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GRADUATE COMMITTEE

The Graduate Committee is responsible for administration of admissions, academics, and other advisory issues for graduate students in the department. The committee acts on applications for associate instructorships, fellowships, and summer research support and monitors academic progress of students. The committee consists of faculty members chosen to represent a range of disciplines and research fields in the department. The committee is assisted in its work by the Graduate Services Coordinator.

2018-19 GRADUATE COMMITTEE MEMBERS

Dr. Simon Brassell, Director of Graduate Studies (simon@indiana.edu)

Michael Hamburger (hamburg@indiana.edu)

Graduate Services Coordinator 'Chelle Filippelli (geolgrad@indiana.edu)
LINKS PROVIDED IN THIS HANDBOOK


University Graduate School: https://graduate.indiana.edu/index.shtml

IU Graduation Ceremony: https://universityevents.iu.edu/

Graduate Student Annual Review Forms: https://graduate.indiana.edu/forms/index.shtml

Graduate Student Theses Deadlines: https://graduate.indiana.edu/thesis-dissertation/index.html

Major/Minor Forms: https://bulletins.iu.edu/iub/college/2017-2018/degree-requirements/index.shtml

Earth and Atmospheric Sciences Graduate Student Handbook: http://earth.indiana.edu/education/handbook.html
Degrees Offered

The following graduate degrees are offered in the Department of Earth and Atmospheric Sciences: M.S. Geological Sciences, M.S. Geological Sciences-Atmospheric Sciences, Ph.D. Geological Sciences, Ph.D. Geological Sciences-Atmospheric Sciences.

Admission Requirements (TOEFL)

If the graduate applicant’s native language is not English, the College requires a score of at least 79 on the TOEFL iBT (delivered via the internet). Please note that the paper-based TOEFL iTP exam – sometimes called the institutional TOEFL – offered by the Intensive English Program on the Bloomington campus, cannot be used in place of the TOEFL iBT. Alternatively, an international applicant may submit the result of the International English Language Testing System (IELTS) examination in lieu of the TOEFL iBT. The College requires a score of at least 6.5 on the IELTS for graduate admission.

Residency

All graduate students must complete at least 30 hours of graduate credits in residence at the IU Bloomington campus. Ph.D. students must be in residence at the Bloomington campus for at least two consecutive semesters during the degree program.

IUB College Information

The websites for the College and the Graduate School (http://graduate.indiana.edu/index.shtml) provide links on the College Graduate Office page to submit requests (Extensions of Incomplete, Family and Medical Leave), to apply for funding (College Travel Awards, College of Arts and Sciences Dissertation Year Research Fellowships), and to appoint your Doctoral Advisory Committee.

Selection of Advisors and Research Committee

The Graduate Committee advises graduate students on course selection until a primary advisor is selected. Students should choose a primary advisor with graduate faculty status (Appendix 5) from the Department of Earth and Atmospheric Sciences or the Indiana Geological Survey (IGS https://igs.indiana.edu/). A co-advisor from the Department is required (Appendix 1) if the primary advisor is from the IGS.

A Research Committee will oversee the student’s academic and research progress toward the degree. For all degrees, a majority of members of the research committee must be selected from the Department of Earth and Atmospheric Sciences. The field of expertise of both the primary advisor and the research committee should reflect the topic of research chosen by the student.

Communication with Research Committee

Students must keep members of their Research Committee informed of progress with research and fulfillment of academic requirements on a regular basis, through both meetings and e-mail. Meetings should occur at least once each semester of the academic year (Spring and Fall), although students are strongly encouraged to meet more frequently with their committee members on an informal basis.

Annual Review

An Annual Review of academic and research progress is required of all graduate students in the department. All students are to submit the completed Annual Review forms by March 15 following the announced procedures for submission. The Graduate Affairs Committee may require a student to submit forms earlier than the March 15 deadline under certain circumstances. Appendices 2 and 3 contain sample copies of M.S. and Ph.D. Annual Review forms. These are available on the departmental website as interactive PDF forms under the Education tab and by the following link to the Graduate Handbook Appendices:

http://earth.indiana.edu/education/handbook.html

To activate the fillable forms, click on “open in another program” and choose “open in Adobe PDF.”

Completion of the Annual Review forms requires a meeting of the student with the research committee and signatures from committee members and the student. Students must scan all pages of the review, including the signed forms, and submit as one PDF to the Graduate Service Coordinator. Students who fail to complete their annual review are subject to loss of departmental support following a review by the Graduate Affairs Committee and the Chair.
Annual reviews will normally consist of three components:

An oral presentation by the student of research progress with a detailed plan for degree completion including coursework and research.

An in-depth discussion with the research committee to critically evaluate the student’s progress and advise the student on future plans to advance his/her research.

Grading of student progress by the research committee. The grading scale, form and the submission process will be determined each year by the Graduate Affairs Committee.

The annual review process is the primary mechanism used by the Department to gauge student research performance and evaluate whether or not a student should continue to receive departmental support and continue in their degree program. It also assists the Graduate Affairs Committee in evaluating merit for student awards. Those students whose performance is judged unsatisfactory by their research committee will be subject to departmental summer probation, which behooves them to demonstrate improved performance in their research and/or coursework. Students in this category are required to undergo a second review by an extended committee (henceforth referred to as the evaluation committee) consisting of the student’s research committee and one or more representative of the Graduate Affairs Committee. This review must take place in August prior to the start of the fall semester. If performance is still judged unsatisfactory the student will be placed on formal academic probation with the Graduate School for the fall semester. Students in probation are afforded a final opportunity to show progress in research based on a third review session administered by the evaluation committee before the end of the fall semester.

**Sources of Funding**

The Department of Earth and Atmospheric Sciences awards AI, RA, and Fellowship support, as well as summer research funds, on a competitive basis. AI support encompasses responsibilities in preparing and/or teaching laboratory courses, among other duties. RA support is dependent on the availability of specific research funds procured by individual faculty members through externally-funded grant proposals. Fellowships and summer research support are available from assets allocated to general or specific departmental accounts.

**Diplomas**

Degrees are granted every month of the year. The University Graduate School requires receipt of an electronic copy of the thesis/dissertation prior to the 15th day of the month for which the degree is to be granted; if received after the 15th the degree will be granted the next month. A degree diploma is mailed to a student’s home address two to three months after the degree is conferred. Diplomas are sent by third-class mail (Printed Matter) through the US Postal Service. Please be aware that items sent third-class are not forwarded to a new address. Hence, students must verify that their correct permanent home address is on file with the Registrar to ensure that the degree is mailed to the desired location. Please see the Graduate Services Coordinator if you are an international student desiring special arrangements for receipt of the diploma. The Graduate Services Coordinator can instruct you in how to have the diploma sent from the University Graduate School to the EAS Graduate Office (GY107). Our department will then send the diploma by airmail to your international address. Duplicate diplomas may be obtained through the Registrar for an additional fee.
**Minimum Grade Point Average**

All Masters students must maintain a 3.0 (B) grade point average. Students with a GPA less than 3.0 can be placed on academic probation until the student’s GPA increases to above 3.0. While on academic probation, the student cannot be supported as an AI, RA, or Fellow. If the GPA does not reach 3.0 after two semesters of probation, the student will be dismissed from the graduate program.

**Primary Advisor**

An advisor (and co-advisor if necessary; see page 4) should be chosen during the first semester and no later than March 1 of the first year in the degree program.

**Research Committee**

A three-person research committee must be formed for each Masters student, consisting of the primary advisor and two other members. Two of the members of this committee must be graduate faculty of the Department (see page 4). The composition of the research committee and signatures from each of the members must be filed with the Departmental Graduate Office by March 1 of the first year of the degree program. Any change in committee membership must be communicated immediately to the Graduate Office.

**Completion of Written Thesis**

The thesis should be prepared in a form that is essentially ready to submit for publication in an appropriate journal(s). Publication and public presentation of research results is strongly encouraged but not required. The format of the thesis must conform to the University’s official policy on the production of theses (Appendix 4).

**Timeframe**

Master’s degrees must be completed within five years of enrollment, or six years for Dual Masters degrees. Students who exceed this time frame must revalidate all coursework taken outside this timeframe.

**M.S. Requirements**

Students in the M.S. degree program who apply successfully for admission into the Ph.D. program in our Department must complete all formal requirements for the degree no later than one semester after entering the Ph.D. program.
**Application for Advanced Degree Form**

This form is on the Graduate School website (http://graduate.indiana.edu/forms/index.shtml), and must be completed and submitted a minimum of 60 days prior to the desired graduation date, regardless of whether you will attend the commencement ceremony.

**Commencement ceremony**

If you wish to attend the commencement ceremony, necessary forms must be filled out in advance. To attend the December commencement, the forms must be completed around mid-September; for the May commencement, they must be completed around mid-February. Further information can be found at the Indiana University Ceremonies website (http://universityevents.iu.edu/). Consult with the Department Graduate Office GY107 for further information.

**M.S. Thesis Presentation**

Students are encouraged to present their final M.S. research results at a regional or national meeting (e.g., AGU, GSA, AAPG, etc.). A departmental defense is not formally required but is strongly recommended and should be announced to the department with title, date, time and location.

**MASTER OF SCIENCE 'REPORT OPTION' OVERVIEW**

This degree option is not recommended for most students because it may limit future educational and professional goals. An exception is students who plan to continue in the Ph.D. program in our Department, building directly on research begun in the M.S. program. In such circumstances the report route can streamline that transition when appropriate but the formal decision to pursue this option should only be taken after admission to the Ph.D.

The degree requirements include:

- Total of 30 credit hours
- 27 of the 30 hours must be graduate-level courses; the remaining 3 can be G810. 400-level courses from the Department of Earth and Atmospheric Sciences that can be taken for graduate credit are listed in Appendix 6. 500- to 700-level Earth and Atmospheric Sciences courses, and lower-level courses from other departments that count toward graduate credit can be found in the University Graduate School Academic Bulletin (see the section entitled "Graduate Credit-General" in the Academic Regulations section of the University Graduate School Academic Bulletin).
- 20 of the 27 hours must be in Earth and Atmospheric Sciences.
- At least three 3-credit hour courses of 500 level or above must be taken from the Department of Earth and Atmospheric Sciences.
- Selection of courses to be taken should be discussed with the primary advisor and research committee.
  - Transfer of credit
  - As above in M.S. overview.
  - Minimum Grade Point Average
  - As above in M.S. overview.
  - Report

The precise format and content of the report are determined in collaboration with the student’s advisor and research committee. The report must be signed by the entire research committee. It is recommended that the report be in a format suitable for publishing, but it is not required.

**Primary Advisor**

An advisor (and co-advisor if necessary; as above in M.S. overview) should be selected no later than March 1 of the first year in the degree.

**Research Committee**

As above in M.S. overview.

**Timeframe**

As above in M.S. overview.

**Application for Advanced Degree Form**

As above in M.S. overview.

**Commencement Ceremony**

As above in M.S. overview.
M.S. Report Option Presentation

Students are encouraged to present their final M.S. research results at a regional or national meeting (e.g., AGU, GSA, AAPG, etc.) or as a departmental defense with title, date, time and location announced to the department.

MASTER OF SCIENCE DEGREE:
GEOLOGICAL SCIENCES-ATMOSPHERIC SCIENCES

Admission Requirements

Undergraduate major in Geological Science, Atmospheric Science, Mathematics, Physics, Chemistry, Biology, or equivalent. Applicants not meeting this requirement may be expected to complete additional coursework.

FIELD OF STUDY - ATMOSPHERIC SCIENCES

Course Requirements

Requirements are the same as the M.S. degree (thesis or report option) with one additional requirement. At least 12 credit hours must be from the list of courses specific to Atmospheric Sciences defined by the Department of Earth and Atmospheric Sciences.

M.S./M.S.E.S.

MASTER OF SCIENCE IN GEOLOGICAL SCIENCES
MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE

This degree program is appropriate for students from a wide range of undergraduate science programs interested in a career in environmental sciences. This dual masters’ program is a 51-credit hour (two year) program that gives the student greater depth and breadth than is possible in a single degree.

Admission Requirements

A student must apply to and be accepted by both the Department of Earth and Atmospheric Sciences and SPEA.

Course Requirements

Course requirements are a minimum of 21 credits from each program distributed as follows:

- Earth and Atmospheric Sciences core (12 cr.)
- Environmental Science core (12 cr.)
- Courses in economics, policy, and law competencies (6 cr.)
- A tool skill (3 cr.)
- Other Earth and Atmospheric Sciences or SPEA courses recommended by advisory committee and
t
- 9 Credits of research divided between Earth and Atmospheric Sciences and SPEA.

The distribution of credits across these requirements can be modified with the approval of the research committee. This committee, with a minimum of three members, will supervise the student’s research program. At least one member of the committee must have a primary affiliation with the Department of Earth and Atmospheric Sciences and at least one member must have a primary affiliation with SPEA. Two members of the advisory committee must be named as co-advisors with one advisor from each program.

Example credit hour distribution for an M.S. student

<table>
<thead>
<tr>
<th>Classes</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>G583 Isotopic Systematics</td>
<td>3.0</td>
</tr>
<tr>
<td>G572 Basin Analysis and Hydrocarbons</td>
<td>3.0</td>
</tr>
<tr>
<td>G601 Clay Mineralogy</td>
<td>3.0</td>
</tr>
<tr>
<td>G571 Principles of Petroleum Geology</td>
<td>3.0</td>
</tr>
<tr>
<td>G451 Hydrogeology</td>
<td>3.0</td>
</tr>
<tr>
<td>G554 Fundamentals of Plate Tectonics</td>
<td>3.0</td>
</tr>
<tr>
<td>G590 The Art of Geological Sciences</td>
<td>1.0</td>
</tr>
<tr>
<td>G637 Seminar in Tectonics (taken twice)</td>
<td>2.0</td>
</tr>
<tr>
<td>A597 Introduction to Programming 1</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Total 24.0

Research Hours:

<table>
<thead>
<tr>
<th>Classes</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>G810</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Total 30.0

Courses that satisfy the 12 credit hour requirement:

- G540 Physical Meteorology, Climate, and Paleoclimate
- G537 Advanced Synoptic Meteorology and Climatology
- G534 Dynamic Meteorology: Synoptic to Global Scale
- G538 Air Pollution Meteorology
- G556 Wind Power Meteorology
- G564 Dynamic Meteorology: Boundary-Layer Meteorology
- G570 Micrometeorology
- G576 Climate Change Science
Primary Advisor
An advisor (and co-advisor if necessary; see page 4) should be selected and agree to fulfill this role no later than December 1 of the first year of the degree.

Advisory Committee
The advisory committee shall approve the student’s program of study and counsel the student until the passing of the Qualifying Exam. The advisory committee must include at least two members from the major area and one from the minor. The name of the primary advisor and two other members of the committee must be confirmed in a signed letter to the Graduate Services Coordinator.

Example credit hour distribution for a Ph.D. student

<table>
<thead>
<tr>
<th>Classes</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>G513 Seismology</td>
<td>3.0</td>
</tr>
<tr>
<td>G583 Isotopic Systematics</td>
<td>3.0</td>
</tr>
<tr>
<td>G514 Geophysical Signal Analysis</td>
<td>3.0</td>
</tr>
<tr>
<td>G612 Inverse Methods in Geophysics</td>
<td>3.0</td>
</tr>
<tr>
<td>G572 Basin Analysis and Hydrocarbons</td>
<td>3.0</td>
</tr>
<tr>
<td>G601 Clay Mineralogy</td>
<td>3.0</td>
</tr>
<tr>
<td>G571 Principles of Petroleum Geology</td>
<td>3.0</td>
</tr>
<tr>
<td>E451 Hydrogeology</td>
<td>3.0</td>
</tr>
<tr>
<td>G554 Fundamentals of Plate Tectonics</td>
<td>3.0</td>
</tr>
<tr>
<td>G589 Geomicrobiology</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>30.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minor:</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A597 Introduction to Programming I</td>
<td>3.0</td>
</tr>
<tr>
<td>A598 Introduction to Programming II</td>
<td>3.0</td>
</tr>
<tr>
<td>P573 Scientific Computing</td>
<td>3.0</td>
</tr>
<tr>
<td>P673 Advanced Scientific Computing</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>12.0</td>
</tr>
<tr>
<td>Total all Graduate Courses:</td>
<td>42.0</td>
</tr>
<tr>
<td>Research Hours:</td>
<td></td>
</tr>
<tr>
<td>G810 Research Hours</td>
<td>48.0</td>
</tr>
<tr>
<td>Total Credit Hours for Ph.D.</td>
<td>90.0</td>
</tr>
</tbody>
</table>
**Research Committee**

Following the qualifying exam, a research committee must be selected, consisting of the primary advisor and 3-4 other members. The research committee can include all of the members of the Advisory Committee, supplemented by other IU faculty or individuals from other institutions connected to the research. Three of the members of this committee must be graduate faculty in the Department. The composition of the research committee and signatures from each of the members must be provided on the annual review form; any change must be communicated to the Graduate Office immediately.

**Selection of a Minor**

Selection of a Minor is also a requirement of the degree. Minors in allied science and mathematics are normally desired to broaden the student’s background. The minor can also be in an area within the geosciences distinct from the chosen major. Formal external and internal minors are approved by the University Graduate School (http://bulletins.iu.edu/iub/college/2016-2017/degree-requirements/index.shtml).

An individualized minor option with a minimum of 12 credit hours from at least two different Departments is also possible through petition to the University Graduate School. An individualized internal minor, which also requires coursework from at least two Departments, must be approved by the Graduate Affairs Committee and by the Graduate School Dean’s office prior to completing the proposed course work.

Minors typically require between 6 and 12 credit hours of coursework. The precise requirements and courses needed will be determined by the Minor Advisor, who must be a faculty member in the minor department. The minor advisor normally becomes a member of the student’s research committee (see below).

Students electing an internal minor must complete a minimum of 6 credit hours of course work in an area of Earth and Atmospheric Sciences distinct from their major research area. Courses taken for the minor may count toward the requirement of 35 credit hours of graduate course work. The objective of the Ph.D. minor is to broaden the student’s background. To assure that this objective is achieved, any students who are planning an internal minor must have their study plan approved by their advisory committee and the Director of Graduate Studies. Internal minors must be approved in advance by the University Graduate School as an individualized minor.

**ADMISSION**

Students are admitted to the Ph.D. program through one of three mechanisms:

- Direct admission to the Ph.D. program following completion of an undergraduate degree program. (Students who enter the Ph.D. program with a baccalaureate degree will be encouraged to complete an M.S. degree.)
- Admission after completion of an M.S. degree at another institution.
- Current Indiana University students enrolled in our M.S. program may apply for admission to the Ph.D. program early in their second year of graduate study. The early review process is used to evaluate a student’s suitability for the Ph.D. program.

The expectations of progress toward the Ph.D. degree and the timelines for review of student progress, as described in Figure 1 (page 16), are different for each of these groups.

**EARLY REVIEW**

**Objectives**

The early review is an extension of the department annual review process. The primary purpose of this requirement is to provide a departmental assessment of each student’s level of preparation to complete the Ph.D. degree in an early stage. The aim is to (i) ensure that students are actively developing a viable research project, and (ii) identify aspects of students’ academic background that need strengthening early in their course of study.

**Administration and Timetable**

The Graduate Affairs Committee administers this review procedure. Figure 1 (page 15) is a graphical representation of the timeline for this review for the three different groups outlined above. A key aspect of this process is that students entering the program with a baccalaureate degree are required to go through this process in the fall of their second year of residence, whereas students entering the program with an M.S. degree will be reviewed in the spring semester of their first year of residence.
Step 1: Study Plan

As illustrated by the timelines in Figure 1 (p. 15), students are required to complete a preliminary Ph.D. research and study plan comprised of three parts:

Research Statement

A brief (less than one page) summary of a student’s research plan. The format should be comparable to the “Intellectual Merit” section of the project summary for a standard proposal to the National Science Foundation written for a non-specialist in the research area.

Personal Statement

An assessment by the student of their perception of individual strengths and weaknesses pertinent to their research goals. This should address three areas:

• (i) academic background (e.g. coursework and field experiences)
• (ii) research skills (e.g. talents in writing, mathematics, computing, laboratory work, etc.) and
• (iii) personality characteristics important to professional success (e.g. tenacity, flexibility, commitment, ability to work in a team, etc.).

Students should view this task as an opportunity for objective professional self-assessment that can help the committee identify appropriate topics for discussion during the oral exam. An honest assessment will be most beneficial in this regard because it will facilitate recognition of areas of academic background that need strengthening and thereby aid ultimate success.

Intellectual Development

A bulleted list of specific targets in academic preparation and research skills that require strengthening in order to complete your Ph.D.

Step 2: Feedback and Review of Study Plan

The Graduate Affairs Committee and the student’s advisor will provide written feedback to the student two weeks after the deadline for submission of the study plan. This response will be in the form of a review that the student should use as a guide in preparation for the oral exam. It will focus on topics that will constitute the principal points for discussion in the oral exam, especially areas that students identify as strengths, rather than weaknesses.

Step 3: Oral Exam

The Graduate Affairs Committee will schedule an oral exam for individual students. The examination committee will consist of two or members of the graduate committee, the student’s advisor, and (optionally) one or more members of the student’s research committee. Question topics will focus on areas of knowledge described in the individual review guide given to each student and centered on their strengths. Students should recognize, however, that the broad objective of the exam is to identify areas that need strengthening; hence, the Committee may ask questions regarding any aspect of geosciences.

Step 4: Results of Exam

There are three possible outcomes of this exam:

Unconditional Pass

This pass recognizes that a student has a background without deficiencies, a viable research plan, and is suitably prepared for success in the Ph.D. program, which includes completion of all requirements for the M.S. degree when applicable.

Deferred Decision

When the student’s self evaluation or the exam reveals a need to augment their academic background there may be a requirement to complete one or more courses, or fulfill other specific conditions, as determined by the Graduate Affairs Committee and advisor. The result of the exam may be deferred pending the student’s fulfillment of the conditions imposed by the Committee. Students in this category are required to demonstrate significant progress by their annual review or they may enter the probation process described above.

Fail

A student can fail this exam. The primary reason for failure will be a student’s inability to convince the committee that he/she can successfully complete the Ph.D. program. For example:

• (i) an inability to provide coherent answers during the oral exam,
• (ii) the absence of a viable research plan,
• (iii) evidence of a lack of commitment to the profession or to the Ph.D. program.

There is no possibility for retaking the exam for stu-
dents who fail. For students entering the program with an outside M.S. degree (group 2 above) the ‘fail’ result is reserved for those exceptional circumstances when a student is disengaged from their intended research program.

**QUALIFYING EXAMINATION**

This is a three-stage process and can be undertaken only after minimum course requirements have been fulfilled. It should be taken no later than the 6th semester in the program:

1) The candidate will prepare a research proposal of approximately 15 pages excluding figures and references. The proposal will be reviewed by the student’s advisory committee and used as part of the exam assessment. The proposal must demonstrate that the proposed research consists of a suitable topic in terms of feasibility and importance. Preliminary results and familiarity with the field and literature are necessary before writing the proposal. Once revisions are made and the proposal is accepted by the advisory committee, the second stage can be initiated.

2) A written examination based on the research proposal is prepared by the advisory committee. This is a closed-book examination taken on a day chosen by the student, spanning approximately 3 hours in the morning and 3 hours in the afternoon. The examination is meant to evaluate familiarity with the chosen research area, to assess the relation of this field of research to others in the Earth and Atmospheric Sciences, and to alert the student to potential weaknesses in the research proposal. The advisory committee will evaluate responses to the examination. If responses are deemed sufficient and satisfactory, the third part of the process occurs. Students who fail the examination will be asked to leave the graduate program at the end of the semester, retake the exam, or complete specified remedial classes within 6 months of the examination date.

3) The oral portion of the exam takes place within a 2 week window after the written exam. The format normally consists of an oral presentation of the research proposal to the advisory committee, and responses to committee members’ questions regarding both the proposal and the examination answers. This examination takes approximately 3 hours. A room within the department must be booked for this purpose and presentation equipment reserved (see the Office Assistant in GY129).

Possible outcomes of this exam are: pass (admission to formal Ph.D. Candidate status), fail with permission to retake the exam, fail without permission to retake the exam, or a conditional pass (the candidate may need to satisfy some requirements set by the committee, which may involve further classes or research).

**Nomination to Candidacy**

The Nomination to Candidacy form must be completed online at http://graduate.indiana.edu/forms/index.shtml prior to the Qualifying Examination. If a candidate passes, all committee members must sign the form on the day of the Qualifying Examination. This form is then sent to the University Graduate School for acceptance of the examinee to become a formal Ph.D. candidate.

**Appointment of Research Committee**

After approval of the Graduate School, the candidate must complete the form for nomination of research committee, which is on the University Graduate School’s website (http://graduate.indiana.edu/index.shtml). It is important that the candidate file this paperwork promptly as nine months must elapse between the time of submission of this form and defense of the dissertation. In the past students have had their graduation delayed by failure to act on this requirement.

**Completion of Written Dissertation**

The dissertation should be prepared in a form that is essentially ready to submit for publication in appropriate journals. Publication of results is strongly encouraged. The format of the dissertation must conform to the University’s official policy on the production of Ph.D. dissertations (Appendix 4).

**Dissertation Defense**

The dissertation defense can be scheduled no sooner than eight months from the date of completion of the Qualifying Examination and appointment of the Research Committee. The Research Committee and student must come to an agreement that the dissertation is at a stage that is suitable for defense, based on drafts of the dissertation submitted to the committee.

An Announcement of the Dissertation Defense must be submitted to the University Graduate School a minimum of 30 days prior to the defense date, but they recommend you start the process 6 weeks before the planned defense date. An example of the format re-
quired is included in Appendix 4. Two weeks prior to the defense a copy of the dissertation must be placed in the front office of the department for public perusal. The defense itself consists of a public presentation of the dissertation research that any interested faculty and students may attend, followed by an open session of questions and discussion, after which the student’s Research Committee conducts a rigorous closed-session, oral examination of the student.

The result of the defense is determined as a pass, conditional pass, a deferred decision, or a failure without the option to retake. The conditional pass usually requires revisions of the dissertation as recommended by the research committee, and a deferred decision indicates that the opinion of the research committee was not unanimous, a circumstance that requires reports from the research committee detailing the differing opinions to the Dean of the Graduate School.

After a successful defense, the Graduate Office needs to receive (i) one signed copy of the dissertation abstract, and (ii) one signed dissertation. Students should plan to submit the final version of their dissertation electronically to the University Graduate School as soon as possible.

**Timeframe**

The Ph.D. dissertation must be accepted by the student’s research committee and a copy must be submitted to the University Graduate School within seven years of passing the Qualifying Examination. Failure to do so will result in termination of Ph.D. candidacy. Reinstatement of candidacy is possible and involves obtaining permission of the department chairperson, fulfilling any reinstatement requirements from the Department, passing the Qualifying Examination again, and then requesting reinstatement from the Dean. Once reinstated, the degree must be completed within three years.

**Ph.D. Commencement Participation Application**

Paperwork must be completed in advance to attend the commencement ceremony. To attend the December commencement, forms must be completed in mid-September; for the May commencement, forms must be completed in mid-February. Further information can be found at the Indiana University Ceremonies website http://universityevents.iu.edu/ or the Grad Services office.
### Course Requirements

Requirements are the same as the regular Ph.D. degree with one additional requirement. At least 12 credit hours from a list of courses specific to Atmospheric Sciences defined by the Department of Earth and Atmospheric Sciences.

<table>
<thead>
<tr>
<th>Courses that satisfy the 12 credit hour requirement:</th>
</tr>
</thead>
<tbody>
<tr>
<td>G534 Dynamic Meteorology: Synoptic to Global Scale</td>
</tr>
<tr>
<td>G537 Advanced Synoptic Meteorology and Climatology</td>
</tr>
<tr>
<td>G540 Physical Meteorology and Climatology</td>
</tr>
<tr>
<td>G556 Wind Power Meteorology</td>
</tr>
<tr>
<td>G564 Dynamic Meteorology: Boundary-Layer Meteorology</td>
</tr>
<tr>
<td>G570 Micrometeorology</td>
</tr>
<tr>
<td>G576 Climate Change Science</td>
</tr>
</tbody>
</table>

### DOCTOR OF PHILOSOPHY DEGREE: GEOLOGICAL SCIENCE-ATMOSPHERIC SCIENCES

#### Course Requirements

Requirements are the same as the regular Ph.D. degree with one additional requirement. At least 12 credit hours from a list of courses specific to Atmospheric Sciences defined by the Department of Earth and Atmospheric Sciences.

### DOCTOR OF PHILOSOPHY DEGREE WITHOUT PRIOR M.SC. DEGREE IN GEOLOGICAL SCIENCES

The requirements below presume that the student begins the program having completed a Bachelor’s degree. The requirements include:

- Total of 90 credit hours
- 35 of the 90 hours must be graduate-level courses.
- 20 of these 35 hours must be graduate courses related to the student’s major research area.
- 12 credits must be taken in the Indiana University Department of Earth and Atmospheric Sciences.
- Credits for the minor count toward the 35 total hours of coursework.
- Transfer of credit - as specified for Ph.D.
- The following items have the same requirements as those specified in the Ph.D. Overview:
  - A 3.0 (B) grade point average
  - G901 Advanced Research
  - Primary Advisor
  - Research Committee
  - Selection of a Minor
  - Ph.D. students are subject to annual and early review procedures described above
  - Qualifying Examination
  - Completion of Written Dissertation
  - Dissertation Defense

Courses that satisfy the 12 credit hour requirement:

- G534 Dynamic Meteorology: Synoptic to Global Scale
- G537 Advanced Synoptic Meteorology and Climatology
- G540 Physical Meteorology and Climatology
- G556 Wind Power Meteorology
- G564 Dynamic Meteorology: Boundary-Layer Meteorology
- G570 Micrometeorology
- G576 Climate Change Science
Figure 1: Illustrates a timeline for completing Ph.D. and M.S. degrees in Geological Sciences at IU.
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APPENDIX 1: FACULTY, EMERITUS, AND ADJUNCT FACULTY

**Teaching Faculty:** (The following people can supervise Ph.D./Masters students and serve on research committees)

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Specialty</th>
<th>Phone</th>
<th>Room</th>
<th>Email</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor</td>
<td>Simon Brassell</td>
<td>Biogeochemistry, Organic Geochemistry</td>
<td>5-3786</td>
<td>MSBIIL 404</td>
<td>simon</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>James Brophy</td>
<td>Igneous Petrology, Geochemistry</td>
<td>5-6417</td>
<td>G309</td>
<td>brophy</td>
<td>EAS</td>
</tr>
<tr>
<td>Assoc. Professor</td>
<td>Douglas Edmonds</td>
<td>Sedimentary Geology</td>
<td>5-4512</td>
<td>G425</td>
<td>edmondsd</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>Michael Hamburger</td>
<td>Geophysics, Seismology and Tectonics</td>
<td>5-2934</td>
<td>G415</td>
<td>hamburg</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>Claudia Johnson</td>
<td>Geobiology</td>
<td>5-0646</td>
<td>G501</td>
<td>claudia</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>Kaj Johnson</td>
<td>Geophysics</td>
<td>5-3612</td>
<td>G401</td>
<td>kajjohns</td>
<td>EAS</td>
</tr>
<tr>
<td>Asst. Professor</td>
<td>Chanh Kieu</td>
<td>Atmospheric Science</td>
<td>6-5704</td>
<td>G517</td>
<td>ckieu</td>
<td>EAS</td>
</tr>
<tr>
<td>Assoc. Professor</td>
<td>Jackson Njau</td>
<td>Geomorphology</td>
<td>6-3170</td>
<td>G513</td>
<td>jknjau</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>David Polly</td>
<td>Paleontology, Geobiology</td>
<td>5-7994</td>
<td>G524a</td>
<td>pdpolly</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>Ed Ripley</td>
<td>Isotope Geochemistry, Economic Geology</td>
<td>5-1196</td>
<td>G329</td>
<td>ripley</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>Juergen Schieber</td>
<td>Geology of Shales and Mudstones</td>
<td>5-5322</td>
<td>G523</td>
<td>jschiebe</td>
<td>EAS</td>
</tr>
<tr>
<td>Asst. Professor</td>
<td>Paul Staten</td>
<td>Atmospheric Science</td>
<td>6-5135</td>
<td>MSBIIL 302</td>
<td>pwstaten</td>
<td>EAS</td>
</tr>
<tr>
<td>Asst. Professor</td>
<td>Brian Yanites</td>
<td>Geomorphology, Surface Processes, Geophysics</td>
<td></td>
<td>G429</td>
<td>byanites</td>
<td>EAS</td>
</tr>
<tr>
<td>Professor</td>
<td>Chen Zhu</td>
<td>Hydrogeology, Mass Transport, Water-Rock-Gas-Microbe Interactions</td>
<td>6-1884</td>
<td>MSBIIL 424</td>
<td>czhu</td>
<td>EAS</td>
</tr>
</tbody>
</table>

**Research Faculty:** (The following people can serve on research committees, and the Senior Scientists can supervise Ph.D./Masters students)

<table>
<thead>
<tr>
<th>Senior Lecturer</th>
<th>Name</th>
<th>Specialty</th>
<th>Phone</th>
<th>Room</th>
<th>Email</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Lecturer</td>
<td>Bruce Douglas</td>
<td>Tectonics and Structural Geology</td>
<td>5-3848</td>
<td>G423</td>
<td>douglasb</td>
<td>EAS</td>
</tr>
<tr>
<td>Senior Lecturer</td>
<td>Erika Elswick</td>
<td>Geochemistry, Sedimentology, Sedimentary Ore Deposits</td>
<td>5-2493</td>
<td>MSBIIL 428</td>
<td>eelswick</td>
<td>EAS</td>
</tr>
<tr>
<td>Research Scientist</td>
<td>Ed Hermann</td>
<td>Geoarchaeology</td>
<td>6-0587</td>
<td>G417</td>
<td>edherma</td>
<td>EAS</td>
</tr>
<tr>
<td>Lecturer</td>
<td>Cody Kirkpatrick</td>
<td>Atmospheric Science</td>
<td>5-3481</td>
<td>MSBIIL 305</td>
<td>codykirk</td>
<td>EAS</td>
</tr>
<tr>
<td>Senior Scientist</td>
<td>Chusi Li</td>
<td>Petrology, Geochemistry, Mineral Deposits</td>
<td>5-1558</td>
<td>G217</td>
<td>cli</td>
<td>EAS</td>
</tr>
<tr>
<td>Research Scientist</td>
<td>Peter Sauer</td>
<td>Biogeochemistry, Paleoclimatology</td>
<td>5-6591</td>
<td>MSBIIL 410</td>
<td>pesauer</td>
<td>EAS</td>
</tr>
<tr>
<td>Senior Scientist</td>
<td>Arndt Schimmelmann</td>
<td>Organic Geochemistry, Chemical Oceanography</td>
<td>5-7645</td>
<td>G321</td>
<td>aschimme</td>
<td>EAS</td>
</tr>
</tbody>
</table>
## APPENDIX 1: FACULTY, EMERITUS, AND ADJUNCT FACULTY

### Emeritus Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Field</th>
<th>Office</th>
<th>Phone</th>
<th>Email</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abhijit Basu</td>
<td>Sedimentary and Planetary Petrology</td>
<td>G507</td>
<td>5-6654</td>
<td>basu</td>
<td>EAS</td>
</tr>
<tr>
<td>David Bish</td>
<td>Clay Mineralogy; X-ray Diffraction</td>
<td>G209</td>
<td>5-2039</td>
<td>bish</td>
<td>EAS</td>
</tr>
<tr>
<td>Robert Blakely</td>
<td>Geophysics</td>
<td>G119</td>
<td>5-4957</td>
<td>dodd</td>
<td>EAS</td>
</tr>
<tr>
<td>J. Robert Dodd</td>
<td>Geobiology</td>
<td></td>
<td></td>
<td>dodd</td>
<td>EAS</td>
</tr>
<tr>
<td>David L. Dilcher</td>
<td>Geobiology</td>
<td>S209</td>
<td>6-0618</td>
<td>dilcher</td>
<td>EAS</td>
</tr>
<tr>
<td>Jeremy Dunning</td>
<td>Structural Geology</td>
<td></td>
<td></td>
<td>dunning</td>
<td></td>
</tr>
<tr>
<td>Brian Keith</td>
<td>Sedimentology, Stratigraphy</td>
<td>S117</td>
<td>5-4213</td>
<td>keithb</td>
<td>IGS</td>
</tr>
<tr>
<td>Enrique Merino</td>
<td>Geochemistry and Petrology</td>
<td>G117</td>
<td>5-5088</td>
<td>merino</td>
<td>EAS</td>
</tr>
<tr>
<td>Greg Olyphant</td>
<td>Hydrogeology, Quaternary Geology and Geomorphology</td>
<td>S423</td>
<td>5-1351</td>
<td>olyphant</td>
<td>EAS</td>
</tr>
<tr>
<td>Gary Pavlis</td>
<td>Geophysics, Seismology and Tectonics</td>
<td>G409</td>
<td>5-5141</td>
<td>pavlis</td>
<td>EAS</td>
</tr>
<tr>
<td>Lisa Pratt</td>
<td>Biogeochemistry, Sedimentology/Stratigraphy</td>
<td></td>
<td>5-9203</td>
<td>prattl</td>
<td>EAS</td>
</tr>
<tr>
<td>Lee J. Suttner</td>
<td>Sedimentology and Stratigraphy</td>
<td>G119</td>
<td>5-4957</td>
<td>suttner</td>
<td>EAS</td>
</tr>
<tr>
<td>Robert Wintsch</td>
<td>Metamorphic, Structural, Sedimentary Petrology, Tectonics and Geochronology</td>
<td>G325</td>
<td>5-4018</td>
<td>wintsch</td>
<td>EAS</td>
</tr>
</tbody>
</table>

### Adjunct Faculty: (The following people can supervise a Ph.D./Masters student, but require a co-advisor from the Faculty or Research Faculty. They can also serve on research committees)

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Field</th>
<th>Office</th>
<th>Phone</th>
<th>Email</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor</td>
<td>Chris Craft</td>
<td>Wetland Ecology</td>
<td></td>
<td>5-5971</td>
<td><a href="mailto:ccraft@iu.edu">ccraft@iu.edu</a></td>
<td>SPEA</td>
</tr>
<tr>
<td>Professor</td>
<td>Jim Handschy</td>
<td>Petroleum Systems, 3D/4D analysis, structural geology, field methods</td>
<td></td>
<td></td>
<td><a href="mailto:jwhandsc@iu.edu">jwhandsc@iu.edu</a></td>
<td>EAS</td>
</tr>
<tr>
<td>Senior Researcher</td>
<td>Sally Letsinger</td>
<td>Hydrogeology, GIS</td>
<td>S427</td>
<td>5-1356</td>
<td><a href="mailto:sletsing@iu.edu">sletsing@iu.edu</a></td>
<td>IGS</td>
</tr>
<tr>
<td>Assoc. Professor</td>
<td>Adam Maltese</td>
<td>Science Education/Adjunct Faculty Geological Sciences</td>
<td>3054</td>
<td>6-8059</td>
<td><a href="mailto:amaltese@iu.edu">amaltese@iu.edu</a></td>
<td>School of Education</td>
</tr>
<tr>
<td>Research Scientist</td>
<td>Maria Mastalerz</td>
<td>Coal Petrology, Coal Geochemistry, Coalbed Gas</td>
<td>S225</td>
<td>5-9416</td>
<td><a href="mailto:mmastale@iu.edu">mmastale@iu.edu</a></td>
<td>IGS</td>
</tr>
<tr>
<td>Senior Researcher</td>
<td>Pat McGlaughlin</td>
<td>Chemostratigraphy, sequence stratigraphy, regional Paleozoic geology, geologic mapping, and sedimentary diagenesis.</td>
<td>5-1350</td>
<td>5-1350</td>
<td><a href="mailto:pimclaug@iu.edu">pimclaug@iu.edu</a></td>
<td>IGS</td>
</tr>
<tr>
<td>Distinguished Professor</td>
<td>Peter Ortoleva</td>
<td>Geochemistry</td>
<td>CH203E</td>
<td>5-2717</td>
<td><a href="mailto:ortoleva@iu.edu">ortoleva@iu.edu</a></td>
<td>Chemistry</td>
</tr>
<tr>
<td>Professor</td>
<td>Kathy Schick</td>
<td>Anthropology</td>
<td></td>
<td>6-0080</td>
<td><a href="mailto:kaschick@iu.edu">kaschick@iu.edu</a></td>
<td>Anthropology</td>
</tr>
<tr>
<td>Director, IGS</td>
<td>Todd Thompson</td>
<td>Clastic and carbonate sedimentology, lake level, shoreline behavior, Indiana Dunes</td>
<td>IGS</td>
<td>5-7428</td>
<td><a href="mailto:tthomps@iu.edu">tthomps@iu.edu</a></td>
<td>IGS</td>
</tr>
<tr>
<td>Professor</td>
<td>Nicholas Toth</td>
<td>Anthropology Cognitive Science</td>
<td></td>
<td>6-0080</td>
<td><a href="mailto:toth@iu.edu">toth@iu.edu</a></td>
<td>Anthropology</td>
</tr>
<tr>
<td>Asst. Professor</td>
<td>Adam Ward</td>
<td>Watershed Hydrology and Engineering</td>
<td>MSBII 430</td>
<td>6-4820</td>
<td><a href="mailto:adamward@iu.edu">adamward@iu.edu</a></td>
<td>SPEA</td>
</tr>
<tr>
<td>Professor</td>
<td>Jeff White</td>
<td>Geochemistry</td>
<td>MSBII 412</td>
<td>5-0731</td>
<td><a href="mailto:whitej@iu.edu">whitej@iu.edu</a></td>
<td>SPEA</td>
</tr>
</tbody>
</table>

1. Only the listed phone number is needed when calling from on-campus; add 85 to the front to reach them from off-campus locations.
2. Add @indiana.edu to each of these emails to contact the person.

Please note that this list changes every year – please consult the updated directory information placed in student mailboxes at the beginning of the fall semester.
APPENDIX 2

ANNUAL REPORT FORMS FOR THE MASTERS DEGREE
APPENDIX 2: EXAMPLE ANNUAL REPORT FORM FOR THE M.S. DEGREE (page 1)

INSTRUCTIONS: Download this form from http://earth.indiana.edu/education/handbook.html
It should be completed and sent to the Graduate Services Coordinator no later than March 15th.

NAME: ________________________________________________________________

ANNUAL REVIEW OF M.S. DEGREE PROGRESS

Students are required to organize a brief meeting with their Advisory Committee at least once a year (before March 15) to ensure that they share a common understanding of course selections, and research activities, plans and goals.

To assist in this process, students should provide copies of the form, duly completed, to all committee members at least 24 hours prior to this progress meeting. After the meeting, a PDF of the completed and signed form should be submitted to the Graduate Services Coordinator (room 107). Information on this form and in the summary statement of research progress will be used by the Committee on Graduate Studies to help rank students for academic awards and financial support.

COURSEWORK CHECKLIST

<table>
<thead>
<tr>
<th>Graduate requirements:</th>
<th>Completed?</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ≥ 9 credit hours ≥ 500 level</td>
<td>☐</td>
<td>_________</td>
</tr>
<tr>
<td>2. ≥ 12 of the 22 hours of graduate course credits in Geological Sciences</td>
<td>☐</td>
<td>_________</td>
</tr>
<tr>
<td>3. ≤ 8 credit hours graduate transfer credit</td>
<td>☐</td>
<td>_________</td>
</tr>
<tr>
<td>4. ≥ 30 credit hours total graduate credit</td>
<td>☐</td>
<td>_________</td>
</tr>
</tbody>
</table>

Annual course load is 30 credit hours: 12 in Fall & Spring Semesters, 6 in Summer Session

RESEARCH PLANS

Program Options:

- M.S. students must complete:
  - ☐ Either a thesis (strongly recommended),
  - ☐ Or a research report

Provisional Thesis (or Report) Title:

Brief Outline (max, 1 page) of Research Objective & Strategies:
- Aims, field work, sampling, analytical methods, etc.

Summary of Immediate (3-6 months) Research Plans:
- Future activities, especially during the summer months
PROPOSED LONG-TERM RESEARCH PLANS AND TIMETABLE:
ANTICIPATED PHASES OF RESEARCH ACTIVITIES AND CONTINGENCIES

Timetable and Dates:
1. Annual Review: Date, time, and venue
2. Thesis Completion: Target dates for draft and final version. Provisional date for thesis defense.

Summary of Financial Support:
Indicate sources of support, e.g. Al (provide course #), RA (note funding agency & PI), Fellowship (give source, self, other grants (e.g. GSA, Sigma XI, etc.)

<table>
<thead>
<tr>
<th></th>
<th>Semester 1</th>
<th>Semester II</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RESEARCH PROGRESS

Summary of Progress
A summary statement, preferably a one-page synopsis, which documents the following items, should be appended to this form. Several of these details would typically be compiled for inclusion in a full curriculum vitae, which may also be appended to this report.

1. Research Activities: Summarize achievement during the past year in field work, in laboratory analyses, in data collection, and written reports.

2. Proposals and Contributions to Proposals: Document grant applications submitted for research or fellowship support, including title, funding agency, date of submission, duration, purpose, and amount of funding sought/awarded, and the current status (whether pending, accepted, or declined). A copy of the proposal should be provided. Comparable information should also be given for grant applications submitted by others, for example an advisor or collaborator, to which you contributed. In such cases a copy of the proposal summary should be provided.

3. Conferences and Short Courses: Give details of meetings, short courses or workshops attended, including their title(s), sponsoring organizations (e.g. GSA, AAPG), dates, location, and the source of any financial support enabling attendance.

4. Presentations: Provide a summary of any contributions to oral presentations or posters with information on the title, authorship, venue, date, and speaker (if applicable). Include a copy of the abstract, if available.

5. Publications: List all abstracts and papers, giving title, authorship, journal or book (e.g. conference proceedings or symposia), volume, pagination, and date of publication. Separately list comparable information for other manuscripts in preparation, submitted, under revision, accepted, or in press. Denote whether publications are peer-reviewed and provide copies of abstracts

6. Other Academic or Career Activities: Comment on any other relevant activities (e.g. internships) and on any awards received.
COMMITTEE REVIEW AND REMARKS

Coursework Status

Based on details documented in Coursework Summary.

1. Required Course. As determined by Advisory Committee:

2. General Requirements. Enter accumulated credit hours within each category.
   - ≥ 500 level Earth and Atmospheric Sciences (≥ 9h) □
   - Total Geol Sci. (≥ 20 h) □
   - Transferred grad. Credit (≤8 h) □
   - Total graduate credit (≥ 30 h) □

3. Options. Specify credit hours accumulated within chosen option.
   - Option A: Research (≤ 8 h) □
   - Option B: Research (≥ 3h) □

COMMITTEE COMMENTS

1. Assessment of Degree Progress and a numerical ranking of research progress on a scale of 1-5
   (1 = unsatisfactory; 2 = minimal; 3 = satisfactory; 4 = good; 5 = outstanding).
   Contents based on coursework & research activities:

2. Recommendations. Specific suggestions or requirements regarding degree progress.

3. Approval. Signatures designate agreement on course selection and research programs.

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Advisor</td>
<td></td>
</tr>
<tr>
<td>Advisory Committee member:</td>
<td></td>
</tr>
<tr>
<td>Advisory Committee member:</td>
<td></td>
</tr>
</tbody>
</table>

INSTRUCTIONS: Download this form from [http://earth.indiana.edu/education/handbook.html](http://earth.indiana.edu/education/handbook.html)
It should be completed and sent to the Graduate Services Coordinator no later than March 15th.
APPENDIX 3

ANNUAL REPORT FORMS FOR THE PH.D. DEGREE
ANNUAL REVIEW OF Ph.D. DEGREE PROGRESS

Students are required to organize a meeting with their Advisory Committee at least once a year (by March 15) – more frequent meetings are encouraged - to ensure that they share a common understanding of course selections, and research activities, plans, and goals.

To assist in the annual review process, students should provide copies of the form, duly completed, to all committee members at least 24 hours prior to this progress meeting. After the meeting, a PDF of the completed and signed form should be submitted to the Graduate Services Coordinator in the Graduate Services Office (room 107). Information on this form and in the summary statement of research progress will be used by the Committee on Graduate Studies to help rank students for academic awards and financial support.

COURSEWORK CHECKLIST

Graduate Requirements:                Completed?

1. ≥ 12 credit hours formal graduate credits in Earth and Atmospheric Sciences
2. ≥35 credit hours total formal graduate coursework
3. ≤30 credits of transferred graduate credit
4. ≥90 credit hours total graduate credit
5. Specified credit hours in minor (determined by minor advisor)

Annual course load is 30 credit hours: 12 in Fall and Spring Semesters, 6 in Summer Session

RESEARCH PLANS

Provisional Thesis (or report) Title:

Brief Outline of Research Objectives and Strategies:
   Aims, field work, sampling, analytical methods, etc.

Summary of Immediate (3-6 months) Research Plans:
   Future activities, especially during the summer months

Proposed Long-term Research Plans and Timetable:
   Anticipated phases of research activities and contingencies
APPENDIX 3: EXAMPLE ANNUAL REPORT FORM FOR THE PH.D. DEGREE (page 2)

Timetable and Dates:
1. Annual Review: Date, time, and venue
2. Qualifying Examination. Proposed date and time

Summary of Financial Support:
Indicate sources of support, e.g. Al (provide course #), RA (note funding agency & PI), Fellowship (give source, self, other grants (e.g. GSA, Sigma XI, etc.)

<table>
<thead>
<tr>
<th></th>
<th>Semester 1</th>
<th>Semester II</th>
<th>Summer</th>
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<td>Year 2</td>
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<tr>
<td>Year 4</td>
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</table>

RESEARCH PROGRESS

Summary of Progress
A summary statement, preferably a one-page synopsis, which documents the following items, should be appended to this form. Several of these details would typically be compiled for inclusion in a full curriculum vitae.

1. Research Activities: Summarize achievement during the past year in field work, in laboratory analyses, in data collection, and written reports.
2. Proposals and Contributions to Proposals: Document grant applications submitted for research or fellowship support, including title, funding agency, date of submission, duration, purpose, and amount of funding sought/awarded, and the current status (whether pending, accepted, or declined). A copy of the proposal should be provided. Comparable information should also be given for grant applications submitted by others, for example an advisor or collaborator, to which you contributed. In such cases a copy of the proposal summary should be provided.
3. Conferences and Short Courses: Give details of meetings, short course or workshops attended, including their title(s), sponsoring organizations (e.g. GSA, AAPG), dates, location, and the source of any financial support enabling attendance.
4. Presentations: Provide a summary of any contributions to oral presentations or posters with information on the title, authorship, venue, date, and speaker (if applicable). Include a copy of the abstract, if available.
5. Publications: List all abstracts and papers, giving title, authorship, journal or book (e.g. conference proceedings or symposia), volume, pagination, and date of publication. Separately list comparable information for other manuscripts in preparation, submitted, under revision, accepted, or in press. Denote whether publications are peer-reviewed and provide copies of abstracts.
6. Other Academic or Career Activities: Comment on any other relevant activities (e.g. internships) and on any awards received.
APPENDIX 3: EXAMPLE ANNUAL REPORT FORM FOR THE PH.D. DEGREE (page 3)

COMMITTEE REVIEW AND REMARKS

Coursework Status
Based on details documented in Coursework Summary

1. Required Courses. As determined by Advisory Committee

2. General Requirements. Enter accumulated credit hours within each category.
   - Total Earth and Atmospheric Sciences (≥ 12 h)
   - Total Graduate Credit (≥ 90 h)
   - Minor
   - Graduate Course Credit (≥ 35 h)
   - Transferred Grad Credit (≤ 30 h)
   - Research

COMMITTEE COMMENTS

1. Assessment of Degree Progress and a numerical ranking of research progress on a scale of 1-5
   (1 = unsatisfactory; 2 = minimal; 3 = satisfactory; 4 = good; 5 = outstanding).
   Comments based on coursework and research activities.

2. Recommendations. Specific suggestions or requirements regarding degree program.

3. Approval. Signatures designate agreement on course selection and research progress.

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Advisor:</td>
<td></td>
</tr>
<tr>
<td>Advisory Committee member:</td>
<td></td>
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<tr>
<td>Minor Advisor:</td>
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<tr>
<td>Student:</td>
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INSTRUCTIONS: Download this form from http://earth.indiana.edu/education/handbook.html
It should be completed and sent to the Graduate Services Coordinator no later than March 15th.
The University Graduate School has a comprehensive website informing students on the requirements for preparing theses and dissertations. Please review materials provided for completion of the research degree at: http://www.indiana.edu/~grdschl/index.shtml

These forms are available online:

M.S. APPLICATION FOR ADVANCED DEGREE

Ph.D. NOMINATION OF RESEARCH COMMITTEE

Ph.D. NOMINATION TO CANDIDACY

Ph.D. SCHEDULE AND ANNOUNCEMENT OF FINAL EXAMINATION (on OneIu)

Ph.D. COMMENCEMENT PARTICIPATION APPLICATION (on OneIu)

A GUIDE TO THE PREPARATION OF THESES AND DISSERTATIONS (on Graduate School website)

INSTRUCTIONS: Go to the Graduate School website to complete and submit the required forms.

https://graduate.indiana.edu/forms/index.shtml
AND
https://graduate.indiana.edu/theses-dissertations/deadlines.shtml
APPENDIX 4: EXAMPLE FORM FOR THE MASTERS DEGREE

APPLICATION FOR ADVANCED DEGREE UNIVERSITY GRADUATE SCHOOL

STUDENT: __________________________________________

Month in which you wish degree to be conferred ______________________________________
Please note that if this date changes you must notify the Recorder for your name to appear in the Commencement program (please initial here) _________.

Diplomas are mailed by the Office of the Registrar approximately three months after the degree is conferred.

CAMPUS ID NUMBER: _________________________ DATE OF BIRTH: ______________________

NAME ____________________________________________________________

Current Address ___________________________ Permanent Address _______________________

Street ____________________________________________________________

(City, State) ___________________ (Zip) __________________________

Local Telephone number (     ) __________________________ Email Address __________________________

Did you ever attend a regional campus for graduate credit? Yes_____No____
If yes, where and when ____________________________________________

Will you be transferring credit from another institution for this degree? Yes_____No____
If yes, from where and how many credit hours ____________________________

Have you ever been a Continuing Non-degree Student? Yes_____No____

Will you be continuing work for the Ph.D. at IU? Yes_____No____

Check appropriate boxes

Master of Arts Department/Program __________ Major __________

(     ) with thesis
(     ) with research skill (specify courses) __________________________
(     ) with language (specify language and how fulfilled) ______________
(     ) with essay, internship, or project
(     ) with exam (date completed) _________________________________

Master of Science Department/Program __________ Major __________

(     ) with thesis
(     ) with research skill (specify courses) __________________________
(     ) with language (specify language and how fulfilled) ______________
(     ) with essay, internship, or project
(     ) with exam (date completed) _________________________________

Master of Fine Arts Department/Program __________ Major __________

(     ) date of thesis show ________________________________
(     ) with thesis

Master of Arts for Teachers* Department/Program __________ Major __________

* Copy of Public Instruction Teacher’s License must be subject to the Master’s Recorder, Kirkwood Hall 111. Diploma will be sent to address on official University records. Please check your address at the Office of the Registrar, 408 N. Union Street, Bloomington, IN 47405
APPENDIX 4: EXAMPLE FORMS FOR THE Ph.D. DEGREE

THE UNIVERSITY GRADUATE SCHOOL
NOMINATION OF RESEARCH COMMITTEE FOR THE Ph.D.

Name of Student_____________________________________   Campus I.D_________________
Department_____________________________________    Birth Date______________________
Major  ____________________________________    Minor(s)____________________________
Date of Qualifying Examination  ____________________________________________________
Date of Enrollment in University Graduate School  _____________________________________
Proposed Dissertation Title  _____________________________________________________________________________________
____________________________________________________________________________________________________________

Dissertation Prospectus: Please attach a one-to-two page summary of the proposed research. If the research involves human subjects, animals, biohazards, biosafety, or radiation, please also attach an approval from the appropriate committee. Note: Your signature below indicates that you have read the attached prospectus and agree to serve, if appointed, on a committee to supervise this research.

NAME   SIGNATURE  DEPARTMENT    EMAIL
(Please type)
___________________    ___________________    ______________________     _____________
(Co-Chair of Committee)
___________________    ___________________    ______________________     _____________
(Co-Chair of Committee)
___________________    ___________________    ______________________     _____________
___________________    ___________________    ______________________     _____________
___________________    ___________________    ______________________     _____________
(Minor representative)

ALL COMMITTEE MEMBERS MUST BE MEMBERS OF THE UNIVERSITY GRADUATE SCHOOL FACULTY AND AT LEAST HALF MUST BE FULL MEMBERS.

I certify that I have examined the attached prospectus and that this committee is appropriate to supervise research in this area.

Signature/Department Chairperson___________________________Date___________

*To be used only by students who have passed the qualifying examinations and who have previously been admitted to candidacy.
APPENDIX 4: EXAMPLE FORMS FOR THE Ph.D. DEGREE

THE UNIVERSITY GRADUATE SCHOOL
NOMINATION TO CANDIDACY FOR THE Ph.D. DEGREE

Name of Student_____________________________________  Student I.D#_________________________________

Current Mailing Address ___________________________________________________________________________

Department______________________ Date of Enrollment in Graduate School______________ Birth Date_________

Date of Qualifying Exam ________________(mo/day/yr)  Date Candidacy Expires_____________________________

Total Graduate Credits Earned (Including Transfer Credits*)_____________________________________________

REQUIREMENT COMPLETION DATES

Academic Plan_____________________________________

Academic Sub-Plan_________________________________

Minor____________________________________________  Date _________/___________/________

Minor____________________________________________  Date _________/___________/________

__________________________________________________________________________________________________

This certifies that the above named student has passed the Qualifying Examination and is hereby nominated to candidacy for
the Ph.D. degree.

Advisory        _________________________________________
Committee       _________________________________________
Signatures      _________________________________________

Outside Minor _________________________________________
(Outside Minor Examination Passed)

OR  ________________________________________
(Outside Minor Examination Waived)

__________________________________________________________________________________________________

Chair or Graduate Advisor/Major Dept_________________________Date_________________________

Information Verified/PhD Recorder__________________________ Date_________________________

University Graduate School

Approved/Dean _________________________________________ Date_________________________

University Graduate School

*Do not submit this form to the University Graduate School until the transfer of credits from other institutions has been
approved.
Announcing the Final Examination of

__________________________________________________

For the
Degree of Doctor of Philosophy in Geological Sciences
Thursday, December 7th, 2012, 1:00 p.m.
Room GY338, Geology Building

Dissertation: Open System Magmatism, and the emplacement of the Partridge River Intrusion, Duluth Complex, Minnesota.

The Partridge River Intrusion (PRI) is one of several large, tholeiitic bodies that occur along the Western portion of the Duluth Complex in northern Minnesota. Mafic magmatism developed in response to intercontinental rifting at approximately 1.1 Ga. The intrusion is host to several Cu-Ni sulfide deposits that are found near the basal contact with metapelitic footwall (the Proterozoic Virginia Formation). The upper portion of the PRI is characterized by thick, unlayered, monotonous sequences of troctolite and augite troctolite. Thin (usually less than 5 meters in thickness) layers of melatroctolite and picrite occur at irregular intervals. Cu-Ni mineralization, and iron-rich units of ferrogabbro occur near the base of intrusion. The ferrogabbro units are also enriched in incompatible elements (P, Y, Ti), and are intercalated with troctolite.

Previous researchers have suggested genetic mechanisms to explain the chemical variations in the PRI that range from differentiation of a single magmatic pulse, to multiple inputs of chemically distinct magma. This study was conducted to evaluate and model the magmatic process involved during the emplacement of the PRI. Samples were selected from a drillcore located to the northwest of the major Cu-Ni sulfide body at the Babbitt deposit. The site was chosen to avoid discontinuities caused by the presence of metapelitic xenoliths of the Virginia Formation, which are common in the vicinity of the mineralization.

Ferrogabbro at the bottom of the intrusion was derived from an evolved melt of ferrodioritic composition, emplaced early in the history of the PRI. A later, more primitive troctolitic melt intruded the ferrogabbro. The main massive Cu-Ni mineralization is distinct, isotopically and compositionally, from the overlying disseminated mineralization, and was emplaced as a separate body, also early in the history of the PRI. Both the differentiated, ferrogabbroic melt and the sulfide melt which formed the massive mineralization evolved in one or more staging chambers in the shallow crust.

Outline of Studies
Major: Geology
Minor: Geochemistry

Educational Career
BS, Indiana University, 1983
MS, Indiana University, 1989

Committee in Charge
Professor Edward Ripley, Chair, Earth and Atmospheric Sciences (855-1196)
Dr. Lisa Pratt
Dr. Robert Wintsch
Dr. James Brophy

Approved: __________________________
Edward Ripley, Chair

(Any member of the Graduate Faculty may attend. As a courtesy, please notify the Committee Chair in advance).
APPENDIX 5
OUTSIDE COURSES APPLICABLE TO THE DEGREES
### APPENDIX 5: OUTSIDE COURSES

**Outside Courses**

(Note: This is not an exhaustive list, other subjects may be taken with permission of the Graduate Committee and the Graduate School. All students are advised to consult the Director of Graduate Studies if you want a course at the 400 level or below to count for graduate credit.)

<table>
<thead>
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<th>Mathematics</th>
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<tr>
<td><strong>Applied Mathematics</strong></td>
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<tr>
<td>M301 Linear Algebra and Applications</td>
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<td>M303 Linear Algebra for Undergraduates</td>
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<td>M311 Calculus III</td>
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<tr>
<td>M312 Calculus IV</td>
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<td>M343 Introduction to Differential Equations w. Applications I</td>
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<td>M415 Elementary Complex Variables w. Applications</td>
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<tr>
<td>M441 Introduction to Partial Differential Equations w. Applications I</td>
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<tr>
<td>M442 Introduction to Partial Differential Equations w. Applications II</td>
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<td>K310 Statistical Techniques</td>
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<tr>
<td>M360 Elements of Probability</td>
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<td>M365 Introduction to Probability and statistics</td>
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<td>M366 Elements of Statistical Inference</td>
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<td>M463 Introduction to Probability Theory I</td>
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<tr>
<td>M464 Introduction to Probability Theory II</td>
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<td>M466 Introduction to Mathematical Statistics</td>
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<td>M467 Advanced Statistical Techniques I</td>
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<td>E538 Statistics for Environmental Science</td>
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## APPENDIX 5: OUTSIDE COURSES

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<th>Computer Science</th>
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<td><strong>A304</strong> Introductory C++ Programming</td>
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<td><strong>A306</strong> Object oriented programming in C++</td>
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<tr>
<td><strong>A346</strong> User Interface Programming</td>
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<td><strong>C201</strong> Introduction to Computer Science</td>
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<tr>
<td><strong>C202</strong> Introduction to Software Systems</td>
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<tr>
<td><strong>C311</strong> Programming Languages</td>
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<tr>
<td><strong>C335</strong> Computer Structures</td>
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<tr>
<td><strong>C343</strong> Data Structures</td>
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<tr>
<td><strong>M371</strong> Elementary Computational Methods</td>
</tr>
<tr>
<td><strong>M471</strong> Numerical Analysis I</td>
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<tr>
<td><strong>M472</strong> Numerical Analysis II</td>
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<th>Physics</th>
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<tr>
<td><strong>P302</strong> Elementary Electronics</td>
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<tr>
<td><strong>P421</strong> Digital Electronics and Microprocessors</td>
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<tr>
<td><strong>P422</strong> Analog Electronics and Semiconductor devices</td>
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<tr>
<td><strong>P431</strong> Electronic Laboratory I</td>
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<tr>
<td><strong>P432</strong> Electronic Laboratory II</td>
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<td><strong>C315</strong> Chemical Measurements Laboratory I</td>
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<tr>
<td><strong>C317</strong> Equilibria and Electrochemistry</td>
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<td><strong>C318</strong> Spectrochemistry and Separations</td>
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<tr>
<td><strong>C364</strong> Introduction to Basic Measurements</td>
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<tr>
<td><strong>C501</strong> Chemical Instrumentation</td>
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<tr>
<td><strong>E515</strong> Vector-based Geographical Information Systems</td>
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<tr>
<td><strong>E526</strong> Applied Math for Environmental Science</td>
</tr>
<tr>
<td><strong>E536</strong> Environmental Chemistry</td>
</tr>
<tr>
<td><strong>E538</strong> Statistics for Environmental Science</td>
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### 400-Level Courses that Count for Graduate Credit

Within the Department of Earth and Atmospheric Sciences

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<tr>
<td>E406</td>
<td>Introduction to Geochemistry</td>
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<tr>
<td>E411</td>
<td>Invertebrate Paleontology</td>
</tr>
<tr>
<td>E413</td>
<td>Introduction to Earth Physics</td>
</tr>
<tr>
<td>E415</td>
<td>Geomorphology</td>
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<tr>
<td>E416</td>
<td>Economic Geology</td>
</tr>
<tr>
<td>E417</td>
<td>Optical Mineralogy</td>
</tr>
<tr>
<td>E418</td>
<td>Igneous and Metamorphic Petrology</td>
</tr>
<tr>
<td>X420</td>
<td>Regional Geology Field Trip</td>
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<tr>
<td>E423</td>
<td>Methods in Applied Geophysics</td>
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<tr>
<td>E427</td>
<td>Introduction to X-Ray Mineralogy</td>
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<td>X429</td>
<td>Field Geology in the Rocky Mountains</td>
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<tr>
<td>E451</td>
<td>Hydrogeology</td>
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