**Earth & Environmental Science
Masters Programs**

Student Handbook

**Master of Science in Applied
Geosciences**

University of Pennsylvania

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Introduction

The purpose of this handbook is to provide students in the Earth and Environmental Science Master of Science in Applied Geosciences (MSAG) Program with information vital to the successful completion of the program. In this handbook you will find information on academic requirements, recommended courses, program and University policies, and resources both inside and outside of Penn. This handbook is designed to provide general information and does not supplant official publications, University web pages, or regular meetings with your adviser. *You should plan to meet with your academic adviser at least once per semester to discuss your progress and course selection*. In addition, should you have questions that are not answered here or problems that you cannot resolve, you should consult your adviser or the MSAG Director immediately.

Student Responsibility

While advisers, faculty, and staff will assist the student in every aspect of their graduate study, it is the **responsibility of the student** to ensure that all steps and necessary paperwork have been completed and submitted to the Program Director and or LPS as appropriate. Grant proposals, awards, accepted publications and other records of achievement should be reported to the Program Director.

I.   Program Overview

The Master of Science in Applied Geosciences (MSAG) is a 12-CU graduate online program at the University of Pennsylvania designed to prepare students to enter various geoscience professions.

The program prepares students to enter into careers as professional geologists or technical specialists. As a culminating exercise, students must complete a capstone that demonstrates their ability to define a project, develop appropriate methods, complete research, and present the results in a clear and concise manner. Most MSAG students select a format for this project that represents the geoscience sector in which they currently work or in which they aspire to work.

Students can study in the MSAG program part-time or full-time and take online courses pre-approved by the student's academic adviser. All students are expected to complete their degree in no more than four years. Students needing additional time to complete their degree must petition the Faculty Advisory Committee for permission to continue beyond the four-year rule (see Section V. Course Registration Procedures).

Relationship within the University

The Masters Programs in Earth and Environmental Science are housed in the School of Arts and Sciences (SAS), are overseen by the Director of Professional Masters Programs in Earth and Environmental Science, and located in the Department of Earth and Environmental Science. The programs are administered through the College of Liberal and Professional Studies (LPS), SAS's division of continuing education. The program schedules specially designed online courses that are taught by members of Penn's standing faculty, affiliated Penn faculty, and experienced environmental professionals.

MSAG students are eligible for Penn services available to other online graduate students with the same enrollment status (part-time or full-time). Full-time students are enrolled in three or four CUs per semester while part-time students are enrolled in one or two CUs per semester. Students are permitted to change their status from full to part time and vice versa at any point in their career without seeking prior permission.

II.   Curriculum

Students are required to complete a minimum of 12 CUs of graduate level course work for the MSAG program. Students must take nine required courses, three electives, and complete a Masters level Capstone or "Technical Paper" positively evaluated by two readers in order to earn an MSAG degree.

Required Courses (9 CUs)

- EESC 5200 Aqueous Geochemistry
- EESC 5630 Hydrology
- EESC 6620 Environmental Groundwater Hydrology
- EESC 6770 Geocomputations
- EESC 6810 Applied and Environmental Geophysics
- EESC 6820 Geomechanics
- EESC 6840 Engineering Geology and Applied Structural Geology
- EESC 6850 Advanced Engineering Geology
- EESC 6998 Project Design

Elective Courses (3 CUs)

Students choose three CUs of electives from the list below in consultation with their academic adviser. You can find your academic adviser on Path@Penn.

- EESC 5704 Geologic Field Methods

- EESC 5720 The Role of the Environmental Professional in Managing Contaminated Site Liability

- EESC 6606 Fate and Transport of Pollutants

- EESC 6664 Field Study of Soils

- EESC 6711 Contaminated site investigation, remediation and long-term stewardship

- EESC 6715 Water Resources for Geologists and Environmental Scientists

- EESC 6720 Landslides

- ENVS 5706 Modeling Geographic Objects

- ENVS 5716 Modeling Geographic Space

Capstone Requirement

The Capstone research is the culmination of the MSAG student's career. The Capstone directly relates to the student's goals for the program. It is not necessary that the work be publishable in a scholarly journal, although this is highly encouraged. Students are expected to submit their capstone proposal and reader candidates as part of the Project Design capstone course EESC 6998. For full-time students, this course should be taken in the first year of their program; for part-time students, this course should be taken in the second year of their program. Students should plan to spend a minimum of one year on the research and writing of the capstone.

The Capstone topic, methodology, and scope of work is developed in the Project Design Seminar EESC 6998 and the final product of that course is a Capstone Proposal. The proposal and selection of readers must be approved by a faculty committee before the student begins the research project. Approval by capstone readers and/or the student's academic adviser is not sufficient to begin research. Final capstone papers submitted without a faculty committee approved proposal will not be considered as fulfilling the final requirement for graduation.

Once the capstone proposal is approved, the student will be placed in a Capstone Group based on planned graduation date and regular check-ins will be required. Failure to complete check-ins on time will result in an academic warning and may delay graduation.

The Capstone length varies depending on the scope and format agreed upon by the student and the Capstone readers. Although there are no set guidelines for Capstone projects, the capstone should document the student's ability to:

- Identify a geotechnical, hydrologic, or environmental problem or issue that would be encountered in professional practice

- Design a protocol to address this question

- Acquire the data necessary to clarify, if not resolve, the question

- Critically assess the quality of the data acquired

- Draw defensible conclusions from those data

- Communicate this process and conclusions to professional colleagues with clarity and precision

In addition to the final written Capstone, students are required to create a poster detailing their work. Capstone readers must evaluate and approve both the capstone paper and poster in order to complete the requirements for graduation.

Field Opportunities

Students who plan to apply for Professional Licensure in Pennsylvania are required to take a field methods-based course during their academic career. This requirement varies with state so be sure to check the requirements for your state early in your academic career. Students who did not take a field course in their undergraduate career can take *EESC 5704 Geologic Field Methods* to fulfill this requirement. In addition, we offer *EESC 6664 Field Study of Soils*. Both courses are based on campus as a one-week intensive summer course. Travel to Philadelphia is required for these courses at the student's expense.

III.   Program Policies

Academic Standards

Students in the MSAG program are expected to maintain the highest possible academic standards. To assure that students are making satisfactory progress toward their degree, the program reviews student performance every semester, but it is the student's

responsibility to ensure that courses taken count toward the degree. Thus, it is vital that students meet with their academic adviser every semester to ensure that they are on track to graduation. The Earth & Environmental Science Faculty Advisory Committee (FAC) has adopted the following requirements for MSAG students as they progress toward their degrees:

- Students must take all courses that will count towards the MSAG degree requirements for a letter grade. Pass/Fail or Audited courses are not counted toward the degree. The letter grades of "S" or "U" also do not count toward the degree.

- Students must maintain a 3.0 cumulative GPA average in order to be in good standing and to graduate.

- Only one grade below a "B-" and no grade below a "C" will be accepted toward fulfillment of the 12 CU's required to complete the program.

- Students must make satisfactory progress on the capstone project including: obtaining approval for their capstone project proposal in the first year of the program, completing scheduled check-ins, submitting drafts on schedule, and obtaining a positive evaluation on the final capstone paper and poster from two approved readers.

Students who receive a grade in a course below a "C" or have more than one grade below a "B-" will be reviewed by the FAC and placed on academic probation. With the permission of the FAC, students may take additional courses in order to increase their GPA or to fulfill requirements in courses where the student received a grade below a "C". In the case where the same course is taken again to meet the academic requirements of the program, both courses and grades appear on the transcript, but only the second course's CU contributes to the total number of CU's to graduate and only the grade for the second course is included in the cumulative GPA. Students on Academic Probation must work with the Program Director to develop an academic plan to facilitate student success; students will not be allowed to register for courses during their academic probation without an approved plan in place.

Program Dismissal

Students who do not meet the terms of academic probation are subject to dismissal from the program. At the end of each semester, the FAC will review the academic progress made by candidates for academic dismissal and decide whether to remove the student from academic probation, continue academic probation, or dismiss the student from the Program. If the Committee decides that the student is unlikely to successfully complete

their degree program, the student will be sent an academic dismissal letter via email and U.S. mail.

Inactive Status

Students who do not enroll in courses for four consecutive terms, including summer, will be considered inactive and will be automatically withdrawn from the program during the fourth term. Students who are withdrawn will be required to apply for readmission to the program. Standard application fees will apply.

Incomplete Grades

An incomplete grade indicates that a student has not completed all the work in a course and has done so with the instructor's permission. An instructor who chooses to grant an extension to a student who has not completed a course by the end of the term may grant either an Incomplete (I) or choose not to submit a grade (NR or GR). An Incomplete (including I, GR, and NR) must be made up within the first four weeks of the start of the next term (including the summer term). In either case, if the Incomplete is not made up by the deadline, it will become an F. An Incomplete is made up only when the official grade is received by the LPS Office and recorded by the Registrar's office on the student's official transcript. Once an Incomplete grade is converted to an F, the instructor may not change the grade even if the student has completed all required work. Students with two or more Incomplete grades are subject to registration hold and are required to meet with the MSAG Director to explain the circumstances of the Incompletes and develop a plan to resolve them. Students with two or more outstanding grades of incomplete will not be allowed to register for courses; students with two or more outstanding grades of incomplete who have already registered will be dropped from courses.

The student's eligibility for student loans will be affected by Incomplete grades and students may not be eligible for additional loans or aid until the Incomplete grades are cleared.

Academic Grievances

Evaluation of a student's performance in a course is the responsibility of the course instructor. Should a final grade in a course be disputed, the student must submit a written appeal to the instructor within the first two weeks of the academic semester immediately following the semester in which the grade was received. The instructor must respond in writing to the student within two weeks of receiving the written appeal. If, after receiving

the written response from the instructor, the student still believes that the grade has been unfairly assigned, the student must submit a written appeal to the EES Faculty Advisory Committee. If the Committee believes the appeal demonstrates evidence of negligence or discriminatory behavior, a sub-committee will be formed to review the student's appeal and make a recommendation to the full Academic Committee. The School of Arts & Sciences and the Provost's Office have policies governing academic grievances. Students should consult these for additional information about the grievance procedure.

SAS policy for graduate students' grievances: https://www.sas.upenn.edu/graduate-division/resources/academic-grievance-procedure

Penn Provost's information on Academic Grievances:
https://catalog.upenn.edu/pennbook/student-grievance/

Leave of Absence

Students may take time away from their studies for a wide variety of reasons that include, but are not limited to:

- Manage a medical concern
- Fulfill a family obligation
- Pursue career-related opportunities
- Complete military service
- Work on a political campaign

While interrupting studies to take time away may seem intimidating, a leave is a means to the successful completion of a degree, not a barrier to graduating. More than three quarters of students who take a leave return to complete their degree within two years.

Students considering a leave should take time to think carefully about their goals for their time away and for when they return. Speaking with the MSAG program director is an important first step. Depending on your circumstances you should get advice from other sources as well. Students taking time away in order to manage a medical condition should discuss the leave with their healthcare provider. Your MSAG program director will help you connect with other campus resources as you prepare to take a leave of absence, such as Student Financial Services.

Students typically take a leave for a full academic year. Individual circumstances may require more or less time. Students on leave should remain in contact with their MSAG program director and update them about changes in plans. The return from leave process supports students in a successful re-entry to academic life at Penn. When preparing to

return, students must consult their MSAG program director to develop a plan that includes connection with appropriate resources.

Leave of Absence: Policies and Processes

Requesting a Leave of Absence

- Students must meet with the MSAG program director to discuss a leave request.
- The student must submit a written request for leave of absence, detailing the reasons for the desired leave.
- The leave request will be evaluated by the Program. If the request is approved, the Program will stipulate conditions that must be met by the student before returning from leave.
- The student will be notified with the result of the leave request. The Program may deny any request for leave. In granting leaves, the decision of the Program is final.
- A student on leave may not be enrolled in Penn classes or "sit-in" on Penn classes and will not receive credit for classes taken elsewhere during the leave. In addition, a student may not participate in and/or hold a leadership position in a registered University organization.
- Discontinuance of study without permission from the University does not constitute a leave of absence. Students who have requested a leave of absence for a given semester may still be dropped from the University rolls if their previous term's grades qualify them for this action.

Checklist: Leave of Absence or Withdrawal

Once a leave of absence or withdrawal has been approved, or the student has been dropped, that action will be posted to the student's transcript. The student's PennCard will be deactivated as soon as the leave, drop, or withdrawal has been processed. The student is responsible for completing the steps outlined below:

(i) Notifications

Students must notify all relevant offices of their leave or drop. These offices may include the following, if applicable:

- [Student Registration and Financial Services](#)
- [Student Health Services](#)
- [The Center for Community Standards and Accountability](#)

(ii) While Out

During the term of the leave or drop, students may call the MSAG program office if they have any questions. Students must be aware of the conditions for return outlined in their leave of absence letter, since they will be required to fulfill them before they may re-enroll.

(iii) Applying to Return

Students must apply to return from leave by the relevant deadline (for the fall semester, July 15; for the spring semester, November 15; for the summer, April 15). At that time, they must fill out a request to return from leave form and show that they have fulfilled all of the conditions for return as outlined in their original letter from the MSAG program. To begin this process, they should contact the MSAG program Director well in advance of the deadline. Any return request submitted to the program director later than the above deadlines may be denied. Timely submission of requests and documentation is a condition of all leave returns.

The standard length of an LPS leave of absence is one year. Students may request an early return from leave after one full semester on leave but should bear in mind that this request may be denied.

Deferred Enrollment

The College of Liberal and Professional Studies does not offer an admission deferral option. All offers of admission are valid only for the specific term to which you have been admitted. If you are unable to enroll for the term offered, you will need to re-apply for admission to a future term.

Transfer Credit

Students who enter the MSAG from Penn's Post-Baccalaureate Undergraduate Studies or Non-Traditional Graduate program may count *up to 4 graduate level* courses towards their MSAG degree. These courses must be submitted to the Faculty Advisory Committee for approval during the first semester of matriculation in the MSAG. Only courses appropriate to the student's degree program will be considered for approval.

Students who enter the MSAG from another graduate program at the University of Pennsylvania for which they did not complete the program may count up to 4 graduate-level courses toward their MSAG degree. These courses must be submitted to the committee for approval during the first semester of matriculation in the MSAG program.

Only courses appropriate to the student's degree program will be considered for approval. Courses from completed degrees are not eligible for transfer.

Students who enter the MSAG from an incomplete graduate program at another university may *count up to 2 graduate-level* courses towards their MSAG degree. These courses must be submitted through the [X-CAT online form](#) for approval during the first semester of matriculation in the MSAG program. Only courses appropriate to the student's degree program will be considered for approval.

Students who enter the MSAG from either of the Applied Geosciences Graduate Certificates may transfer *all 4 CUs* into the MSAG degree program. Likewise, if students have taken graduate courses through the Applied Geosciences Course-Taking options then *up to 4 CUs* may be transferred into the MSAG degree program.

Additional Notes:

- Students may not transfer a course that they have taken as part of a completed degree program.

- No course taken as part of an undergraduate program may be transferred into the MSAG.

- Transferred courses must have been taken in the last 5 years.

Courses taken outside of the University of Pennsylvania during a student's matriculation in the MSAG program are not eligible for transfer credit.

Financial Aid

Tuition Support

MSAG students are not eligible for university-based fellowships or scholarships. United States citizens or permanent residents are eligible to apply for federal subsidized student loans through Penn's Office of Student Financial Services: https://srfs.upenn.edu/sfa. Full-time students (taking three CUs or more in a semester) and part-time students (taking two CUs in a semester) may be eligible for these subsidized student loans and should fill out a FAFSA form to determine eligibility. International students are not eligible for these US government subsidized loans. Students may seek outside scholarship support or tuition benefits from their employers.

Research Support

The MSAG program has limited funding available to support costs incurred during the conduct of student research. These funds are awarded on a competitive basis and are

available for equipment and lab fees associated with the student's research. Awards are typically on the order of a few hundred dollars. In addition, MSAG students may apply for funds to present their research at a conference or scientific meeting.

To be eligible for research funds through the MSAG program, students must identify an adviser who will work with them on the research project. Students must be in good academic standing. Students with Incompletes (I) or unreported course grades (NR or GR) are not eligible for these funds. Proposals (including a detailed budget) are accepted on an ongoing basis. Forms are available on the *Canvas MSAG Program Community* under "Forms."

Students applying for funds to cover expenses associated with an oral or poster presentation at a conference or meeting must submit a copy of the accepted abstract, the notice of acceptance of that abstract, and a budget of the costs associated with travel to the conference. There are no deadlines for these requests, but students must submit materials at least 4 weeks prior to travel to allow for processing of such requests.

Computational Systems and Generative AI

In light of the growing use of computational systems (such as AI, Chatbots, and LLMs) to generate text for student assignments, the College of Liberal and Professional Studies releases the following statement:

Computational systems which may be classed as Chatbots, Large Language Models (LLMs), Artificial Intelligence (AI), or generative AI (gAI) may or may not be approved for use by individual instructors. Some instructors may permit use of these systems in a given class; If they do so, they will specify when, where, and how it is to be used and any restrictions about the specific tools permitted. In the absence of these specifications, students should assume that use of such tools will be considered a violation of Penn's Code of Academic Integrity and suspected use will be reported to the Center for Community Standards & Accountability.

Computational systems which fall under this statement include, but are not limited to, ChatGPT, GPT-4, BingChat, Claude, goblin.tools, and Grammarly.

IV. Designing Your Program

Student Advising

Each student entering the MSAG program will be assigned an academic adviser. That academic adviser will guide the student through the initial course registration and

program introduction as well as throughout their academic career in the MSAG. Students will meet with their adviser and define a plan for the remainder of their MSAG career.

Students should meet with their academic adviser at least once a semester (usually during Advance Registration) to discuss their program progress and choose courses for the following semester. Students should use the student planning worksheet available on the *Canvas MSAG Program Community* to choose courses each semester and ensure that all degree requirements are fulfilled for graduation.

Course Selection

Prior to Advance Registration each semester approved lists of courses from the MSAG program will be posted on the *Canvas MSAG Program Community*. Departmental web pages often include course descriptions as well. Additionally, the Appendix of this handbook includes course descriptions. The Course Timetable appears in March and October and may be viewed online at https://srfs.upenn.edu/registration-catalog-calendar/timetables/main. Finally, Path@Penn allows students to search for courses online using keyword searches. If a student selects a course that does not appear on the approved lists on the *MSAG Program Community*, they must seek approval from their adviser as it may not be acceptable for the program.

V.   Course Registration Procedures

Advance Registration

The course registration process involves two registration periods. The first is *Advance Registration* during which students enter their requests for courses they wish to take. Students are encouraged to register during this period so that they have the best chance of getting into the courses they prefer. At the end of Advance Registration, a scheduling program processes all registration requests at the same time to determine who is enrolled in the courses that have been requested. Students will then be able to view their courses online to see which courses they have actually been enrolled in. Students may advance register during a two-week period starting in late March for the following summer and fall terms and during a two-week period in early November for the following spring term Check the LPS website (https://www.lps.upenn.edu/about/academic-calendar) and/or the Registrar's website for the exact dates for Advance Registration.

Regular Registration

The regular registration add/drop period opens approximately three weeks after the advance registration request period has closed and students have been notified of their schedules. During the regular registration period students know immediately whether or not they will be able to enroll in the course they are requesting. Students must register for courses through Path@Penn (online registration). Registering through Path@Penn requires the use of a personal computer and access to the web and is the only method of registration.

To access the system, students must have a PennKey. To establish a PennKey, go to http://www.upenn.edu/computing/pennkey/ and follow the steps there. *Note: A Set-Up Code will be emailed to each new student to set up a PennKey.*

Some important information to remember when registering for courses:

- Check with your academic adviser to be sure the course for which you are registering fulfills a requirement for your degree.
- Courses must be taken for a normal letter grade in order to count toward the MSAG degree. "Pass/Fail" or "Audit" are not acceptable options.
- Only courses numbered 5000 and above may count toward the degree (the first set of three digits after the course subject is the course number -- e.g., EESC 6011 690 but **not** EESC 1106 601).
- Full-time students should enroll in 3 or 4 CUs. Students are not permitted to enroll in more than 4 CUs per semester.
- Part-time students should enroll in 1 or 2 CUs per semester.

Independent Study Courses

Students interested in pursuing an individualized study project should obtain a "Request for Independent Study" form from the *Canvas MSAG Program Community*. The student should then approach a faculty member and obtain agreement from them to direct their project. It is the responsibility of the student to define the individualized project. Students should not approach a faculty member and request that they define a project for the student. Students must obtain the appropriate signatures from faculty member and the Director of the MSAG program, who will then set up the Independent Study course once approved.

Independent Study Courses may not duplicate other courses offered during the same semester. Students should bear in mind that faculty members are not required to supervise an Independent Study course. MSAG students may register for up to two

Independent Study courses during their career. ***NOTE: Internships cannot be counted for Independent Study credit.***

Auditing Courses

MSAG students may audit courses with the permission of the course instructor. However, they will be charged tuition and fees at the MSAG tuition level. Audited courses will appear on the student's transcript, but no grade will be issued, and the course will not count toward the 12 CUs needed to complete the program. Most courses are open to auditors on a space-available basis.

Course Changes

MSAG students are subject to LPS registration and add/drop deadlines which may be different than deadlines for other schools and departments. Students should consult the current LPS Course Guide or the LPS website for deadlines for making registration changes and corresponding financial obligations (https://www.lps.upenn.edu/about/academic-calendar). Students can make these changes in Path@Penn. Adherence to LPS deadlines is strictly observed. Should students need to drop or withdraw from a course beyond the deadline, they should petition LPS (https://srfs.upenn.edu/registrar/forms). It may be necessary to provide documentation of the situation that necessitates the drop or withdrawal, particularly if the student is requesting a refund of tuition.

Adding a Course

Students may add a new course through the second week of the semester. After that it is not possible to add a course. Students may add a course during the first two weeks of the semester via Path@Penn.

Dropping a Course

Students may drop a course with no financial obligation until the published add/drop deadline posted on the LPS Website (https://www.lps.upenn.edu/about/academic-calendar), typically two weeks into the semester. Students may also drop a course between the second and fourth weeks of the semester, but in so doing they will incur a 50 % financial obligation for the tuition and fees for the dropped course. Absence from class does not constitute a drop, nor does notifying the instructor. Students can officially drop a course through Path@Penn through the second week of the semester. After the second week of the semester, students must submit a Withdrawal Form online. When

making registration changes via Path@Penn, it is always advisable to double check to make sure the changes have taken effect before logging-out. Students may also want to contact the MSAG department or their academic adviser to confirm that the dropped courses are no longer on their schedules. Students who fail to drop a course officially may receive a grade of F and will be required to pay the full tuition rate.

Changing Grade or Credit Status of a Course

All MSAG courses must be taken for a letter grade. However, students may register for courses that they do not want to count for their program on an audit or Pass/Fail basis. Before doing so, however, they should discuss this with their MES academic adviser. Once they have done so, students may change their status in a course from credit to audit, from a letter grade to Pass/Fail or from Pass/Fail to a letter grade until the published deadline on the LPS website (approximately four weeks into the term). No change is permissible after the published deadline. Auditors pay full tuition and fees.

Withdrawing from a Course

Students may withdraw from a course after the deadline to drop a course has passed (approximately four weeks into the term). To withdraw, students must submit a Withdrawal Request (https://srfs.upenn.edu/registrar/forms). Normally, permission is granted and a W (withdrawal) is recorded on the transcript. After the published withdrawal deadline, students are permitted to withdraw only under extraordinary circumstances, which must be documented. Students who withdraw from a course have full financial obligation, except in documented cases of illness, military service, or other extraordinary circumstances, when they may petition for a 50 percent refund.

Note: Dropping a course is not identical with withdrawing from a course. Withdrawing from a course takes place after the sixth week of class and carries with it full financial obligation. In addition, the student's transcript will read "W" (Withdrawal) next to the title of this course. However, if a student drops a course during the normal Add/Drop period, no record of that course will appear on the transcript and there is no financial obligation.

Masters Thesis Registration

MSAG students who have completed all course work toward the degree, but have not completed their Capstone project, will need to enroll in the non-credit Masters Thesis course EESC 9900 for every subsequent semester until the Capstone is complete. This

includes summer semester, thus if a student does not complete their capstone in May, they must enroll in Masters Thesis in Summer 11-Week. If the capstone is not completed by August, the student must enroll in Masters Thesis for the Fall. The cost of thesis registration is less than the cost of a regular course and keeps the student status active. Students enrolled in Masters Thesis have access to the library and other systems. Should a student wish to extend Masters Thesis registration beyond two semesters, they must receive permission from the MES Faculty Advisory Committee. Students not completing the program requirements after two semesters of Masters Thesis may be withdrawn from the program for lack of progress towards degree.

Student Status

Students with loan requirements should be aware of their student status. Students are considered full-time if they meet one of the following criteria:

- Student is enrolled in three or four CUs in a single semester

- Student is enrolled in Masters Thesis: EESC 9900

If a student is enrolled in two or fewer CUs in a single semester (other than Master Thesis) they are considered part-time.

Time to Completion

Master of Science in Applied Geosciences students may enroll on either a part-time or full-time basis. Time to completion will vary depending on how many CUs are taken each semester and whether summer classes are taken. Full-time students can complete the program in two years, taking three or four CUs per semester. Part-time students typically complete the degree in three years, taking one or two CUs per semester. Students are expected to complete their degree in four years or less. Students needing additional time to complete their degree must petition the Faculty Advisory Committee for permission to continue beyond the four-year rule. In addition, students may not be on Masters Thesis EESC 9900 for more than two semesters. Students not completing the program requirements after two semesters of Masters Thesis may be withdrawn from the program for lack of progress toward degree.

VI. Capstone and Graduation Procedures

Faculty Readers

Two faculty readers are required for the Capstone Project: one designated as the primary reader and the other as the secondary reader. The primary reader will work with the student to plan and carry out the proposed Capstone. The Primary Reader works with the student on a regular basis to complete the project and ultimately approve the final Capstone project. The secondary reader will evaluate drafts of the Capstone project, though they may also be involved in formulating the project. The primary reader must be an expert in the Capstone topic; the secondary need not be.

At least one capstone reader must be a Penn standing faculty or lecturer, while the other reader may be drawn from outside of Penn. Readers from outside of Penn must be academically engaged in the student's Capstone topic. Professors from local universities have served as Capstone readers, as have adjunct faculty members and lecturers. In general, students choose faculty readers from among the professors they have had within the MSAG program.

Students will identify a reader during the EESC 6998 Project Design Seminar course under the guidance of the course instructor. All readers must be approved by the MSAG Faculty committee before they are asked by the student to work on the project.

Students will meet with their committee (both the primary and secondary reader) once per semester, including the Summer semester, from when their proposal is approved until the capstone is completed. Students are responsible for setting up these committee meetings, including providing agendas. Committee meeting forms must be completed by all members (the student, primary reader, and secondary reader) following each meeting. The link to these forms is available on the *MSAG Program Community* on Canvas.

Registering for Project Design

All students are required to take EESC 6998 Project Design. For full-time students, this course should be taken in the first year of their program; for part-time students, this course should be taken in the second year of their program. In that course students will write the proposal prior to the student beginning their research work.

Writing the Project Design

The Project Design may take one of two forms: an extended traditional academic research paper or a professional technical paper. Details of expectations for the Project Design proposal and project, including a timeline for completing the project, are available on the

Canvas MSAG Program Community capstone group once the student's proposal has been approved in the EESC 6998 Project Design Seminar course.

Academic Integrity and Generative AI for your Capstone

Students are expected to be familiar with and comply with Penn's Code of Academic Integrity, which is available in the [Pennbook](). This program has a zero-tolerance policy for cheating or plagiarism, and all violations will result in substantial penalties. If you have any doubts or questions about what constitutes academic misconduct, please do not hesitate to contact your advisor.

Generative AI creates text, images, computer code, and more in response to user prompts. These programs are used for a variety of purposes and in academic settings are often used to generate ideas, create content, and edit work to improve writing clarity. However, these programs are tools and should only be used as such; they should not replace your own creativity and independent thinking.

These tools can be helpful for brainstorming when you are developing ideas for your capstone research. However, the final products of the capstone (thesis & poster) should reflect your own independently attained understanding, analysis, and synthesis of the project work. You may not submit any work generated by an AI program within your capstone thesis or poster. If you use AI as part of your prep work, you are required to disclose its use and appropriately cite all sources. You should also be mindful that AI programs will not necessarily give the best explanation or answer to your questions, and often the material(s) generated may be inaccurate, based on outdated information, or completely fabricated.

Using AI should supplement your learning experience, not replace your intellectual work. Your capstone research, and the effort taken to synthesize this work into a thesis and poster, are an essential part of your intellectual and professional development in environmental studies.

Incomplete Capstones and Masters Thesis Registration

Students who fail to complete their project by the end of the semester, must remain active students in all subsequent terms in order to complete their MSAG program and graduate. In brief, the final capstone product is due to the Capstone Readers approximately two weeks prior to the evaluation deadline (students should check with their readers to see if they will need additional time for grading). Any students who have not had their final Capstone and poster evaluated by both readers by that semester's deadlines will be required to register for EESC 9900 Masters Thesis in the subsequent

semester and for each and every semester thereafter until the completed and approved Capstone is submitted to the MSAG Program. Note: EESC 9900 may only be repeated twice (see *Masters Thesis Registration* section above about limitations for this course).

In addition to the requirements for enrollment in each term during which students continue to work on the research project, graduation posting will also be affected. Students must reapply online for graduation in the semester during which they plan to complete their research. Thus, if a student does not complete the capstone in the semester in which they originally applied, they must re-apply for graduation in the next semester. The student's graduation date will be posted for the semester in which they complete their project and receive passing evaluations, not the semester in which the student originally intended to graduate.

VIII.   University Policies and Resources

The Pennbook (https://catalog.upenn.edu/pennbook/) is a collection of policies that relate to student life at the University of Pennsylvania. These policies govern academic activities such as grading and exams, provide guidance on the use of campus resources, and explain expectations for membership in the university community.

Enrollment Status

MSAG students who are enrolled for three or four CUs per term are considered full-time students and will be billed the full general fee. This fee covers access to many of the services described below. MSAG students enrolled in one or two CUs per term are considered part-time students. However, students enrolled in the Masters Thesis EESC 9900 are considered full-time.

Student Identification

Once a student is enrolled at Penn, a student ID number (PennID) will be issued; this ID is used for registration and other transactions throughout the University. Never give out your social security number via email or fax. Once matriculated, students should never give out their entire social security number; the PennID number or the last four digits of your social security number are all that is necessary.

PennCard and PennCard Center

If you are going to be on campus you will need a photo PennCard to access buildings. The PennCard is the official University of Pennsylvania identification for students, faculty, and staff. The PennCard provides access to university facilities, services, cash convenience and more. To obtain a PennCard, students should bring a valid form of photo ID (driver's license, passport, etc.) to the PennCard Center, located on the 2nd Floor of the Penn Bookstore, 3601 Walnut Street. Appointments for obtaining a PennCard can be scheduled at: https://penncard.business-services.upenn.edu/. Only active students registered for courses in the current or upcoming term may receive a PennCard, which should be carried at all times on campus.

PennKey

A PennKey is required to authenticate, or verify, an individual's identity for many of Penn's networked computer systems and services. Authorized users need a PennKey and password to access such resources as Path@Penn (course registration), Canvas (used in most classes, https://canvas.upenn.edu), certain library resources, and public campus computers. A PennKey is also required to obtain a Penn email address. New students should receive either a letter or an email with information on how to create a PennKey and password within a few days of their admission to the MSAG. For further information, see: https://pennkeysupport.upenn.edu/

Path@Penn

https://path.at.upenn.edu/

Path@Penn provides secure access via the Internet to online course registration, class schedules, academic records, future academic planning, billing, financial aid application status and awards, address corrections and updates, and student health information. A PennKey is required to access Path@Penn.

Email

https://computing.sas.upenn.edu/help/students/email

All students enrolled at the University of Pennsylvania are eligible for a Penn email address free of charge. Even if the student plans to use a non-Penn email account, they should also establish a Penn address. The MES program will send out program information to this address and also contact students with important information through this system. Course instructors will be given this address as well and will expect to contact students in

this way. Should students wish, they may forward email from their Penn address to another account through Penn's webmail site. Instructions on how to create and use a Penn email account are available through the SAS Computing website above. Students can arrange to forward email from their Penn account to another account at this website.

Academic Support Services

Weingarten Learning Resources Center

https://weingartencenter.universitylife.upenn.edu/   215-573-9235

220 South 40th Street, Suite 260

Provides professional consultation services in skills such as academic reading, writing, study strategies, and time management. This academic support is provided through a variety of services and programs including the very popular series of study skills workshops offered at the beginning of each fall and spring term for students. Consult their website for specific dates and times for these workshops or for more information.

Student Disability Services (SDS)

https://weingartencenter.universitylife.upenn.edu/disability-services/

215-573-9235 or TDD 215-746-6320

Stouffer Commons, 3702 Spruce Street, Suite 300

The Weingarten Learning Resources Center houses the Office of Student Disabilities Services (SDS), which provides comprehensive professional services and programs for students with disabilities to ensure equal academic opportunities and participation in University-sponsored programs. Reasonable accommodation to a qualified student's known disability may be provided to assure equal access. Penn invites students with disabilities to self-identify at any time during their course of study as enrolled students. Although the self-identification process is confidential and completely voluntary, it is required for those requesting accommodation.

Student Financial Services (SFS)

https://srfs.upenn.edu/contact   215-898-1988

100 of the Franklin Building at 3451 Walnut Street

Student financial aid, including applications and disbursement of money, are handled through SFS. Call or visit the website for deadlines and procedures.

Penn Bookstore

https://www.facilities.upenn.edu/maps/locations/bookstore-university-pennsylvania

36th St. and Walnut St   215-898-7595

The Penn Bookstore carries textbooks and trade books as well as stationery, art supplies, school supplies, gifts, and other items. For supplies and electronics, please visit: https://upenn.bncollege.com/shop/upenn/products/supplies-electronics

Career Counseling

https://careerservices.upenn.edu/   215-898-7531

3718 Locust Walk

The University provides career counseling through the Career Services office. Career information specific to the MSAG program may be found at: https://careerservices.upenn.edu/channels/industry-communities/.

Family Center at Penn

https://familycenter.upenn.edu/resources-support   215-746-2701

3615 Locust Walk

Libraries

http://www.library.upenn.edu/   215-898-7555

3420 Walnut Street (entrance on College Green)

Van Pelt Library, the main University library has extensive holdings, computers, and the Weigle Information Commons.

Writing Center

http://www.writing.upenn.edu/critical/   215-573-2729

Weigle Information Commons at Van Pelt Library

The Writing Center provides free writing consultation by appointment at Weigle Information Commons. Appointments are made online.

Office of the University Ombudsman

https://ombuds.upenn.edu/   215-898-8261

The Office of the Ombudsman assists individuals in finding solutions to problems that they may not be able to resolve through normal channels. The office is concerned with safeguarding individual rights and promoting better channels of communication throughout the University. It is independent of all administrative offices. The Ombudsman is not an advocate for any one individual or group. He or she is an advocate for fairness, adherence to University regulations, due process, and personal responsibility. The Office supplements, but does not replace, any existing grievance mechanisms or modes of redress. It can and does recommend changes in the existing rules and practices when necessary.

Student Health and Counseling

https://wellness.upenn.edu/student-health-and-counseling

Counseling Office: 3624 Market Street, First Floor, West   215-898-7021

Student Health and Counseling (formerly SHS and CAPS) provides professional psychological and psychiatric services to all Penn students who need help in dealing with academic stress, social difficulties, situational crises, managing personal problems, developing greater self-awareness and skills for life-long learning. Students presenting with more serious concerns like depression, anxiety, and eating disorders, among others, are seen as well. Licensed psychologists, psychiatrists, and social workers provide confidential short term psychotherapy for individuals, group counseling, emergency crisis services, medication evaluations, workshops, career assessments/development counseling, and referrals free of charge.

SUPER Program (Substance Use, Prevention, Education, and Recovery)

https://wellness.upenn.edu/wellbeing-initiatives/super-program-substance-use-prevention-education-and-recovery

3624 Market St, 1st Floor West   215-898-7021

The mission of the SUPER Program is to reduce harm related to substance use at the University of Pennsylvania. Key efforts spearheaded by this office focus on education, prevention, and brief interventions for both individual Penn students and student groups. Our programs meet students where they are at in their harm reduction journey from a place of empathy and without judgement. We also oversee alcohol policy

initiatives, violence prevention, data collection, strategic project management, and (in a collaboration with Student Intervention Services) proactive crisis management.

Office of Student Affairs

https://osa.universitylife.upenn.edu/   215-898-6533

The Office of Student Affairs, a department within the Division of University Life, serves as a primary source of information and advice about co-curricular opportunities and resources. Staff members assist students in becoming involved in campus life, conduct leadership development programs, provide continuity for organizations from year to year, manage organizational finances, educate students about University policies, mediate disputes, advise event planners, and help students put classroom learning into practice through the techniques of experiential education. A full list of services provided by the Office is available.

The Office of Student Affairs seeks to provide a range of co-curricular experiences designed to supplement students' classroom experience and contribute significantly to their personal development. Staff members encourage students to create and participate in intellectual, artistic, social, recreational and multicultural activities; to assume campus leadership and governance responsibilities; to develop positive interpersonal relationships and skills within groups; to explore different cultures, ideas and experiences; and to put their learning into practice in the laboratory of co-curricular programs. Staff members support students through various forms of advocacy, through the encouragement of proactive approaches to campus problems and concerns, and through a commitment to the creation of a Penn community.

OSA provides information on student organizations categorized as follows. Students can learn more by visiting their website:

- Academic and Educational
- Cultural and Support
- Environmental Organizations
- Governmental and Umbrella
- Hobbies and Recreation
- Honor Societies
- Performing Arts
- Political Issues
- Publications and Media
- Religious
- Service
- Social

- Graduate and Professional Organizations
- Registered Organizations

Immunization

Students enrolled in the MSAG are part of the University community and benefit from the University's efforts to provide a safe and healthy environment. All MSAG students who plan to come onto campus for any reason including the 1-week intensive field courses are required to comply with immunization requirements upon first enrolling in credit courses: https://wellness.upenn.edu/public-health-and-wellbeing/immunization-and-insurance-requirements

To comply, students should complete a Pre-Matriculation Health Record obtained from the Student Health Service. Please note: Students born on or before January 1, 1957 are exempt from the above requirements. The Student Health Service can provide missing immunizations at a fee that covers costs. In the event of an outbreak of a communicable disease in any in-person Penn class, all students in that class would be required to comply immediately with the University's immunization requirements. Contact the Immunization Coordinator at 215-746-4200 for more information.

Code of Conduct and Code of Academic Integrity

Provost's Code of Academic Integrity: https://catalog.upenn.edu/pennbook/code-of-academic-integrity/

Provost's Code of student conduct: https://catalog.upenn.edu/pennbook/code-of-student-conduct/

Student Guide to Academic Integrity: http://www.upenn.edu/academicintegrity/

Inasmuch as the standing of an educational institution and the value of a degree from that institution are dependent upon the integrity of study and research carried on at that institution, the Code of Academic Integrity is drawn to make clear the policy of the University concerning academic honesty. Each student attending the University must abide by this code, the text of which appears in the Pennbook and is found at the website above.

Student Codes of Conduct Enforced

In addition to the Code of Academic Conduct, Penn students are expected to adhere to the provisions of all other codes as well. More information on these codes is available at the above link. They are:

- Code of Student Conduct
- Code of Academic Integrity
- Policy on Acceptable Use of Electronic Resources
- Guidelines on Open Expression
- Acquaintance Rape and Sexual Violence Policy
- Sexual Harassment Policy
- Anti-hazing Policy
- Alcohol and Drug Policy
- Bicycle Policy

The Student Disciplinary System does not handle alleged violations of the University's parking regulations.

Leadership and Committee Position Eligibility

To serve in any student association leadership or committee position at the University of Pennsylvania, LPS students must: 1) be actively enrolled on a part- or full-time basis, and 2) maintain good academic standing as defined by their program. Students who are placed on academic probation or take a leave of absence must relinquish their position so that a replacement can be appointed to fill the vacancy.

Confidentiality of Student Records

https://catalog.upenn.edu/pennbook/confidentiality-student-records/

Pursuant to the Family Educational Rights and Privacy Act of 1974, as amended, in general, personally identifiable information can be disclosed to people outside the University only with the written consent of the student or alumnus involved. A statement setting forth specific University policy concerning (1) disclosure of information to people outside the University, (2) disclosure of information to people within the University, (3) permitting students to inspect and review records and (4) providing students with the opportunity to seek the correction of their records appears in the Pennbook and is found at the website above.

Nondiscrimination Policy

https://oaaeop.upenn.edu/   215-898-6993

3451 Walnut Street, Franklin Building 4th Floor, Room 421

The University of Pennsylvania values diversity and seeks talented students, faculty and staff from diverse backgrounds. The University does not discriminate on the basis of

race, color, sex, sexual orientation, religion, national or ethnic origin, age, disability or status as a disabled or Vietnam Era veteran in the administration of its educational policies, programs, or activities, admissions policies and procedures, scholarship and loan programs, employment, recreational athletic or other University administered programs. Questions or concerns regarding the University's equal opportunity and affirmative action programs and activities or accommodations for people with disabilities should be directed to the Director of Affirmative Action.

Also see: https://catalog.upenn.edu/pennbook/student-grievance/

Equal Opportunity and Affirmative Action Policy:
https://catalog.upenn.edu/pennbook/equal-opportunity-affirmative-action-policy/

Rules Governing Exams

Provost's Policy on Common Midterm Examinations:
https://catalog.upenn.edu/pennbook/common-midterm-examinations/

Rules Governing Final Examinations: https://catalog.upenn.edu/pennbook/final-examinations/

Holidays

Provost's Policy on secular and religious holidays:
https://catalog.upenn.edu/pennbook/secular-religious-holidays/

The University observes the following holidays: Martin Luther King, Jr. Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Thanksgiving and the day after, and the week between Christmas Day and New Year's Day, inclusive. The University also recognizes that there are several religious holidays that affect large numbers of University community members, including Rosh Hashanah, Yom Kippur, the first two days of Passover and Good Friday. In consideration of their significance for many students, no examinations may be given and no assigned work may be required on these days. Students who observe these holidays will be given an opportunity to make up missed work in both laboratories and lecture courses. If an examination is given on the first class day after one of these holidays, it must not cover material introduced in class on that holiday.

Center for Community Standards and Accountability

https://csa.upenn.edu   215-898-5651

3440 Market St., Suite 400, Philadelphia, PA 19104

The Center for Community Standards and Accountability (CSA) (formerly the Office of Student Conduct (OSC)) is responsible for acting on behalf of the University in matters of student discipline. CSA deals with alleged instances of academic dishonesty and other student misconduct, in order to determine how best to resolve these allegations consistent with the goals and mission of the University as an educational and intellectual community.

The mission of the Center for Community Standards and Accountability (CSA) is to promote accountability, integrity, healing, and community building within the Penn community. CSA works to resolve violations of the Code of Academic Integrity and the Code of Student Conduct, as well as to coordinate university response to address incidents of bias and harm within our community.

Appendix

MSAG COURSE LIST

NOTE: This is a comprehensive list of courses offered in the MSAG program as of 7/8/2024 that may be taken to fulfill requirements in the MSAG curriculum. Be aware that new courses are being offered all the time and some courses are being discontinued due to faculty availability. Please consult the latest course lists each semester for the most up to date lists.   The parentheses indicate which requirement the course fulfills and the brackets indicate the semester when the course is typically offered. Not all courses are offered every year. Check current course listings for which courses are offered each semester. Some courses may fulfill more than one requirement.

EESC 5200 Aqueous Geochemistry (Required Course) {Fall}

This course is designed to provide the graduate student with an understanding of the fundamentals of aqueous geochemistry. The chemistry of water, air and soil will be studied from an environmental perspective. The nature, composition, structure, and properties of pollutants coupled with the major chemical mechanisms controlling the occurrence and mobility of chemicals in the environment will also be studied. Upon completion of this course, students should expect to have attained a broad understanding of and familiarity with aqueous geochemistry concepts applicable to the environmental field. Environmental issues that will be covered include acid deposition, toxic metal contamination, deforestation, and anthropogenic perturbed aspects of the earth's hydrosphere.

EESC 5630 Hydrology (Required) {Fall}

Introduction to the basic principles of the hydrologic cycle and water budgets, precipitation and infiltration, evaporation and transpiration, stream flow, hydrograph analysis (floods), subsurface and groundwater flow, well hydraulics, water quality, and frequency analysis.

EESC 5704 Geologic Field Methods (Elective) {Summer}

In an intensive week of daily field trips on site in Philadelphia, students will study field methods for the collection of geologic data. Use of the Brunton compass for basic surveying and collection of rock strata orientation will be stressed. Students will have an opportunity for field study of rocks and minerals, geomorphology, and geologic structures. This course is intended for students who need a field methods course for PG licensure or for their careers. Transportation and equipment will be provided.

EESC 5720 The Role of the Environmental Professional in Managing Contaminated Site Liability (Elective) {Fall}

Evaluation of environmental contamination and liability is an important tool during acquisition of real estate property, and a standard work product in the environmental consulting field. This course will cover the purpose and history of the Superfund law, the various classifications of Superfund liable parties, and protections against Superfund liability, specifically with regard to bona fide prospective purchasers (BFPP). In the context of the BFPP liability defense the course will focus on the performance of "All Appropriate Inquiry" for the presence of environmental contamination (e.g. Phase I environmental site assessment). Our study of "All Appropriate Inquiry" will include evaluation of historical maps and other resources, aerial photography, chain-of-title documentation, and governmental database information pertaining to known contaminated sites in the area of select properties on or near campus. Site visits will be performed to gain experience and knowledge for the identification of recognized environmental conditions. Students will prepare environmental reports for select properties and will have an opportunity to hone technical writing skills.

EESC 6606 Fate and Transport of Pollutants (Elective) {Summer}

This course covers basic groundwater flow and solute transport modeling in one-, two- and three-dimensions. After first reviewing the principles of modeling, the student will gain hands-on experience by conducting simulations on the computer. The modeling programs used in the course are MODFLOW (USGS), MT3D, and the US Army Corps of Engineers GMS (Groundwater Modeling System).

EESC 6620 Environmental Groundwater Hydrology (Required) {Spring}

This course is designed to introduce the major definitions and concepts regarding groundwater flow and contaminant transport. The theory underlying concepts, including mathematical derivations of governing equations used to model groundwater flow and contaminant transport, will be discussed and applications to environmental problems addressed. Upon completion of this course, students should expect to have attained a broad understanding of and familiarity with groundwater flow and contaminant transport concepts, and to have acquired the skills necessary to pursue work in flow and transport modeling.

EESC 6664 Field Study of Soils (Elective) {Summer}

Processes of soil development in a variety of temperate environments. Effects of lithology and climate on soil properties. This course includes 5 full field days on campus combined with zoom based sessions. Transportation and equipment will be provided.

EESC 6711 Contaminated site investigation, remediation and long-term stewardship {Spring}

The superfund law authorizes the president to respond to releases of hazardous substances into the environment in order to protect public health and the environment. This course will focus on topics related to such responses, including environmental investigation and risk assessment, environmental remediation techniques, and related topics.

EESC 6715 Water Resources for Geologists and Environmental Scientists (Elective) {Summer}

This class will provide an overview of water topics and issues and is intended to provide geologists and environmental scientists with a working understanding of current water resource issues and challenges ranging from stormwater and flooding to stream restoration, water re-use and ecological restoration. Starting with an understanding of hydrology, streams, and related ecosystems, the class will look at the various ways we use and depend on water, the ways in which water resources are degraded, and practices to restore and protect the resource. Topics to be covered include green infrastructure, water and wastewater sources and water reuse, stream health, stream channel restoration, riparian buffers, floodplains, best practices, and the concept of "one water". We will also cover current regulations, changing water policies, sustainability, and the implications of climate change.

EESC 6720 Landslides (Elective) {Spring}

Landslides are important geomorphic agents in mountainous terrain, mobilizing sediment and playing a key role in controlling relief and elevation. The work of landslides is often characterized by their magnitude-frequency, which also has direct implications for people, property, and infrastructure in mountainous terrain, and for the approaches taken to minimize the risk from landslides. This course will introduce students to a conceptual understanding of landslides at a range of spatial scales, including the mechanics of the processes governing landslides from trigger to deposition. Methods of slope monitoring and the varied approaches to landslide risk mitigation and management will be explored, with a range of geotechnical and environmental applications. This course includes lab-based sessions to demonstrate simple techniques to understand fundamental landslide processes, and applications of GIS technology to explore slope monitoring and failure prediction.

EESC 6770 Geocomputations (Required) {Fall}

Review and applications of selected methods from differential equations, advanced engineering mathematics and geostatistics to problems encountered in geology, engineering geology, geophysics and hydrology.

EESC 6810 Applied and Environmental Geophysics (Required) {Fall}

The application of geophysical investigation techniques to problems of the local and shallow subsurface structure of the earth. The application of geophysical measurements and interpretation for environmental site characterizations, locating buried structures, groundwater investigations, and identifying geotechnical hazards with emphasis on gravity methods, seismic refraction and reflection, electrical resistivity, electromagnetic methods, ground penetrating radar, and borehole nuclear logging.

EESC 6820 Geomechanics (Required) {Fall}

Mechanical properties of solid and fluid earth materials, stress and strain, earth pressures in soil and rock, tunnels, piles, and piers; flow through gates, wiers, spillways and culverts, hydraulics, seepage and Darcy's law as applied to the hydrologic sciences.

EESC 6840 Engineering Geology and Applied Structural Geology (Required) {Fall}

Engineering Geology is the branch of geology that assures the safety, efficiency, and economy of engineering and environmental projects. As the human population continues to increase, building in the environment, protecting and remediating the environment, and sustainably mining earth's resources become more important. Engineering geology interfaces closely with Civil Engineering to assist in site selections, desktop site investigations, direct subsurface site investigations, development of three-dimensional engineering stratigraphic models, and assistance with soil and rock engineering and geochemical design parameters. This course will concentrate on the occurrence and distribution of earth's rocks and soils and their engineering and environmental properties. The engineering classification, testing, and use of the earth materials will be emphasized. The geohazards of engineering in rocks and soil, as well as natural geologic hazards such as floods and earthquakes will also be studied in the context of geologic history and the planning and use of the geologic environment.

EESC 6850 Advanced Engineering Geology (Required) {Spring}

This course focuses on the rock mechanics aspects of Engineering Geology. The theme is characterization of the geologic environment for engineering and environmental investigations. Covered are the various exploration tools and methods, including: Collection and analysis of existing engineering data; Interpretation of remotely sensed imagery; Field and laboratory measurements of material properties; Measurement and characterization of rock discontinuities; Rock slope stability analysis; Stress, strain and failure of rocks and the importance of scale; Rock core logging; Rock mass rating;

Rock support and reinforcement; Rock excavation, blasting and blast monitoring and control.

EESC 6998 Project Design (Required) {Spring}

This course is designed to prepare Master of Science in Applied Geosciences students to undertake their capstone exercise. In this course, we discuss how to identify an appropriate research project, how to design a research plan, and how to prepare a detailed proposal. By the end of the course, each student is expected to have completed a capstone proposal.

ENVS 5706 Modeling Geographic Objects (Elective) {Fall}

This course offers a broad and practical introduction to the acquisition, storage, retrieval, maintenance, use, and presentation of digital cartographic data with both image and drawing based geographic information systems (GIS) for a variety of environmental science, planning, and management applications. Its major objectives are to provide the training necessary to make productive use of at least two well-known software packages, and to establish the conceptual foundation on which to build further skills and knowledge in late practice.

ENVS 5716 Modeling Geographic Space (Elective) {Spring}

This course explores the nature and use of digital geographic information systems (GIS) for the analysis and synthesis of spatial patterns and processes through 'cartographic modeling'. Cartographic modeling is a general but well defined methodology that can be used to address a wide variety of analytical mapping applications in a clear and consistent manner. It does so by decomposing both data and data-processing tasks into elemental components that can then be recomposed with relative ease and with great flexibility.