

**DEPARTMENT OF GEOSCIENCES  
GRADUATE HANDBOOK  
approved by the Geosciences Faculty October 2008**

**ADMISSIONS**

We encourage students with majors in geology and complementary disciplines to enter our geoscience graduate program. We do not require incoming students to have completed an exact equivalent of our undergraduate curriculum in geology prior to admission. We do require students to have completed at least one year each of geology, calculus, physics, and chemistry prior to admission. However, at the discretion of the Graduate Admissions Committee, course deficiencies may be satisfied during the student's first year. Such students and those with non-geology undergraduate degrees will meet with their prospective thesis advisor to design a suitable schedule of remedial coursework

Applicants are required to submit a standardized form listing completed coursework (Form A) and a personal statement with a clear discussion of research interests that indicates faculty with whom the student wishes to work.

Our expectations for admission include the following:

1. GPA of 3.0 or higher in geosciences and related sciences,
2. GRE scores in the 70th percentile or higher,
3. Strong letters of recommendation, and
4. Acceptance by a faculty member as a provisional advisee.

The Department recognizes the variance in these measures from different colleges, various curricula, and test taking abilities. Thus, strong performance in some areas may outweigh lesser results in others.

**FINANCIAL AID AND THESIS RESEARCH FUNDING**

Several forms of financial aid are available through the Department. We support some graduate students with teaching assistantships (TAs) made available by the Graduate School. These TAs are generally awarded to incoming students based on merit and, with satisfactory performance, continued for a second year for M.S. students and, occasionally, a third year for Ph.D. students. Research assistantships, off-campus internships, or other awards in lieu of the TA will not change the duration of the initial total award for students (four **consecutive** semesters for M.S. or six **consecutive** semesters for Ph.D.). All remaining semesters of TA support will be forfeited if a student resigns a TA position without first receiving written permission to return to the TA position. Other funding opportunities, including occasional one-semester teaching assistantships, are advertised within the Department. Through their grants and contracts, faculty members may also provide research assistantships or limited research funds. The number of research assistantships varies considerably from year to year; the allocation of research funds is the responsibility of the funded faculty member. Graduate support from external fellowships and scholarships is available from a large number of agencies and organizations.

**GRADUATE PROGRAM**

The requirements for graduate degrees in the UM Department of Geosciences are described below. These are in addition to the basic degree standards for advanced degrees of the University of Montana available on <http://ordway.umt.edu/AA/GRAD/index.cfm/name/indexpolicies>. Both sets of requirements must be satisfied for fulfillment of the degree program.

**Advising**

Interaction between graduate students and advisors is an integral part of graduate education in the

Department of Geosciences. The advisor is responsible for ensuring that the student is aware of and satisfies the requirements for the graduate degree outlined below. The advisor is also responsible for supervising the graduate research, mentoring the student in the field of study, and training the student in the techniques and concepts of the area of research. The student should meet with the advisor at the start of their program to develop a curriculum of study and at the beginning of each academic year to make sure the curriculum is still appropriate. The student and advisor should also meet regularly to discuss research progress.

Part of the graduate admissions process entails the selection of an advisor. This advisor should have expertise in the candidate's field of study. The advisor is responsible for ensuring that the student is aware of the degree requirements and for training the student in the techniques and concepts of the area of research. Departmental faculty are not obligated to advise any particular graduate candidate; rather, the individual faculty member selects candidates based on scientific interest, capabilities, and funding opportunities. A faculty member may serve as an advisor without providing financial support to a student. Terminating the student-advisor relationship requires a petition to the Department's Graduate Committee.

### **Courses**

Graduate students in Geosciences degree programs must register for credits each Autumn and Spring semester (with exceptions including some distance learning programs, or the School of Education where students may be registering primarily in the summer). Graduate students must register for thesis or dissertation credits each semester while working on a dissertation or thesis. Full-time student status requires at least 9 credits during the regular session, and 4 credits during a summer half-session. Full-time Teaching and Research Assistants must carry at least 9 credits per semester unless a waiver is obtained from the Graduate School. These credits may include GEOS 599 (thesis research) or GEOS 699 (dissertation research). Undergraduate credits do not apply to graduate degree requirements unless designated UG in the catalog. A limited number of UG undergraduate credits may be applied to the graduate degree. Specific course requirements for the M.S. and Ph.D. degrees are given below.

Students must petition for a leave-of-absence if they are not continuously registered. Beginning in Spring 2008, continuous registration requires completing at least 3 credits per semester. Students who step out of their graduate programs without an approved leave-of-absence for more than two consecutive semester terms will be dropped from their program's roster and will need to petition their program and the Graduate School for readmission. The petition for readmission will require an evaluation of the student's progress and plan for completing the degree. Not all students will be readmitted.

### **Transfer Credits**

Graduate credits for Geosciences courses may be transferred only from a school that has a graduate program in Geosciences or Geology. After satisfactory performance in graduate courses at the University of Montana, and upon recommendation of the student's graduate advisor and department chair, up to 9 credits may be transferred from another school and applied to a Master's degree after one semester of residence at the University of Montana. A Ph.D. student may transfer and apply up to 30 credits. Thesis or dissertation credits and credits for courses with grades of C or lower are not transferable. A request for transfer of credits is initiated by petitioning the Chair of the Department.

### **Grades**

A grade point average of 3.0 or better must be maintained throughout the graduate program. Courses with grades of C or lower cannot be applied to the requirements for the degree program but are included in the calculation of grade point average. Grades of N (continuing) and CR/NCR (Credit/No Credit) are

given for credits in Thesis Research (Geol. 599) and Dissertation Research (Geol. 699). Many courses numbered Geol. 500 or above are graded on a CR/NCR basis. If an instructor offers such a course for a letter grade then it must be taken for a letter grade to apply toward a degree program.

## **MASTER'S DEGREE**

A checklist and timetable of degree requirements for the Master's degree are provided in Appendix A.

### **Advising**

In addition to an advisor, a Master's student must choose two additional members of the faculty to constitute the research committee; one faculty member must be from a Department other than Geosciences. This committee is responsible for evaluating the student's research and for providing supplemental instruction in their respective research specialties to complement the primary training of the student. Members of the committee should be selected by the pertinence of their expertise in the intended course of study. A maximum of one member of the committee may be emeritus faculty of the Geosciences Department. The composition of all graduate committees are subject to the approval of the current tenured and tenure-track faculty.

### **Courses**

The Master's degree requires 34 credits. No more than 6 of these may be thesis credits. Only courses designated for graduate credit in the university catalog may apply. A minimum of 28 credits in formal coursework is required of which 20 must be Geosciences courses. 3 credits of Advanced Problems (GEOS 597) may be applied toward the degree. Seminars (GEOL 58X) may be taken more than once with the consent of the instructor. No more than 6 credits from 300-level UG courses and 3 credits from field trip courses may be applied toward the degree. A minimum of 25 credits applied toward the degree must be taken on the University of Montana - Missoula campus. A maximum of 8 credits of coursework may be repeated upon approval of the Department.

Cognate science courses taken outside the Geosciences Department may be required, depending on the field of study, advisor, or research. Cognate science courses are generally taken in Math, Physics, Chemistry, Biology or Computer Science. The nature of the cognate coursework will be decided in consultation with the thesis advisor.

### **Thesis**

Completion of a Master's degree also requires submission and approval by the faculty of a thesis research proposal by the last day of classes of the second semester. The proposal must be submitted **two weeks** prior to the end of classes. The content of the proposal must include a concise description of the scientific problem to be addressed, a summary of current research relevant to that problem, and a description of the experimental design or methodology to be used. This content should demonstrate basic scientific literacy as well as familiarity with the specialty chosen.

The completed research and thesis must be defended to the committee and approved by all members. An acceptable thesis may consist of one or more papers submitted or ready for submission to peer-reviewed scientific journals or a single longer document presenting the thesis research. The Master's thesis must present the results of original scientific research in the field of specialization in an appropriate scientific style and format. Length and content requirements are subject to the requirements of the advisor and the committee. However, an advanced degree in the physical sciences requires a demonstration of competence in scientific method, as well as familiarity with the current state of

knowledge in a specialty.

Defense of the written thesis consists of a public oral presentation to students, faculty, and other interested members of the public, and an oral examination conducted by the faculty. The presentation typically includes 40 minutes allotted to the presentation and several minutes for questions from the audience for a total time limit of 50 minutes. The final exam follows the public talk. The exam includes the defense of the thesis as well as questions designed to test competence in the course of study. The exam is conducted by the committee, and chaired by the advisor, but the exam is open to interested members of the university faculty as well. There are three possible outcomes of the exam:

- a. Pass with thesis accepted as it stands.
- b. Pass with minor revisions required on thesis.
- c. Fail or major revision required on thesis.

After a failure, a second defense is allowed after the waiting period required by the Graduate School. Only one repeat exam is permitted. The defense must be held during the period of a regular Autumn or Spring semester and must be completed at least 15 days before graduation.

### **Time Limit**

The Graduate School requires that the Master's degree be completed within five years of beginning coursework at The University of Montana. A leave of absence does not waive these time limits except when the leave is granted prior to commencing coursework. A leave of absence or delayed admission requires a "Request for Leave of Absence from the M.S. Program" form from the Graduate School. Such a leave of absence may be granted for a maximum of one calendar year. The Graduate School, upon receipt of a written request and with agreement from the Geosciences Department, may grant a 12-month extension to a leave of absence.

### **Intellectual Property**

The preservation and publication of samples and data collected during thesis research is of the highest priority. Therefore, raw data and samples generated as part of research projects supported by faculty grants and/or support from the Department of Geosciences will reside in the Department. The student must develop a plan for the archiving and transferring of data and samples with his/her advisor prior to finishing research and writing the thesis. The advisor has the responsibility to explain to the student any restrictions or dispensations on intellectual property rights of the data/information generated during the student's research. The advisor and student should consult to determine content, authorship and acknowledgements before papers are submitted for publication.

### **Application for Graduation**

At least one semester before the Master's degree is to be awarded, the student must submit three copies of the Application for Graduation form to the Graduate School and pay a graduation fee. See the Calendar of Deadlines on their website, <http://www.umt.edu/grad>, for the exact dates to file paperwork. The Graduate School will conduct a degree audit and send two copies of this form back to the Geosciences Department (one departmental copy and one student copy) early in the semester of graduation. The faculty advisor and student should note any problems and rectify them at least two weeks prior to the end of the final semester by using a Graduation Amendment Form. If the student fails to meet the original graduation date as requested on the form then the student may request the application be reactivated for the following semester by notifying the Graduate School one semester prior to the revised completion date.

After the defense, the successful candidate must follow the Graduate School rules for the submitting the thesis (<http://www.umt.edu/grad/mastersgrad/default.htm>). Formatting guidelines for the thesis are available at the same site. In addition, the student must complete the following tasks:

1. Prepare one hard copy of the thesis for each research committee member. The copy should be bound according to the requirements of the thesis advisor. Some committee members may prefer only an electronic copy.
2. Where appropriate, the advisor may require a representative collection of samples, specimens, thin sections or other materials, as well as copies of field and laboratory notes, for the departmental collections.
3. Clean up all lab and office space and return any departmental equipment and keys (remember to claim key deposits!).
4. Return any books or other items borrowed from the faculty.
5. Provide forwarding contact information to the department secretary.

### **DOCTORAL DEGREE**

The Department offers two courses of study for the doctoral degree: Ph.D. in Geosciences and Ph.D. in Applied Geosciences. The fundamental requirement for the Ph.D. is demonstration of outstanding scholarship and research ability in a field of Geoscience. Admission to the graduate program does not automatically entail admission the Doctoral program, which requires satisfaction of an additional set of requirements described below. A checklist and timetable of all Doctoral degree requirements is provided in Appendix B.

#### **Advising**

In addition to an advisor, a Ph.D. student must choose four additional faculty members to constitute the research committee. This committee is responsible for evaluating the student's research, for providing supplemental instruction in their research specialties to complement the primary training of the student, for administering the comprehensive exam, and for assessing the dissertation. Committee members should therefore be selected by the pertinence of their expertise in the intended course of study. The committee must include at least one member from outside the Department of Geosciences, but at least three members of the committee must be current faculty of the Department. The Graduate School and the faculty of the Department of Geosciences must approve any committee members from outside of the University of Montana. Not more than one member may be emeritus faculty of the Department. The composition of all graduate committees are subject to the approval of the current tenured and tenure-track faculty.

#### **Courses**

A minimum of 60 graduate credits beyond the Bachelor's degree is required for the Ph.D. degree at the University of Montana. The committee may require additional coursework beyond the minimum of 60 credits. Up to 30 credits may be transferred from a completed Master's degree. Candidates entering the Ph.D. program without a Master's degree may transfer 9 graduate credits from another institution. No more than 6 geology credits at the 300 level designated UG may be applied toward the Ph.D. degree. This limit includes courses taken for the Masters. A maximum of 14 credits of GEOS 699, dissertation research, and 6 credits of Advanced Problems (GEOS 597) may be applied toward the degree. A minimum of 6 graduate credits of coursework must be taken outside of the Geosciences Department. This coursework must comprise a coherent program relevant to the dissertation research and/or professional goals. Courses taken for the Master's degree may be applied toward the 6 credit cognate requirement with the approval of the advisor. Cognate courses are generally in Biology, Math, Physics,

Chemistry, or Computer Science. Some courses in Geography or Forestry may be suitable for some fields of study.

The department also offers a Ph.D. in Applied Geoscience, a tailored degree program designed for professional physical scientists. Extensive background in relevant industry or governmental work in geoscience-related disciplines may constitute grounds for the Applied Ph.D. program and reduced or modified formal course requirements and residence requirements. The curriculum is designed under the supervision of an advisor and research committee. A course of study must meet the majority approval of the Department of Geosciences faculty and the Dean of the Graduate School. Dissertation and exam requirements are the same as required for the Ph.D. in Geosciences.

### **Teaching Requirement**

A minimum of one semester of teaching is strongly recommended for completion of the Ph.D. degree. TA-ships automatically satisfy this requirement, alternatively, the requirement can be satisfied by instructing any course offered by the Department of Geosciences or by developing an alternative teaching experience with the advisor (e.g. guest lectures, field trips, field camp instruction).

### **Comprehensive Exam**

Successful completion of the comprehensive examinations is required for a student to be admitted to the Doctoral program.

The comprehensive examinations will consist of a written part and an oral part, both of which must be completed by the end of the fourth semester of study. Prior to taking either part, the dissertation proposal must be discussed by the student and committee in a closed session and approved by a unanimous committee vote. The written part will then be given by the student's research committee and will consist of a series of questions designed to test the student's knowledge of the geosciences and their scientific writing skills. These questions may cover general knowledge of geosciences topics, general knowledge of cognate sciences, and specific skills and knowledge pertinent to the field of research, at the discretion of the committee. The student will have seven days to complete the written exam, and may use any standard scientific research materials with proper citation. The research committee will determine other details of the specific exam format (number of questions, use of computing resources, etc.) on a case-by-case basis. The written exam must include at least one question from each of the committee members.

The oral part of the exam will consist of a defense of both the student's Ph.D. dissertation proposal and the student's answers to the written part of the exam, and may also include any other questions pertaining to general geosciences or the chosen field of research. The dissertation proposal must be approved by a unanimous committee vote in a closed meeting prior to the oral exam.

Possible exam outcomes include 1) pass; 2) conditional pass, in which case the student may be asked to elaborate upon one or more answers or fulfill some other requirement such as completion of a specific course; and 3) fail. Students who fail the comprehensive exam will be given one opportunity to retake the exam, but a second failure is final.

Following successful completion of the Ph.D. examinations, the student will have the opportunity to revise his/her dissertation proposal before submitting it to the Geosciences faculty for formal discussion and evaluation. The final version of the dissertation proposal must be approved by simple majority vote of the Geosciences faculty prior to formal admission to Ph.D. candidacy and before the end of the semester following completion of the Ph.D. examinations.

## **Dissertation**

Completion of the Ph.D. degree requires submission and defense of a doctoral dissertation. This document may consist of two or more papers submitted or ready for submission to peer-reviewed scientific publications or of a single long document containing original scientific research, although the journal-paper format is strongly encouraged. Length and content requirements are subject to the advisor and the committee. In the case of the journal paper format, additional chapters or appendices including data, detailed methods, or other unifying material may be required. However, an advanced degree in the physical sciences requires a demonstration of competence in scientific method, as well as familiarity with the current state of knowledge in a specialty and a substantive new contribution either to the body of methodology or the body of theory applicable in the field of expertise. All graduates of the program must also demonstrate a thorough understanding of the principles in their specialization, current techniques and methods in that field, a thorough understanding of scientific data and error analysis, and competence in scientific writing.

The oral defense of the dissertation may be scheduled only after the research committee has approved the draft dissertation. A copy of the accepted and corrected committee draft of the dissertation must be placed in the department office at least one week before the defense for inspection by any university faculty member. The defense will be no later than two weeks before the end of the semester in which the degree is to be granted; defenses are not conducted during summer sessions.

The dissertation defense has two parts; a public oral presentation and the examination conducted by the faculty. The public presentation is open to all students and faculty of the Department and any other interested people.

The final defense before the research committee and members of the university faculty follows the public presentation. The purpose of this defense is to test general comprehension of the dissertation project and related material. Following a period of questioning, the committee will meet in closed session to vote. Possible outcomes are:

- a. Unanimous pass without revision.
- b. Unanimous pass with minor revisions to the dissertation.
- c. Failure of defense that, in most cases, will lead to major revisions of the dissertation. If a failing vote is cast, the candidate must make the changes required by the committee and may defend again after 30 days. A second failure is final.

## **Time Limit**

All requirements for the degree must be completed within seven years of commencing graduate coursework at The University of Montana. Candidates are not excused from program time limitations by virtue of a leave of absence except when the leave is granted prior to commencing coursework.

## **Application for Graduation**

At least one semester before the Ph.D. degree is to be awarded, the student must submit three copies of the Application for Graduation form to the Graduate School and pay a graduation fee. See the Calendar of Deadlines on their website, <http://www.umt.edu/grad>, for the exact dates to file paperwork. The Graduate School will conduct a degree audit and send two copies of this form back (one departmental copy and one student copy) early in the graduating semester. The department and student should note any problems and rectify them at least two weeks prior to the end of the final semester by using a

Graduation Amendment Form. If the student fails to meet the original graduation date as requested on the form, the student may request the application be reactivated for the following semester by notifying the Graduate School one semester prior to the revised completion date.

After the defense, the successful candidate must follow the Graduate School rules for the submitting the dissertation. In addition, the student must complete the following tasks:

1. Prepare one hard copy of the thesis for each research committee member. The copy should be bound according to the requirements of the thesis advisor. Some committee members may prefer only an electronic copy.
2. Where appropriate, the advisor may require a representative collection of samples, specimens, thin sections or other materials, as well as a copy of all field and laboratory notes, for the departmental collections.
3. Clean up all lab and office space and return any departmental equipment and keys (remember to claim key deposits!).
4. Return any books or other items borrowed from the faculty.
5. Provide forwarding contact information to the department secretary.

### **Intellectual Property Rights**

The preservation and publication of samples and data collected during thesis research is of the highest priority. Therefore, raw data and samples generated as part of research projects supported by faculty grants and/or support from the Department of Geosciences will reside in the Department. The student must develop a plan for the archiving and transferring of data and samples with his/her advisor prior to finishing research and writing the dissertation. The advisor has the responsibility to explain to the student any restrictions or dispensations on intellectual property rights of the data/information generated during the student's research. The advisor and student should consult to determine content, authorship and acknowledgements before papers are submitted for publication.

## **APPLICATION OF STANDARDS AND RULES**

All graduate students are also subject to the general rules of the Graduate School of The University of Montana. Exceptions to the Department rules may be made with unanimous consent of the faculty of the Department. Exceptions to the University rules are occasionally allowed by petition to the Graduate School. Standards and rules regarding honorable scientific conduct and plagiarism are not negotiable. Throughout this document we provide a number of rules and time limits for successful performance in our graduate program. Failure to meet these rules or time limits constitutes reason for dismissal from our graduate program.

## **PUBLICATIONS AND PROFESSIONAL PRESENTATIONS**

The Department of Geosciences strongly encourages graduate students to submit their scientific work for publication in peer-reviewed journals and for presentation at national and regional meetings. Presentation of findings should be undertaken with the supervision of the advisor or members of the committee.

The Department and the Graduate School may help defray the expense of presenting a paper at a professional meeting. Notice of accepted publications, awards, and presentations must be provided to the committee and to the department secretary, and should also be added to a CV, which may also be

held by the department secretary.

#### APPENDIX A: Master's degree checklist

Action	Timing
Application to UM geosciences program	3 months before starting term
Acceptance by advisor	2 months before starting term
Meet with advisor to develop curriculum	1 week before starting term
Meet with committee to review curriculum	At beginning of each semester
Submission of thesis proposal	End of second term
Submission of thesis draft	4 <sup>th</sup> term (min.) – 8 <sup>th</sup> term (max.)
Completion of 34 graduate credits	4 <sup>th</sup> term (min.)-10 <sup>th</sup> term (max.)
Thesis defense	4 <sup>th</sup> term (min.)-10 <sup>th</sup> term (max.)

#### APPENDIX B: Ph.D. checklist

Action	Timing
Application to UM geosciences program	3 months before starting term
Acceptance by advisor	2 months before starting term
Meet with advisor to develop curriculum	1 week before starting term
Meet with committee to review curriculum	At beginning of each semester
Comprehensive exam	4 <sup>th</sup> term
Submission of dissertation draft	6 <sup>th</sup> term (min.) – 12 <sup>th</sup> term (max.)
Completion of 60 graduate credits	6 <sup>th</sup> term (min.)-14 <sup>th</sup> term (max.)
Dissertation defense	6 <sup>th</sup> term (min.)-14 <sup>th</sup> term (max.)

As amended 3/17/2009 by vote of the faculty.