma, Jordan canonical form and spectral theory for finite dimensional operators.

M 504. Abstract Algebra. 3 Credits. (3 Lec) S
PREREQUISITE: M 431 or consent of instructor. The theory of groups, rings and fields with particular emphasis on finite groups, polynomial rings and fields of characteristic zero.

M 505. Principles of Mathematical Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: M 384 or consent of instructor. Principles of analysis in Euclidean spaces and metric spaces.

M 508. Mathematics of Machine Learning. 3 Credits. (3 Lec) S
Alternate Even Years PREREQUISITES: M 273 and M 441 Mathematics of Machine Learning" is an introductory graduate level course on mathematical models for pattern recognition and machine learning. The students will become familiar with fundamental concepts such as learning of parametric and non-parametric probability distributions, the curse of dimensionality, correlation analysis and dimensionality reduction, and concepts of decision theory. Advanced machine learning and pattern recognition problems will be covered, including data classification and clustering, regression, kernel methods, artificial neural networks, and Markov-based models such as hidden Markov models and Markov random fields. These methods will be illustrated by practical examples drawn from practical data science problems.

M 509. Stochastic Processes. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: STAT 421. Conditional probability theory, discrete and continuous time markov chains including birth and death processes and long run behavior; Poisson processes; queuing systems; system reliability. Cross-listed with STAT 509.

M 511. General Topology. 3 Credits. (3 Lec) F
PREREQUISITE: M 384 or consent of instructor. Definition of a topology, relative topology, metric topology, quotient topology, and the product topology. Connectedness, local connectedness, components and path components. Compactness and local compactness, countability and separation axioms, the Urysohn Lemma, metrization and compactification.

M 512. Geometry & Algebraic Topology. 3 Credits. (3 Lec) S
PREREQUISITE: M 511 or consent of instructor. Topics in continua theory, topics in dimension theory, covering spaces and the fundamental group, simplicial complexes, topics in homology and cohomology theory.

M 516. Language of Mathematics for Teaching. 3 Credits. (3 Lec) Su On Demand.
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Features of the language of mathematics, including syntax, vocabulary, and structure. Logic, proof and mathematical communication for high school classrooms.

M 517. Advanced Mathematical Modeling for Teaching. 3 Credits. (3 Lec)
Alternates with M 526 PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Focus on the use of modeling to solve real-world problems. Topics include the modeling process, an overview of relevant technology, strategies to engage students in modeling in the secondary classroom, and classroom assessment of modeling activities. Extensive use of mathematics to explore application areas, leading to the construction of original models.

M 518. Statistics For Teachers. 3 Credits. (3 Lec)
Distance format PREREQUISITE: Graduate standing in mathematics or science education, teaching endorsement in mathematics or science, or consent of instructor. Stochastic concepts including probabilistic underpinnings of statistics, measures of central tendency, variability, correlation, distributions, sampling, and simulation. Exploratory data analysis including experiments, surveys, measures of association and inferential statistics. Discussion of methods for teaching statistics in secondary mathematics and science.

M 519. Ratio and Proportion in School Mathematics. 3 Credits. (3 Lec)Su alternate years, to be offered odd years.
PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Develop knowledge of ratio and proportion necessary to teach standards-based school mathematics. Connect ratio, rate, and proportion to elementary, middle, and high school topics. Explore use of manipulative materials and technologies, and discuss related pedagogical issues and national standards.

M 520. Standards-Based Mathematics for Teaching. 3 Credits. (3 Lec) Su, to be offered odd years.
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Study of key content themes and connections in algebra, geometry, probability/data analysis, number, and

measurement with a focus on mathematical practices. Exploring, extending, designing, and teaching standards-based classroom activities for middle/high school students and reflecting on student outcomes.

M 521. Mathematics Learning Theory for Teaching. 3 Credits. (3 Lec) F alternate years, to be offered even years.
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Examine theories of learning as they apply to the mathematics classroom. The course focuses on theories of and research about learning, human development, personality and motivation. The theories and research are used (a) to understand mathematics learning among students of all cultural, linguistic and socioeconomic backgrounds, and (b) to formulate effective teaching and learning strategies.

M 522. Assessment of Mathematics for Teaching. 3 Credits. (3 Lec) S on demand
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Connects assessment theory and models to teachers' practice through classroom observations and hand-on activities. Focus on assessment practices consistent with standards-based mathematics, classroom assessment of student learning, evaluation of mathematics programs and curricula, and standardized testing practices.

M 523. Number Structure for Teachers. 3 Credits. (3 Lec) Su, to be offered even years.
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Develop the relationship and distinction between the mathematics that underlies the structure of number and the learning and teaching of number structure in schools. Explore representation, abstraction, and basic proof in the context of number and operations. Develop foundations of the real number system and examine relevant research about students' understanding of number.

M 524. Linear Algebra for Teachers. 3 Credits. (3 Lec) Su
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Algebraic systems, special matrices, determinants, vector spaces, and linear programming. Includes applications relevant to industry and business and connections to topics in secondary mathematics.

M 525. Analysis for Teachers. 3 Credits. (3 Lec) F
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. A study of calculus concepts and processes from graphical, numerical and algebraic perspectives. Extensive use of activities and projects. Modeling and technology are incorporated throughout the course.

M 526. Discrete Mathematics for Teachers. 3 Credits. (3 Lec) Su
for two consecutive years; alternates with M 517. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. A study of classical topics in discrete mathematics, chosen from combinatorics, probability, graph theory, and other areas relevant to secondary mathematics. Emphasis on problem solving and justification.

M 527. Geometry for Teachers. 3 Credits. (3 Lec) S
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Explorations of special topics in geometry, such as geometry of transformations including Euclidean motions and similarity, projective geometry, geometric topology and geometry of inversion.

M 528. Curriculum Design. 3 Credits. (3 Lec) S alternate years, to be offered even years.
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Focuses on the design, implementation, and evaluation of curricula in mathematics. Includes historical changes and trends in mathematics curriculum and an examination of current research.

M 529. Assessment Models and Issues. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Examines critical K-12 issues including; alignment and interaction of assessment with standards, curriculum, and instruction; role of assessment systems at local, state, and national levels; evaluation of assessment tools and programs; equity considerations in assessment.

M 533. History of Mathematics for Teaching. 3 Credits. (3 Lec) F On Demand.
Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Focus on the history of mathematics as a context for classroom instruction. Includes the changing nature of mathematics, classical problems, proofs and mathematical processes, and the development of teaching units that incorporate the history of mathematics.

M 534. Research in Mathematics Education. 3 Credits. (3 Lec) F, to be offered even years.
PREREQUISITE: Consent of instructor. Examination of quantitative and qualitative research findings and methodology in mathematics education. Review of current trends and literature. Writing for publication and proposals.

M 535. Technology and Mathematics for Teaching. 3 Credits. (3 Lec) Su On Demand.
PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics, or consent of instructor. Calculator, computer and Web-based technologies for K-12 mathematics education. Analysis of the influence of technology on the K-12 mathematics curriculum, instruction, and assessment.

M 540. Introduction to Calculus on Manifolds. 3 Credits. (3 Lec)F
PREREQUISITE: M 503 and M 505 or consent of instructor. An introduction to: manifolds and their atlases, fiber bundles, vector fields, tensor fields and differential forms, the exterior and Lie derivatives, Stokes Theorem, and de'Rham cohomology.

M 544. Partial Differential Equations I. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: M 384 and M 451, or consent of instructor. An extended survey of the origins of a large number of scientific and mathematical partial differential equations and an overview of the theoretical techniques which are available to solve them.

M 545. Partial Differential Equations II. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: M 544 and M 547. Linear partial differential equations and the function spaces and functional analysis which one uses to study them. Topics include: Holder and Sobolev functions, Sobolev and Poincare inequalities, embedding density, semigroup theory for evolution equations.

M 547. Measure Theory. 3 Credits. (3 Lec) F
PREREQUISITE: M 384 or M 505. Lebesgue measure, and the Lebesgue integral of functions of a real variable. General measure and integration theory. Lebesgue-Stieltjes integral and product measures.

M 551. Complex Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: M 505. Analytic functions and conformal maps, contour integrals, Cauchy's theorem, Cauchy's integral formula, the maximum modulus theorem, harmonic functions, Taylor's theorem and Laurent series. Classification of singularities, the residue theorem and evaluation of definite integrals, Rouche's theorem and the argument principle.

M 560. Methods of Applied Mathematics I. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: M 451. Finite dimensional vector spaces, spectral theory, Fredholm theorem of matrices, pseudo-inverses. Integral equations, Fredholm alternative and resolvent kernels, singular integral equations. Differential equations and Green's functions, eigenvalue expansions for differential operators.

M 561. Methods of Applied Mathematics II. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: M 560. Calculus of variations, Hamilton's principle, asymptotic and perturbation methods, transform techniques and scattering theory. Partial differential equations, Green's functions, separation of variables and transform methods.

M 570. Individual Problems. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

M 571. Principles of Action Research in Mathematics Education. 2 Credits. (2 Lec) Su On Demand.
PREREQUISITE: Graduate standing in mathematics education and consent of instructor. Prepares practicing mathematics teachers to study a mathematics education problem within their classroom, school or district with supervision by a faculty member. Course topics include how to interpret educational research and literature; design and implement reliable and valid action research; identify worthwhile problems; and formulate questions that can be addressed through action research.

M 572. Investigating Problems in Mathematics Education. 2 Credits. (2 Lec) F On Demand.
Distance format. PREREQUISITE: M 571, graduate standing in mathematics education and consent of instructor. With guidance from faculty, students research and investigate a problem related to mathematics education and student success in the context of their classroom, school or district.

M 575. Professional Paper and Project. 1-4 Credits. (1-4 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

M 576. Internship. 2-12 Credits. (2-12 Ind; unlimited max) F,S,Su

PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

M 577. Conducting Action Research in Mathematics Education. 3 Credits. (3 Lec) S
Alternate Odd Years. Distance format. PREREQUISITE: Graduate standing in mathematics education, teaching endorsement in mathematics and consent of instructor. With guidance from faculty, students conduct action research addressing a problem in the context of their classroom, school or district that influences student success in mathematics. Students work with a faculty advisor to implement an intervention, collect and analyze data resulting, and summarize results. Findings are presented orally to peers and faculty.

M 580. Special Topics. 4 Credits. (1-4 Lec, 12 max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

M 581. Numerical Solution of Partial Differential Equations I. 3 Credits. (3 Lec) F
PREREQUISITE: M 442. Finite difference and finite element solution techniques for elliptic, parabolic, and hyperbolic partial differential equations, numerical linear algebra.

M 582. Numerical Solution of Partial Differential Equations II. 3 Credits. (3 Lec) S
PREREQUISITE: M 581. A continuation of topics from M 581.

M 584. Functional Analysis I. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: M 547. Banach spaces, fixed point theorems, Hilbert spaces, the Dirichlet principle, generalized Fourier series, and spectral theory.

M 585. Functional Analysis II. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: M 584. The Hahn Banach theorem, variational principles, weak convergence, uniform boundedness theorem, the open mapping theorem and the implicit function theorem.

M 586. Probability Theory. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: M 547. Combinatorial probability and measure theoretic foundations of probability; axioms for probability spaces. Borel-Cantelli Lemmas, weak and strong laws of large numbers, and the central limit problem.

M 587. Lie Groups. 3 Credits. (3 Lec) F
PREREQUISITES: M 504, M 511. Lie groups, Lie algebras, representation theory.

M 588. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max) On Demand
PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one time basis to fulfill professional development needs of in-service educators. A specific focus is given to each course which is appropriately subtitled. May be repeated.

M 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su
PREREQUISITE: Master's standing. This course may be used only by students who have completed all of their course work (and thesis, if on a thesis plan) but who need additional faculty or staff time.

M 590. Master's Thesis. 1-10 Credits. (1-10 Ind; max cr unlimited) F,S,Su
PREREQUISITE: Master's standing.

M 591. Topics in Applied Math I. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing and consent of instructor. Topics may include numerical solution of linear and nonlinear problems, eigenvalue problems, continuation methods, numerical optimization, computational mechanics, spectral methods, bifurcation theory, invariant manifold theory, index theory, nonlinear analysis, reaction-diffusion equations, nonlinear oscillations, asymptotic methods and perturbation methods.

M 592. Topics in Applied Math II. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing and consent of instructor. Topics may include numerical solution of linear and nonlinear problems, eigenvalue problems, continuation methods, numerical optimization, computational mechanics, spectral methods, bifurcation theory, invariant manifold theory, index theory, nonlinear analysis, reaction-diffusion equations, nonlinear oscillations, asymptotic methods and perturbation methods.

M 594. Seminar. 1 Credit. (1 Sem; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

M 595. Dynamical Systems I. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: M 503. Topics in differential equations including existence and uniqueness, continuous dependence on parameters, extendibility, the existence and stability of equilibria and limit cycles and the Poincare-Bendixon theorem.

M 596. Dynamical Systems II. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: M 595. Topics include Hartman's theorem, invariant manifold theory, Smale-Birkhoff theorem, horseshoe chaos, and the Melnikov method. Topics in discrete dynamical systems may also be covered.

M 597. Topics in Math I: Character Varieties and 3-manifolds. 3 Credits. (3 Lec) F
PREREQUISITE: Graduate standing or consent of instructor. Topics include the theory of representations of finitely generated groups into matrix groups and applications of this theory to the study of low-dimensional topology. Our primary tools will be SL(2, C) and PSL(2, C) character varieties. Culler-Shalen theory and its applications will be discussed in depth. We will also cover some of the basics of low-dimensional topology along with classical affine and projective algebraic geometry. Computational techniques in algebraic geometry and commutative algebra will be highlighter to encourage experimentation and exploration.

M 598. Topics in Math II. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing and consent of instructor. Topics selected from: continuum theory, symbolic dynamics, ergodic theory and low dimensional topology.

M 689. Doctoral Reading & Research. 3-5 Credits. (3-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: Doctoral standing. This course may be used by doctoral students who are reading research publications in the field in preparation for doctoral thesis research.

M 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.

STAT - Statistics

STAT 421. Probability Theory. 3 Credits. (3 Lec) F
PREREQUISITE: M 273Q and M 242 Strongly recommended. Fundamentals of probability; discrete and continuous random variables; expected value; variance; joint, marginal, and conditional distributions; conditional expectations; applications; simulation; central limit theorem; order statistics.

STAT 431. Nonparametric Statistics. 3 Credits. (3 Lec)S
To be offered alternate odd years PREREQUISITE: One of the
following: STAT 217Q, STAT 332, STAT 401 or STAT 411/STAT 511. Goodness-of-fit tests, sign tests, randomization and permutation tests, Wilcoxon and Mann-Whitney tests, Kruskal-Wallis and Friedman's tests, Spearman and Kendall's measures of association, bootstrap techniques, and other alternative nonparametric test procedures. Emphasis on methods and interpretations rather than theory.

STAT 436. Introduction to Time Series Analysis. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: STAT 411/STAT 511 or consent of instructor. An introduction to time series analysis considering time series regression, autoregressive, moving average, and ARIMA models, time series model building, estimation, and forecasting, and basic frequency domain methods. Co-convened with STAT 536.

STAT 437. Introduction to Applied Multivariate Analysis. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: STAT 412/STAT 512 or consent of instructor. Classic multivariate methods, including but not limited to principal components analysis, canonical correlation analysis, factor analysis, discrimination and classification methods, cluster analysis, and other topics may depend on instructor.

STAT 439. Introduction to Categorical Data Analysis. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: STAT 412/STAT 512. Contingency table analysis, Poisson regression, logistic regression, log-linear models, multicategory logit models.

STAT 441. Experimental Design. 3 Credits. (3 Lec) S

PREREQUISITE: STAT 411/STAT 511 and M 221 or M 333 or M 441 or consent of instructor. An introduction to the design and analysis of experiments: topics include analysis of variance methods, matrix forms, multiple comparisons, fixed and random effects, factorial designs, balanced complete and incomplete blocking designs, designs with nested effects, and split plot designs. Co-convened with STAT 541.

STAT 446. Sampling. 3 Credits. (3 Lec) F
PREREQUISITE: One of the following: STAT 217Q, STAT 332, or STAT 401. Probability sampling, sources of bias and uncertainty, survey design, methods for the natural sciences, simple random sampling, stratified random sampling, systematic sampling, cluster sampling.

STAT 448. Mixed Effects Models. 3 Credits. (3 Lec) F alternate years
offered in odd years. PREREQUISITE: STAT 411/STAT 511 or consent of instructor. In depth analysis of random, fixed and mixed effects models including use of stat software and interpretation of results. Emphasis on observations correlated in time (repeated measures) and space, and on random coefficients models (growth curves).

STAT 501. Intermediate Probability and Statistics. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 422 or consent of instructor. Families of probability distributions, distributions of functions of random variables, limiting distributions, order statistics. Cross-listed with M 501.

STAT 502. Intermediate Mathematical Statistics. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 501 or M 501. Estimation, likelihood inference, statistical hypothesis tests, sufficient statistics, exponential families, Bayesian statistics. Cross-listed with M 502.

STAT 505. Linear Models. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 412 or STAT 512. Special matrix theory for statistics, multivariate normal distribution, distributions of quadratic forms, estimation and testing for the general linear model, one-way and two-way classification models, contrasts (main effect, simple effect and interaction), multiple comparison techniques.

STAT 506. Advanced Regression Analysis. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 505. Applications of linear models using statistical packages; detecting and dealing with violations of assumptions including nonconstant variance, nonnormality, and collinearity; mixed effects models.

STAT 509. Stochastic Processes. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: STAT 421. Conditional probability theory, discrete and continuous time markov chains including birth and death processes and long run behavior; Poisson processes; queuing systems; system reliability. Cross-listed with M 509.

STAT 510. Statistical Consulting Seminar. 1 Credit. (1 Sem; 6 cr max) F,S
PREREQUISITE: Graduate standing in statistics. Seminar discussions of issues and cases in statistical consulting. Supervised practice in consulting with researchers from various disciplines.

STAT 511. Methods of Data Analysis I. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: Graduate standing, STAT 216Q or STAT 401, and consent of instructor. This course targets non-statistics graduate students. Introduction to statistical inference and design, t-tools, non-parametric alternatives, one-way ANOVA, simple linear regression and multiple linear regression, with an emphasis on statistical thinking, appropriate inference, interpretation of results and writing. Semester project required. Co-convened with STAT 411.

STAT 512. Methods of Data Analysis II. 3 Credits. (2 Lec, 1 Lab) F,S
PREREQUISITE: STAT 411/STAT 511 (co-convened). Continuation of STAT 411/STAT 511 to cover principles of experimental design, multi-factor ANOVA, repeated measures, logistic regression, Poisson log-linear regression, and introductions to multivariate and time series analyses, with an emphasis on statistical thinking, appropriate inference and interpretation, and writing. A semester project is required. Co-convened with STAT 412.

STAT 520. Topics in Applied Statistics. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 422 and consent of instructor. Current topics selected from computational statistics, time series and spatial statistics, decision theory, sampling, linear and mixed models, and multivariate statistics.

STAT 525. Biostatistics. 3 Credits. (3 Lec) F alternate years
to be offered even years PREREQUISITE: STAT 411 or STAT 511. Statistical methodology applicable to vital statistics, life tables and survival curves, clinical trials, epidemiologic investigations, and cause-effect studies. Co-convened with STAT 425.

STAT 528. Statistical Quality Control. 3 Credits. (3 Lec) F alternate years, to be offered odd years.
PREREQUISITE: STAT 421 or an equivalent transfer course in probability theory. Modeling process quality, traditional SQC tools, control charts for variable and attribute data, CUSUM and WMA charts, process capability analysis, reliability statistics, accelerated testing.

STAT 532. Bayesian Data Analysis. 3 Credits. (3 Lec) F
PREREQUISITE: STAT 422 or STAT 502 or M 502 and STAT 506 recommended. Fundamentals of Bayesian inference, methods of Bayesian data analysis, computational methods for posterior simulation, fundamentals of hierarchical modeling.

STAT 534. Spatial Data Analysis. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: STAT 412, STAT 512, and STAT 422, or equivalent, or consent of the instructor. Statistical methods of spatial data analysis, stationary and nonstationary random fields, covariance structures, geostatistical models and analysis, spatial point process models and analysis, spatial lattice models and analysis.

STAT 536. Time Series Analysis. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: STAT 411, STAT 511, or consent of the instructor. An introduction to time series analysis considering time series regression, autoregressive, moving average, and ARIMA models, time series model building, estimation, and forecasting, and basic frequency domain methods. Co-convened with STAT 436.

STAT 537. Multivariate Analysis I. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: STAT 505. Multivariate regression, principal components analysis, exploratory and confirmatory factor analysis, discriminant and classification analysis, cluster analysis, classification and regression trees, basic structural equation modeling, along with bagging and boosting methods.

STAT 538. Multivariate Analysis II. 3 Credits. (3 Lec) F alternate years, to be offered even years.
PREREQUISITE: STAT 537. Special topics in multivariate analysis including general latent variable methods, analysis of covariance structures, common principle components, robust and distribution free multivariate analysis.

STAT 539. Generalized Linear Models. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: STAT 422 and STAT 411/STAT 511. Analysis of categorical data including logistic regression, log-linear models, analysis of deviance, extrabinomial variation, quasi-likelihood.

STAT 541. Experimental Design. 3 Credits. (3 Lec) S
PREREQUISITE: STAT 411/STAT 511 and M 221 or M 333 or M 441. An introduction to the design and analysis of experiments: topics include analysis of variance methods, matrix forms, multiple comparisons, fixed and random effects, factorial designs, balanced complete and incomplete blocking designs, designs with nested effects, and split plot designs. Co-convened with STAT 441.

STAT 550. Advanced Mathematical Statistics. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: STAT 502 or M 502 and either M 384, M 505, or M 547. Sufficiency, completeness, ancillary statistics, invariance, likelihood-based inference, large sample theory, Edgeworth and saddlepoint approximations.

STAT 575. Professional Paper and Project. 1-4 Credits. (1-4 Lec; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing. A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee.

STAT 576. Internship. 2-12 Credits. (2-12 I; max cr unlimited) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

STAT 578. Response Surface Methodology. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: STAT 541 or STAT 505. Diagnostics; fractional-factorial designs; method of steepest ascent; canonical analysis; response optimization; ridge analysis; response surface design including central composite designs, orthogonal designs, rotatable designs, and optimal designs; mixture designs.

STAT 589. Graduate Consultation. 3 Credits. (3 Ind) F,S,Su
PREREQUISITE: Master's standing. This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time.

STAT 590. Master's Thesis. 1-10 Credits. (1-10 Ind; max cr unlimited) F,S,Su
PREREQUISITE: Master's standing.

STAT 591. Special Topics. 1-4 Credits. (1-4 Lec, 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

STAT 592. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

STAT 594. Seminar. 1 Credit. (1 Sem; 6 cr max) F,S,Su
PREREQUISITE: Graduate standing or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

STAT 689. Doc Reading & Research. 3-5 Credits. (3-5 Ind; 15 cr max) F,S,Su
PREREQUISITE: Doctoral standing. This course may be used by doctoral students who are reading research publications in the field in preparation for doctoral thesis research.

STAT 690. Doctoral Thesis. 1-10 Credits. (1-10 Ind; max unlimited) F,S,Su
PREREQUISITE: Doctoral standing.

Resources

Department of Mathematical Sciences: www.math.montana.edu

Graduate School: www.montana.edu/gradschool/

University Health Partners: www.montana.edu/health/

Student Accounts: www.montana.edu/ubs/studentaccounts/

Financial Aid: www.montana.edu/financialaid/

Family Graduate Housing: www.montana.edu/fgh/

Residency Information: www.montana.edu/registrar/Residency.html

Conduct Guideline and Grievance Procedures for Students:
www.montana.edu/policy/student_coduct/