

John and Willie Leone Family Department of Energy and Mineral Engineering
College of Earth and Mineral Sciences
The Pennsylvania State University

Graduate Student Handbook

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Scope

This handbook is intended to provide a useful resource for graduate students enrolled in the John and Willie Leone Family Department of Energy and Mineral Engineering (EME). This handbook contains important information on department, college, and university requirements, policies, and procedures for successfully completing a graduate degree.

In many cases, this handbook will reference online information from LionPATH (the Penn State University academic record database), the University Bulletin (the official record of all university programs and courses), University Senate (the university body that sets official academic policies), the Graduate Council (the university body that sets policies for graduate degrees), the Registrar (the university office that sets course schedules and maintains student transcripts), and others. Students should be aware that these online sources (and not this handbook) contain the official documents and information. In any case where there is a conflict between the information provided in this handbook and any of these online sources, the online source should be considered correct and authoritative.

The Graduate Student Handbook does not attempt to be a completely comprehensive document, as the number of possible combinations of unique circumstances for each student and faculty member make that impossible. However, most common needs and questions should be addressed by the information found here, and if not, students should begin by contacting their faculty adviser or the Director of Graduate Studies.

This handbook is maintained by the EME Graduate Program Office. The most up to date version of this handbook will be made available here: www.eme.psu.edu/graduate/graduate-resources.

Change Log

Date	Description of Change
1 July 2023	Transition from MS Word to Overleaf L ^A T _E X document. Significant revision to all sections of the document to update with current policies. Moved Health and Safety section to first place. Updated all links to current department, college, and university policies.
1 August 2021	Original publication date.

Approval:



Jeremy M. Gernand, June 20, 2023

1 Health and Safety

1.1 Emergency Phone Numbers

For any active emergencies, crimes in progress, serious injuries or illnesses, or fires, anyone on campus or off campus should dial 911.

Fire-Police-Ambulance: 911

In cases, where a crime, injury, illness, safety issue, or infrastructure damage on Penn State's campus may need to be reported, but there is not an imminent danger of the loss of life or property, then the following non-emergency phone numbers can be used:

University Police: (814) 863-1111

University Health Services: (814) 865-6556

Environmental Health and Safety: (814) 865-6391

Physical Plant: (814) 865-4731

1.2 Hosler Building

The Charles L. Hosler Building contains offices for faculty, staff, and students, laboratories, and classrooms. Most EME Department faculty, staff, and students find their home in this building, but several may be located elsewhere across the Penn State campus.

Charles L. Hosler was a former Dean of the College of Earth and Mineral Sciences between 1965 to 1985.

1.2.1 Fire Alarms

If the fire alarm sounds in Hosler Building everyone should leave the building through the shortest route possible and then gather at the designated meeting location on the ramp to the Westgate Building until the responsible people have indicated that it is safe to re-enter.

If you are in your office – Please click the button on the door to keep it from locking. Move the "evacuated" magnetic sticker from inside the door frame to the outside of the door frame and shut the door. This helps first responders to know that the room is empty and can do a quick look and move on.

If you are teaching a lab – Please speak with Tom Motel (tjm14@psu.edu) or James Miller (jrm112@psu.edu) to find out how to safely stop the lab during the experiments. This is crucial.

DO NOT GO BACK IN THE BUILDING EVEN IF THE ALARM STOPS! You must wait for the All Clear from a responsible official or staff member to re-enter the building.

1.2.2 AED

There is an Automated External Defibrillator (AED) in Hosler Building located on the first floor between the doors for rooms 106 and 132A and across from 119.

An AED is a lightweight, portable device. It delivers an electric shock through the chest to the heart when it detects an abnormal rhythm and changes the rhythm back to normal.

AEDs help people who have a sudden cardiac arrest, which occurs when the heart suddenly stops beating regularly. This happens when the heart's natural electrical system doesn't work correctly. If not treated within minutes, cardiac arrest quickly leads to death.



Figure 1: Location of the gathering point for people in Hosler Building following a fire alarm. Gathering point is located across Burrowes Road on the near side of the ramp to the Westgate Building.

1.3 Other Facilities

Students may be assigned to offices or laboratories in other buildings on campus on a temporary or continuous basis. Every building on Penn State's campus has an assigned safety officer. That individual will ensure that appropriate information on workplace hazards and safety procedures are provided to the students, faculty, or staff working there.

1.4 Laboratory Safety

All Penn State personnel who must do any work in a laboratory must complete the Laboratory and Research Safety Training. All EME graduate students, regardless of responsibilities, should plan to take and complete this training course. The initial training course consists of four modules and associated quizzes. A shorter refresher course should be completed annually thereafter.

The course can be found at the following location:

<https://ehs.psu.edu/training>

1.5 Medical Care

1.5.1 University Health Service

University Health Services (UHS) is a comprehensive on-campus health care resource specializing in out-patient student health including the treatment of medically urgent problems and ongoing health concerns. They provide preventative care, education, and resources to help students live a healthy lifestyle.

<https://studentaffairs.psu.edu/health>

1.5.2 Mount Nittany Medical Center

The closest hospital to the Penn State University Park campus is the Mount Nittany Medical Center. Mount Nittany Medical Center is a 260-bed acute care facility offering medical, surgical, diagnostic and community services.

<https://www.mountnittany.org/mount-nittany-medical-center>

1.5.3 Health Insurance

The US medical system is very capable, but costly. As a result, health insurance is a necessity to manage potentially unexpected expenses. Most EME graduate students have coverage through the Student Health Insurance Plan for Penn State. Additional information can be found here:

<https://studentaffairs.psu.edu/health-wellness/health-insurance>

1.6 Mental Health

Penn State's Counseling and Psychological Services (CAPS) offers a wide range of services for undergraduate and graduate students including:

- Wellness and self-help options
- Group, individual, and couples counseling
- Crisis intervention
- Psychiatric services
- Virtual Services
- Community education and outreach services for the University community.

Additional information on these services can be found here:

<https://studentaffairs.psu.edu/counseling>

CAPS services are available in a variety of modalities. Please call the CAPS office at (814) 863-0395 to learn more about your options.

If there is an emergency situation after hours, contact the 24/7 Penn State Crisis Line at 1-877-229-6400.

1.7 Disability Resources

Students with short-term or long-term disabilities should contact Student Disability Resources (SDR). Short-term disabilities include those disabilities that might result from injury or illness, while long-term disabilities may last longer periods of time (even permanently) and have a variety of causes.

Students who feel comfortable should discuss their disability and need for accommodations with their academic adviser. However, there are times when this is not comfortable or possible for a student. In those cases, a confidential consultation with the office of Student Disability Resources can help communicate reasonable accommodations to a student's instructors and supervisors without disclosing private, personal health information.

<http://equity.psu.edu/student-disability-resources>

The staff in the Student Disability Resources office look forward to working with you and helping students who want to:

- Explore individualized reasonable accommodations for equal access and full participation in academic pursuits;
- Seek interactions with peers or study space;
- Connect with on- and off-campus resources; and
- Promote disability as an important aspect of diversity.

Currently, students can choose either in-person or virtual appointments with SDR office staff. Please call us at 814-863-1807 to schedule an appointment as needed or email upsdr@psu.edu with any questions. A few reasons students may choose to schedule an appointment include:

- Using Student Disability Resources for the first time;
- Resolving any questions related to your academic accommodations;
- Requesting new accommodations specific to your individual course or program needs; or
- Seeking assistance navigating an academic problem or connecting to other campuses' resources.

2 Graduate Student Processes and Procedures

2.1 Academic Calendar

The academic calendar for the university can be found here:

<https://www.registrar.psu.edu/academic-calendars/>

The academic calendar outlines when classes begin and end for each term, when final exams are scheduled, and when no classes are held because of university-recognized holidays. Be aware that during many academic holidays (no classes), the university continues to operate normally in all other respects. As such, depending on one's funding or employment situation and their supervisor, regular work hours for research or other required tasks may be expected.

2.2 Course Registration

Students should register for courses online via LionPATH well in advance of the first day of classes – by the end of October for the following spring semester, and by late March for the following summer session and the following fall semester. Students are strongly encouraged to register as soon as possible so that adjustments in course offerings can be made in a timely fashion.

The dates for when the registration window opens for each term can be found here:

<https://registrar.psu.edu/registration/registration-timetable.cfm>

Following the date that the registration window opens for graduate students (generally around the middle of the previous semester, for example, the Fall 2022 registration window for graduate students opened on March 22, 2022 in the Spring), graduate students may add courses to their schedule. Students may continue to add courses through the 7th calendar day after the beginning of classes for that term.

Students may also drop courses from the start of the registration window through the 6th calendar day after the beginning of classes for that term. The academic calendar will always include these specific dates for each semester.

Students may register for (add) or drop courses during the first week of classes at no charge, but after the first week there is a nominal charge for making changes.

2.2.1 EME 601

Registration for EME 601, a designation for research credits that only applies to PhD students who have passed both their qualifying and comprehensive examinations, is restricted. A student who needs to register for EME 601 will have to have these courses added manually to their schedule by the Graduate Program Coordinator in the Energy and Mineral Engineering, Graduate Office, 103 Hosler Building.

2.2.2 Minimum and Maximum Credit Loads

The maximum number of credits for which students holding regular or supplemented assistantships may register are restricted by the Graduate School. These limitations are summarized in Table 1 and apply to all 400-, 500- and 600-level courses except audits and EME 601. For most MS and pre-comprehensive PhD students on assistantships, this number is 12 credits in both the fall and spring semesters. In a particular semester, more credits than those listed may be taken, provided that fewer are taken in subsequent semesters so that the annual total does not exceed that implied by the table. Note that a student holding an assistantship may take more than 12 credits in a fall or spring semester or more than 5 credits in the summer only with the written permission of the Department Head or Associate Head of the Graduate Program. Without such approval, the department may terminate the assistantship.

Although credit limits for the summer are listed, most graduate students holding research assistantships in the fall and spring semesters do not register in the summer but are paid on a summer assistantship.

Table 1: Maximum Credit Loads during Fall/Spring Semesters for Graduate Students Supported by Assistantships or Fellowships

Status	Total Credits
No Assistantship	15
Regular Assistantship	12

Table 2: Maximum Credit Loads during Summer Semester for Graduate Students Supported by Assistantships or Fellowships

Status	Total Credits
No Assistantship	12
Regular Assistantship	5

The minimum number of credits for graduate students to be considered full-time students is 9 during the Fall and Spring semesters. Students must register for *and maintain* enrollment in at least 9 credits to remain eligible for fellowships and assistantships and international student visas.

All full-time graduate students in EME are recommended to register for 12 credits each Fall and Spring semester. In many cases, students may only take 2 or 3 3-credit courses each semester, so the additional credits to make up a total of 12 should be filled in by the necessary credits of EME 600 (or EME 601 for applicable PhD students).

2.3 Taking Undergraduate Courses

Graduate students may register for undergraduate courses, however, how those courses count towards degree requirements and other graduate school requirements varies depending on the particular type of course taken.

2.3.1 Advanced Undergraduate Courses (400-level)

Graduate students at the MS- or PhD-level may take up to 6 credits of 400-level courses and have those credits count towards their graduate degree, if approved by their adviser and the director of graduate studies.

Generally, engineering, mathematics, and statistics courses at the 400-level are acceptable as meeting graduate requirements in EME, however there are exceptions. Not every 400-level course would be considered relevant to the degree in EME, nor is every 400-level course appropriate given the background of an individual student. Students should get approval from their assigned adviser and the EME Director of Graduate Studies for any 400-level courses they wish to apply to their MS or PhD degree requirements.

Students who earn their MS in EME, and then begin the PhD program in EME, may only count a total of 6-credits of 400-level undergraduate coursework towards **both** graduate degrees. So, a student who completed a MS degree counting 6 credits of 400-level coursework, who then enters the PhD program, must complete all 18-credits of additional required coursework at the 500-level or above.

In terms of determining full-time student status (at least 9 credit hours) or evaluating the maximum credit load (Table 1), 400-level courses are counted the same as any graduate level (500-level, 600-level, or 800-level) courses.

2.3.2 Other Undergraduate Courses

Non-advanced undergraduate courses, such as those that carry a 100, 200, or 300 course number designation may be taken by graduate students, but these courses cannot count towards one's graduate degree requirements, and they cannot count towards the minimum credits necessary to maintain full time status as a graduate student. However, these credits would count towards the maximum credit load allowable for graduate students (Table 1).

For instance, a new graduate student with a teaching assistantship who requires certain background training in statistics, and decides to take STAT 301 in their first semester, must be registered for 9 additional credits of graduate-level coursework in addition to the STAT 301 course. This would make them a full-time graduate student (9 credits) and would not exceed the maximum credit load for graduate students with a teaching assistantship (12 credits including STAT 301).

For students who are required to take English as a Second Language (ESL) courses, this rule applies. Since the ESL courses are not graduate level course, ESL 118 for example is a 100-level course, the student taking the ESL course and being supported on an assistantship must be registered for exactly 9 credits of graduate-level coursework in addition to the ESL course.

2.4 Student Advising

All EME graduate students will be assigned a faculty adviser. In most cases, this will be the faculty member overseeing the student's research. However, in cases where a student is pursuing a non-research degree (e.g., non-thesis MS) or a student has not yet identified a research supervisor, the Director of Graduate Studies will serve as the student's adviser or designate another faculty member to serve as interim adviser.

All students pursuing research degrees (thesis MS or PhD) are expected to identify a faculty research adviser and to select a research topic within the first academic year.

Once a research topic has been identified, each student must form a committee composed of the student's adviser and two other faculty members familiar with the research area. One of these two members may be from another institution if appropriate. Each semester, the committee should meet informally with the student to review the student's progress toward the degree and to offer advice as needed. The Graduate Coordinator in 103 Hosler has a form on which is listed the members of this committee.

Soon after passing the PhD Qualifying Exam, each PhD student must form a regular PhD committee having at least four Graduate Faculty members, at least one of whom is from outside the Department of Energy and Mineral Engineering. Committee members from other institutions can be added as special members, beyond the minimum of the four Penn State members. A committee signatory page must be obtained from the Graduate Staff Assistant in the department. Note that the Graduate School must be notified of the membership of the regular PhD committee at least three weeks before the student's Comprehensive Exam is scheduled.

2.5 Annual Progress Reviews

The department requires each student to complete an annual progress report. The report is due to the Associate Head for the Graduate Program by August 1 every year and will be used in the annual review that summer of each student's progress throughout the previous academic year. The EME graduate office will provide links to current graduate students and their advisers for the appropriate forms to be completed and reviewed, and the deadlines as they set by the EME Graduate Program Office.

Annual progress reviews are intended to facilitate communication between a student and their adviser regarding the setting of goals and intermediate milestones for their progress in both training and research, and document communication to that effect.

2.6 Grades

At Penn State grades are assigned to students for all instructional courses. The following +/- grading system is used for both undergraduate and graduate students: A, A-, B+, B, B-, C+, C, D, or F. Each of these grades earns grade points as defined in Table 3.

Table 3: Letter Grades and Associated Earned Grade Points

Grade	Grade-Point Equivalent
A	4.00
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
D	1.00
F	0

Each course instructor individually defines the scores necessary to achieve one of the above letter grades in their course. These requirements are presented in the syllabus, which should be provided to students during the first week of classes.

The grade R, which denotes satisfactory progress, and which is not used in calculating a grade point average, may be used in the courses listed in the table below.

Table 4: Description of Research Courses and When to Register for Them

Course Code	Description
EME 600	Credits for conducting research by MS students or by PhD students before they have passed their comprehensive examination. MS students pursuing the thesis option must complete at least 6 credits of EME 600. Students may receive letter grades for EME 600, but only for a maximum of 6 credits. Any credits beyond that will receive an "R" grade.
EME 601	Credits for research by PhD students only after they have successfully passed their comprehensive examination. All credits for EME 601 receive an "R" grade and do not affect a student's GPA.

2.6.1 Grade-Point Average (GPA)

The number of grade points obtained by a student in any course is computed by multiplying the number of credits in the course by the grade-point equivalent of the grade received in the course. Courses given satisfactory/unsatisfactory grades or R grades are not used in computing grade points (that is, those credits are not applied to the denominator of the GPA calculation). A student's cumulative grade-point average is the weighted mean value of all grade points earned at the university.

Table 5: Example Grades and Grade-Point Average Calculation for a Graduate Student

Course	Credits	Grade	Grade Points
STAT 501	3	A-	$3 \times 3.67 = 11.01$
EME 521	3	B+	$3 \times 3.33 = 9.99$
EME 501	3	A	$3 \times 4.00 = 12.00$
EME 600	3	R	$3 \times 0 = 0.00$
			$\Sigma = 33.00$

Grade Point Average (GPA): $33.00/9 = 3.67$

2.7 Academic Status

A graduate student is expected to maintain at least a 3.00 cumulative grade point average (GPA) and to have obtained a research supervisor by the end of their second semester in residence. If a student maintains this average and has obtained a research supervisor, then this student will retain regular academic status.

The progress of a student in the graduate program will be monitored closely by the student's thesis committee and the Associate Head of the Graduate Program. A formal review of all students will be performed by the Associate Head after each spring semester. A student's transcript through the recently completed spring semester, and an updated student and adviser's report on research progress (same as the annual progress report) will be considered in the review.

The program of a graduate student will be terminated for unsatisfactory scholarship if any of the following conditions are met:

1. **Failure to exhibit and promote the highest ethical, moral, and professional standards.** This includes but is not limited to academic integrity violations, instances of plagiarism or submitting fraudulent research results, or cheating on milestone exams or in graduate courses. All suspected cases will undergo the processes specified by the graduate school (GCAC-801) and the academic integrity procedures for the College of Earth and Mineral Sciences.

2. **Inadequate grade-point average.** Consistent with Graduate School Policy (GCAC-404) and all graduate programs at Penn State, the Graduate Program in Energy and Mineral Engineering requires that graduate students maintain a Grade Point Average (GPA) of 3.00 or higher. If a student's overall GPA (not including EME 600 credits), falls below 3.00 for one semester, the student will be provided a warning from the Associate Head. If the student's GPA remains below 3.00 for two consecutive semesters or if the student receives a D or F in any semester, this will constitute grounds for termination.
3. **Failure to make satisfactory progress in research.** If a graduate student, as evaluated by his/her research adviser or dissertation committee, fails to make sufficient progress in research or if the research is of unacceptably low quality, they will receive a warning from the Associate Head. If after a warning required minimum progress is not demonstrated, this may constitute grounds for termination from the graduate program. For PhD degree students, a faculty member must agree to be the dissertation research adviser no later than the second semester (by the end of the first year in the program). Because a PhD is, by design, a mentored research experience, doctoral students cannot remain in the program more than one semester without a committed adviser.
4. **Failing the qualifying, comprehensive, or final oral examination for doctoral students.** For all formal milestone exams – qualifying examination, comprehensive examination, and final dissertation defenses – students will be allowed two attempts to pass before termination. The student will be notified of this decision according to Graduate School policy (GCAC-803).

If any of the above conditions are met, then the Director of Graduate Studies, after consultation with the appropriate faculty, will summarize the actions that must be taken by the student during the following semesters for adequate progress on eliminating the above deficiencies. Each subsequent semester, the Director of Graduate Studies and appropriate faculty will ascertain whether this student has demonstrated sufficient progress to be allowed to remain in the graduate program.

2.8 International Students

The Immigration and Naturalization Service (INS) has regulations that pertain to international students with F-1 and J-1 visas. Each student is responsible for learning about and abiding by these regulations. Students or faculty who have questions regarding these regulations should contact the Penn State University Office of Global Programs or may e-mail questions to dissa-adviser@psu.edu. International graduate students need to maintain full-time status and good academic standing at all times.

It is advisable to frequently check <https://global.psu.edu/category/international-students> for updates. This website contains detailed information about the SEVIS fee, rules and regulations governing international students, such as change of address, maintaining status, necessary immigration documents, authorization for off-campus employment, health insurance, taxes, dependent visas (if you want to move your spouse and/or children here, for example), obtaining a driver's license, and Social Security.

2.8.1 English Oral Skills Test for Teaching Positions

International students who are or may be on teaching assistantships must take the American English Oral Communicative Proficiency Test (AEOCPT) before the commencement of classes. Typically, this test is administered during the orientation program for incoming international students.

Scores range from 0-300. Effective August 1999, a score of 250 or higher allows an international student to assume teaching responsibilities with no restrictions. Scores under 250 require additional coursework in English. The following scores and interpretations constitute the guidelines followed by the Department of Applied Linguistics.

Table 6: Scores on the American English Oral Communicative Proficiency Test (AEOCPT) and Their Interpretation

AEOCPT Score	Required Course Prognosis
250-300	None. Student may assume teaching duties with no restrictions.
200-249	Enroll in ESL 118G before assuming teaching duties. Students enrolled in ESL 118G must pass the qualifying exit examination, called the Interactive Performance Test (IPT), before they can assume teaching duties with no restrictions.
150-199	Enroll in ESL 117G Will require at least two semesters before student is recommended to teach.
<150	Enroll in ESL 115G Will require at least three semesters before student is recommended to teach.

The Department of Applied Linguistics schedules the required courses for the student.

As a general practice, all resident EME international graduate students are assigned a requirement to take this exam, as it is possible that any graduate student could be asked to serve as a teaching assistant at some point during their academic career. For that reason, it is imperative that all students assigned to take the AEOCPT exam pass the exam with a score of at least 250 points, or enroll in the required ESL courses during their first year. *Students who do not achieve a passing score (250+) on the exam, and do not complete the required course(s) are not eligible for teaching assistantship positions with the EME department until they have completed the required course(s).*

In the event that exam availability is limited, students already nominated for teaching assistantships and students pursuing a PhD will be prioritized over other graduate students.

2.8.2 I-20 Dates

International students must complete their program of study (M.S. or Ph.D.) by the date issued on their I-20s. If they are unable to do so, then they must seek an extension on their I-20s by contacting the University Office of Global Programs (UOGP) in Boucke Building (4th floor).

2.9 Workspace Assignments

All graduate students in the EME department will be assigned an office workspace as available space allows. Most work spaces consist of a desk and office chair in a room shared with other graduate students. Each graduate student may only be assigned one office workspace. Some students may have to choose between a workspace that is convenient to their laboratory research space or a workspace that is convenient to department administration and most classrooms.

Graduate student offices do not include computer equipment. Desktop or notebook computers must be provided by a student's research adviser or by themselves. The EME department does not generally have spare computer equipment or a budget for computer equipment for graduate students, with the exception of the computer laboratory described in the following section.

As desks are freed by graduating students, they will be offered to existing students on the basis of seniority by semester of entry into the program.

Students who complete their final defense should confirm their desk move-out date with the EME graduate office.

2.10 Lockers

Students who have not been assigned a workspace with a desk whether by choice or on the basis of limited resources, may be assigned a locker in the EME graduate student lounge in Hosler 214.

2.11 Information Technology

Computers (desktops or notebooks or tablets), if they are provided to graduate students, must be provided by their respective faculty advisers. The EME department does not have individual computers to assign to graduate students.

2.11.1 EME Computer Laboratory

The John and Willie Leone Family Department of Energy and Mineral Engineering has computer facilities that include a PC-based computer laboratory available to students on a 24-hour basis, 7-days-per-week. The facilities are located in 318 Hosler Building. Individuals are expected to exercise responsibility and ethical behavior when using the University's computer information, networks and resources.

Upon admission to the University, all students are notified of the University's Information Assurance and IT Security Policy - AD95.

The computer lab is secured by an electronic combination lock. The code for this lock can be found at the following site:

<https://www.eme.psu.edu/graduate/graduate-resources/computer-lab>

2.12 Shared Space

EME graduate students have access to the graduate lounge in 214/215 Hosler Building.

2.13 Graduate Student Mail

EME graduate students may receive mail at the following address:

YOUR NAME
113 Hosler Building
Penn State University
University Park, PA 16802

Graduate students are not assigned individual mailboxes. Graduate students' mail is placed into combined mailboxes designated by the first letter of their last name (surname) in 113 Hosler Building. Students expecting mail should periodically review the contents of the appropriate mailbox. Students should not remove mail for other students, but only their own.

Mail sent to this address is expected to be professional in nature, not personal. Academic and professional society communications, laboratory materials or related information, and trade- or career-related communications are typical examples.

2.14 Keys and Building Access

All EME graduate students will be provided with keys and/or ID card reader access to Hosler Building as well as the locations of their assigned office space and designated research laboratory, if applicable. Graduate students will have access at all times (24 hours per day, 7 days per week including holidays) to their designated work areas and common graduate student spaces.

All keys are serialized and must be returned to the department once a student has completed their time with EME.

2.15 Department and College Ombudspersons

In most cases, if any graduate student has a concern or question, these should first be addressed that the student's faculty adviser, or to the EME Director of Graduate Studies. However, there are sometimes questions or issues where that would be undesired or inappropriate. In those cases, the student may wish to contact one of the two EME ombudspersons or any of the EMS college ombudspersons.

The goal of the Ombuds Program is to provide graduate students and postdocs with a neutral, third-party to assist with conflict resolution and solutions-oriented support. The ombuds program provides an alternative to the formal grievances and complaint process. It emphasizes non-adversarial problem-solving options, rather than formal, rights-based options.

The program is comprised of graduate faculty volunteers serving as ombuds in their own departments. Ombudspersons are nominated by the Associate Head and approved by the Department Head, rather than elected by departmental vote. Each department has at least one ombudsperson serving graduate students and postdocs. Graduate students and postdocs within EMS can choose to meet with any ombudsperson across the college.

EME	Luis Ayala	hfa101@psu.edu	(814) 865-4053
	Derek Elsworth	elsworth@psu.edu	(814) 865-2225
GEOG	Jennifer Baka	jeb525@psu.edu	(814) 865-9656
GEOSC	Sridhar Anandkrishnan	sxa17@psu.edu	(814) 863-6742
MATSE	Tze-Chiang (Mike) Chung	tcc3@psu.edu	(814) 863-1394
	Venkatraman Gopalan	vxg8@psu.edu	(814) 865-2910
METEO	Jerry Harrington	jyh10@psu.edu	(814) 863-1584
	Sukyoung Lee	sxl31@psu.edu	(814) 863-1587

The EMS college listing of current ombudspersons and the overall objectives of the program are available here:

<https://www.ems.psu.edu/graduate/graduate-student-resources/graduate-student-and-postdoctoral-scholar-ombuds-program>

2.16 Travel

All graduate students traveling either individually or in a group for university purposes, or with University funding, must record all international travel in the Travel Safety Network (TSN) database prior to departure. This includes travel for international conferences, research, and internships.

- Registration with the TSN is required prior to departure for all university-affiliated international travel (see the University's international travel policy TR01 International Travel Requirements). Failure to do so may result in travelers being denied reimbursement for travel expenses.
- A new travel record for each university-affiliated international trip must be completed at least 30 days before departure. Once the TSN record has been reviewed, the traveler will receive a confirmation email confirming they have met the requirements to record their travel.

Penn State considers the safety and security of its staff and students to be of the utmost importance. Therefore, graduate students wishing to travel to countries restricted by the University for student travel (see University Restricted Travel), using University funds, in fulfillment of degree requirements, and/or carrying out University-sponsored or affiliated activities, are required to file a request for approval of such travel with the University's International Restricted Travel Committee (IRTC) via the Travel Safety Network (TSN), prior to commitment of University resources or to finalizing arrangements (e.g., purchase of plane tickets) towards such travel.

Additional details on this policy can be found here:

<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-920-international-travel/>

2.17 EME Graduate Student Council

The graduate students in the EME department elect a council of 5 representatives each August. August 2022 is the most recent reinstatement of the EME graduate council after a period of several years without elected representatives. All EME graduate students are considered members of the EME graduate student organization, and are eligible to vote on the 5 at-large representatives.

The EME graduate representatives select leadership from among themselves to identify a president, a treasurer, and other officers as needed. The representatives can then either select from among themselves or from among the EME graduate student population to appoint representatives to the college graduate student council, the university graduate and professional student association, and other groups as desired.

The EME graduate student representatives serve as part of multiple department and college committees and groups to communicate the needs and desires and priorities of the EME graduate students as a whole. The EME graduate student council is self-organizing and sets its own rules for term limits, qualifications, election frequency, and other aspects. Students should become familiar with the elected representatives, so that communication occurs freely as needed.

3 Science and Research Integrity (SARI)

SARI (Scholarship and Research Integrity) is a responsible conduct of research (RCR) education program for students, postdocs, and faculty at Penn State. The SARI program is designed to create an awareness of ethical principles and established professional norms in the performance of all activities related to scholarship and research. Ultimately, our goal is to further foster trust among scholars and researchers and to increase the public's support for research.

All scholars confront ethical issues in their professions. Training is critical to prepare students and researchers to address ethical challenges that may arise in their work. Penn State requires RCR training for all graduate students, postdocs, and new faculty to ensure the ethical conduct of research and scholarship at the University. In addition, funding agencies including NIH, NSF, and NIFA have requirements for RCR training for students, postdoctoral researchers, and other trainees.

The SARI program has two components:

1. **Online Training:** Completion of at least one online course in CITI (Collaborative Institutional Training Initiative): Responsible Conduct of Research (RCR), Human Subjects Research (IRB), or Animal Research (IACUC). Check with your graduate program adviser to determine which CITI course is appropriate; the RCR course is recommended. Researchers funded by NIFA must take the RCR course in CITI, as outlined in the terms and conditions of all NIFA grants. Note: The online CITI training is different from the CATS submission trainings, which do not count toward SARI credit.
2. **Discussion-based Education:** Participation in a minimum of 5 hours of in-person, discussion-based educational activities that address topics related to the Responsible Conduct of Research (RCR) before graduation. This is a one-time requirement that does not need to be fulfilled each year. It is up to the departments or programs within each college to determine how the discussion-based education requirement should be met. Many programs require their students to take a course that covers all of the recommended topics for responsible conduct of research. Other programs offer their own workshops or seminars that count for SARI credit. Certain Rock Ethics events can also count for SARI credit. The ORP also offers workshops for SARI credit in the Fall and Spring Semesters. Only two of the five hours required can be obtained from workshops outside of the departments.

Graduate students must complete both the online AND discussion-based SARI components. The ORP highly recommends the Responsible Conduct of Research (RCR) course be taken in the first year of enrollment. Most students should take the RCR course. Students should check with their program director for information on which CITI Program course to take.

SARI is tracked in LionPath by the graduate program coordinator. LionPath tracking is not the responsibility of the ORP. Doctoral students who completed SARI requirements for a masters degree do not have to complete additional SARI requirements. However, CITI training for human subjects or animal research protocols must be renewed every three years.

Fulfilling your SARI requirement at PSU is serious and the responsibility of each individual. For graduate students, the consequence for failing to meet SARI requirements by graduation are determined by each department and/or program. If you have concerns about your ability to fulfill SARI requirements prior to graduation, speak with your graduate program advisor or program head. For postdocs and new faculty members, failure to fulfill SARI will result in notification to the supervisor, department head, and/or dean.

For additional information, review our page on SARI Tracking and Plan Development or contact us at sari@psu.edu.

4 MS Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies.

The MS degree program in Energy and Mineral Engineering is designed for students to gain advanced knowledge for research, analysis, and design in Energy and Mineral Engineering.

4.1 Core Course Requirements

MS students must take at least two (2) courses (6 credits of core courses) from the list of prescribed (core) courses (Table 7).

Table 7: EME Core Courses

Code	Title
EME 501	Design Under Uncertainty in Energy and Mineral Systems
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements
EME 521	Mathematical Modeling of Energy and Mineral Systems
EME 531	Thermodynamics of Energy and Mineral Systems
EME 551	Safety and Environmental Risk Analysis for Energy and Mineral Systems

An additional set of prescribed twelve (12) option credits (as a minimum) must be taken if the student chooses to pursue an EME disciplinary option (petroleum and natural gas engineering, mining and mineral process engineering, fuel science, or energy systems engineering). Students are not required to choose an option and may complete the base program in EME.

4.2 Research Requirements

Students pursuing an MS degree in EME will be required to complete a prescribed culminating research experience and the minimum amount of credits associated with each experience, which include the completion of minimum core and option (if any) course requirements. The thesis and non-thesis MS culminating experience tracks are:

4.2.1 Thesis-Based MS in EME

Students are required to complete a minimum of 30 credits total (at least 18 at the 500 or 600 level) including: 24 credits in course work, 6 thesis research credits (EME 600 Thesis Research), and a thesis accepted by the adviser(s) and committee members, the head of the graduate program, and the Graduate School. The student must pass a thesis defense.

4.2.2 Non-Thesis-Based MS in EME

Students are required to complete a minimum of 36 credits in total (at least 24 at the 500 level) including: 33 credits in course work and 3 credits for the completion of a culminating research experience. Within the 33 credits of coursework, MS students must take at least two extra courses (6 credits) from the EME

core course list (beyond the six credit MS core requirement) or chosen graduate option (beyond the option's 12-credit minimum option requirement). The non-thesis culminating research experiences are:

Paper-based MS: Students take three (3) credits of non-thesis research (EME 596 Individual Studies) and complete a satisfactory scholarly paper evaluated by their adviser(s) and a reader.

Course-based MS: Students take a capstone research course EME 580 Methodology of Research in EME (3 credits) where they will create a work product demonstrating evidence of analytical thinking and synthesis of knowledge in the Energy and Mineral Engineering field.

4.3 Recommended Academic Plan

The specifics of any academic plan must be negotiated between a student and their adviser within the bounds established by the degree requirements outlined above, and any relevant options (following section). The specific courses recommended for any student will depend on their individual academic and professional background, their research objectives, any teaching responsibilities, and their future professional and academic objectives. However, most MS students should expect to follow a plan similar to this one:

Table 8: Recommended Academic Plan for Thesis-Based MS Students

Semester 1	3 courses (9 credits) including one core course and 3 credits of EME 600 [12 credits total]
Semester 2	3 courses (9 credits) including one core course and 3 credits of EME 600 [12 credits total]
Summer	Research towards thesis (not registered for any credit)
Semester 3	2 courses (6 credits) and 6 credits of EME 600 (Thesis Research) [12 credits total]
Semester 4	12 credits of EME 600 (Thesis Research). Final thesis defense would occur during semester 4.

Please note that the above plan includes 24 credits of coursework, which meets the minimum thesis-based MS requirement, and it also includes 24 credits of EME 600, which is more than the degree requirement of 6 credits. The reason for this is that most students need a minimum of 9 credits during each Fall and Spring semester to maintain their full-time student status, and the program recommends that all graduate students maintain a load of 12 credits. Depending on needs and progress, students and their advisers may decide to redistribute these required credits as desired, for example, into summer semesters.

The recommended academic plan for non-thesis MS students is included in Table 9.

Table 9: Recommended Academic Plan for Non-Thesis-Based MS Students

Semester 1	4 courses (12 credits) including one core course
Semester 2	4 courses (12 credits) including one core course
Summer	1 course (3 credits) and 3 credits of capstone experience [6 credits total]
Semester 3	2 courses (6 credits) including one core course and 6 credits of capstone experience [12 credits total]

Again, based on needs and interests, students and their adviser may decide to redistribute these credits to support particular objectives, for instance taking 2 core courses each during the first two semesters and then taking additional electives in semester 3, or continuing on into semester 4.

4.4 Thesis and Thesis Research

The MS thesis, normally less than 100 pages in length, is written on a topic approved by the student's adviser. This thesis is read by the student's committee, and it is approved by the Associate Head of the Graduate Program. By writing an acceptable M.S. thesis, students demonstrate that they are capable of completing a well-defined, directed study of a limited problem and are capable of writing a relatively brief, coherent report summarizing the major objectives and results of the study.

Because the entire Masters program should take only two years to complete, it is paramount that a student begins work on the thesis research as soon as possible, but certainly before the end of the first year of study. In the first semester of residence, it is the responsibility of each student to determine which of the faculty members might be willing to serve as a thesis adviser. The student's committee is an important resource to help the student find a research topic. Students should not expect the faculty to come looking for them.

The thesis must be written according to the formatting and style guidelines discussed in the Thesis Guide that is available from the Graduate School. There are three thesis submission deadlines that must be met:

1. Intent to Graduate (typically very early in the semester, done on LionPATH)
2. Thesis format review (typically within about 6 weeks after the semester start)
3. Submission of signed, archival copy of the thesis (typically 1 month before graduation)

Students who do not meet these deadlines will be removed from the graduation list by the Graduate School. It is incumbent on any student who has missed a deadline to get in touch with the Graduate Program Coordinator, in the EME Graduate Program Office, 103 Hosler Building.

To help students prepare their theses, the Graduate Communication Enhancement Program (Graduate Writing Center) schedules a number of workshops for M.S. and Ph.D. students. Topics of these workshops include: 1) Editing Your Writing for Grammar and Style, 2) Basic Principles of Technical Writing in English, and 3) Developing Your Written Expression in English.

4.5 Thesis Defense

For MS students completing a thesis, to be approved, that thesis must be defended in an oral examination conducted by the student's research committee. That research committee is made up of the student's research adviser and two other members of the EME department faculty.

All MS thesis-option students defend their research in a 30- to 50-minute seminar that is normally given one to two weeks prior to the final submission of the thesis. The penultimate thesis draft must be distributed to the student's committee early enough that the committee has time to read the thesis or paper before the seminar is given. After the seminar, there will be ample time for a public discussion of the work. After that public session, the committee may discuss the thesis or paper further with the student. This private session is normally the time that feedback is provided and that the revisions required by the committee are discussed before the student may submit the final thesis or paper draft to the Thesis Office or the department as appropriate.

The policy for the conduct and scheduling of the MS thesis defense can be found in the following linked document:

https://www.eme.psu.edu/sites/www.eme.psu.edu/files/documents/graduate/ms_thesis_final_oral_examination_policy.pdf

4.6 Paper Option

The paper, normally less than 20 pages in length, is written on a topic approved by the student's adviser and read by the student's three-person departmental committee that is composed of the adviser and at least one other member of the Graduate Faculty of the university. The topic need not be original and may be a review of the literature on a particular topic or it may be a suitably extended term paper from a graduate course within the major or option requirements. The paper should have a title page and signatory page

that has the same form as that signed for an M.S. thesis. The Graduate School does not review the paper. The final, corrected Masters paper must be submitted to the department – not the Graduate School – in electronic format by the same deadline as that for the final version of a thesis. Students must register for 3 credits of EME 596 under their adviser in the semester they write the paper.

4.7 IUG Program Requirements

The Department of Energy and Mineral Engineering offers an integrated B.S./M.S. program, also called the Integrated Undergraduate-Graduate (IUG) program, that is designed to allow academically superior students to obtain both the B.S. and the M.S. degree in Energy and Mineral Engineering in five years of study. In order to complete the program in five years, students interested in the IUG program in Energy and Mineral Engineering must apply for admission to the Graduate School and the IUG program no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

During the first three years, the student will follow the course scheduling of one of the options in the B.S. degree, normally the Energy and Mineral Engineering or the General Option (see the Undergraduate Bulletin). Students who intend to enter the IUG program are encouraged to take upper level classes during their first three years whenever appropriate. However, students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. By the end of the junior year, students normally apply for admission to both the IUG Program and to the Graduate School. Acceptance decisions will be made prior to the beginning of the senior year and M.S. advising committees appointed for successful applicants. During the senior year, IUG students follow the scheduling of the selected B.S. Energy and Mineral Option, with an emphasis on completing 500-level course work as appropriate. At the same time, IUG students will start work on their theses or papers that are designed to meet the requirements of the M.S. degree in Energy and Mineral Engineering. During the fifth year, IUG students take courses fulfilling the departmental M.S. degree requirements and complete their M.S. theses. If a student cannot continue in the integrated program, then this student will be able to receive the undergraduate degree upon completion of all of the B.S. requirements.

5 PhD Degree Requirements

5.1 Summary of Degree Requirements

Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.

Studies for the Ph.D. degree are designed to accommodate the interests and capabilities of the candidate, and they are overseen by a doctoral committee, which also administers comprehensive and final oral examinations. Before being admitted to Ph.D. candidacy, a student must have the academic support of a faculty member and the student must pass the Ph.D. Qualifying Examination. The exam must be taken within three semesters (excluding summer sessions) of entry into the doctoral program. If a student does not pass the exam on their first attempt, then a second attempt may be allowed at the discretion of the graduate faculty members of the Department.

In addition, Ph.D. degree requirements include successful completion of the following: approved graduate course work, English Competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). The student must pass the English competency exam before scheduling the comprehensive exam. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the doctoral committee, the head of the graduate program, and the Graduate School. The Ph.D. program in Energy and Mineral Engineering requires completing a minimum of twelve (12) post-M.S. course credits, which must include the completion of all minimum core and option (if any) course requirements, and twelve (12) research credits. For students without an M.S. degree, 24 additional course credits must be taken to complete a total of 36 course credits and 48 credits total overall. At least 18 credits of these must be at the 500 or 600 level. A student's Ph.D. committee can require additional course work based on the student's background and research plans.

All Ph.D. students must take at least one (1) course (3 credits of core courses) from the following list of prescribed (core) courses. Ph.D. students without an M.S. are required to take three (3) courses (9 credits

of core courses) from this list:

Table 10: EME Core Courses

Code	Title
EME 501	Design Under Uncertainty in Energy and Mineral Systems
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements
EME 521	Mathematical Modeling of Energy and Mineral Systems
EME 531	Thermodynamics of Energy and Mineral Systems
EME 551	Safety and Environmental Risk Analysis for Energy and Mineral Systems

5.1.1 Dissertation

Students will complete a dissertation, normally less than 200 pages in length, on an original topic that is approved by the student's adviser and Ph.D. committee, read by the committee, and approved by the Associate Head of the Graduate Program. By writing an acceptable Ph.D. dissertation, students demonstrate that they are capable of completing a well-defined, self-directed study of a new problem and are capable of writing a relatively brief, coherent report summarizing the major objectives and results of the study. The dissertation work must be of publishable quality.

5.1.2 Registration Requirements

Students must register continuously in the fall and spring semesters up to and including the semester or session in which the Final Oral Exam is passed. Summer session registration is not required unless a student is taking a Comprehensive or Final Oral Exam in that session. Active off-campus students who have passed their Qualifying Exam and who have satisfied the two-semester full-time residence requirement need only register each fall and spring semester.

After passing the Comprehensive Exam, a student will normally register in the fall and spring for the noncredit course EME 601 (Thesis Preparation, full-time)

If a Ph.D. student will not be in residence for an extended period for compelling reasons, then the Senior Associate Dean of the Graduate School will consider a petition for a waiver of the continuous registration requirement. This petition must come from the doctoral committee chairperson and must carry the endorsement of the Department Head or the Associate Head of the Graduate Program.

5.1.3 Residency Requirement

The University residency requirement is that each student must spend at least two consecutive semesters, exclusive of summer sessions, as a registered full-time student engaged in academic work at the University Park Campus. The residency requirement can be completed at any time after a student has been admitted to the Ph.D. program.

5.1.4 Time to Completion Requirement

The Ph.D. degree must be completed within eight years of admission to candidacy (i.e., passing the Qualifying Exam) and within six years of passing of the Comprehensive Exam.

5.2 Composition of Doctoral Committee

A student's Dissertation Committee shall be nominated to the Graduate School by the student's major Graduate Program Head as soon as possible after passing the Ph.D. Qualifying Exam. A student's Dissertation Committee shall consist at minimum of four members of the Graduate Faculty, each of whom shall be in a position to contribute substantially to the student's education (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>). At least two Committee members shall be from the student's major graduate program (i.e., Energy and Mineral

Engineering). At least one Committee member must be a Graduate Faculty member from outside of the Department of Energy and Mineral Engineering. Dissertation Committees may also include other participants who are not members of the Graduate Faculty but are otherwise qualified and have particular expertise in the student's research area.

For students pursuing a graduate minor, the Dissertation Committee shall include a Minor Field Member representing each graduate minor. For students pursuing dual-title degrees, either the Dissertation Committee Chair or a co-Chair must be a Graduate Faculty member of the dual-title program.

The Graduate Program Head can consult with the student and the student's adviser on the composition for the committee. The Graduate Program Head is also responsible for nominating non-PSU members of the Dissertation Committee to the Graduate School, and ensuring appropriate Dissertation Committee composition that is in the best interests of the student and the completion of their dissertation.

The Dissertation Committee shall meet with the student no less than annually to assess student progress toward the degree.

5.3 Qualifying Exam

The PhD qualifying exam is the first major milestone faced by PhD students. The purpose of the qualifying exam is to evaluate the background and capabilities of students in the fundamentals of their field and their readiness to conduct research.

PhD students may attempt the qualifying exam twice. Any student not passing the qualifying exam on the second attempt may not continue in the PhD program, though they may complete a MS degree in the department.

The qualifying exam takes place at the beginning of each Fall and Spring semester. Most PhD students will take this exam at the beginning of their third semester of study. The EME department procedure for the conduct of the qualifying exam can be found in the document linked below:

<https://www.eme.psu.edu/file/emequalifyingexamformatandprocedurepdf>

Students who pass the qualifying exam should immediately form their research committee with the guidance of their adviser.

5.4 Comprehensive Exam

The comprehensive exam is the second of the three major milestones of the PhD program. The comprehensive exam is meant to provide a review of a student's research plan for the completion of their dissertation. The student's research committee will review the student's proposal and conduct an oral examination of the student based on that proposal. The purpose of this exam is to evaluate the impact and feasibility of the proposed research and the readiness of the student to carry it out. Students who fail the comprehensive exam may retake the exam at a future date.

Each PhD student will schedule their individual comprehensive exam in consultation with their research committee. Students are encouraged to get the advice of their committee regarding their readiness for the comprehensive exam.

The EME department policy on the scheduling and conduct of the comprehensive exam can be found in the following linked document:

https://www.eme.psu.edu/sites/www.eme.psu.edu/files/documents/graduate/comprehensive_examination_policy.pdf

Successful completion of the comprehensive exam makes the examinee a PhD Candidate.

PhD candidates are generally not allowed to take courses following the completion of their comprehensive exam, and only register for EME 601 each semester until their dissertation is completed. It is possible for students to appeal to have registration in a single course approved in special cases. PhD candidates should discuss this with their adviser and the Director of Graduate Studies.

5.5 Dissertation and Final Defense

All Ph.D. candidates must write a dissertation. The topic of the study must be original and must be developed in large part by the student. A typical dissertation is 100 to 200 pages in length and should be completed within two years after a student has passed the Ph.D. Comprehensive Exam.

The dissertation must be written according to the formatting and style guidelines discussed in the Thesis Guide that is available from the Graduate School. There are three thesis submission deadlines that must be met:

1. Intent to Graduate (typically very early in the semester, done on LionPATH)
2. Thesis format review (typically within about 6 weeks after the semester start)
3. Submission of signed, archival copy of the thesis (typically 1 month before graduation)

Students who do not meet these deadlines will be removed from the graduation list by the Graduate School. It is incumbent on any student who has missed a deadline to get in touch with the Graduate Program Coordinator, Department of Energy and Mineral Engineering, 103 Hosler Building.

Once completed in manuscript form, the dissertation is given to the student's Ph.D. Committee whose members read it and then administer a Final Oral Exam, or thesis defense. The committee members must have copies of the completed dissertation at least two weeks prior to the scheduled defense date. Once the Final Oral Exam is scheduled with the committee, the student must inform the Graduate Staff Assistant. The Graduate Staff Assistant then will notify the Graduate School, at least two weeks prior to the exam, in the same way that the Comprehensive Exam was scheduled.

There must be at least three months between the Comprehensive and Final Oral Exams. All Final Oral Exams begin as special departmental seminars that are open to all available faculty and graduate students of the department. This seminar is a formal, scholarly one and should be conducted as would be a seminar for a job interview. Typically, this seminar is scheduled first and then the student's committee and other interested faculty meet with the student after the seminar to ask any additional questions. This committee then decides whether a student passes the exam; as for the Comprehensive Exam, at least 2/3 of the committee must vote in favor of passing the student for the student to have passed the exam.

The EME department policy on scheduling and conducting the final oral defense can be found in the linked document:

https://www.eme.psu.edu/sites/www.eme.psu.edu/files/documents/graduate/phd_final_oral_examination_policy.pdf

5.6 Recommended Academic Plan

Academic plans for PhD students are highly individualized based on the backgrounds of the student and the training needs associated with their research. The following recommended academic plans are included here simply as a baseline example with which students and their advisers can begin a discussion around expected milestones and planning to meet the mandatory degree requirements.

While the qualifying exam milestone has a fixed date based on department and graduate school policy, the comprehensive exam and final defense dates are set based on a student's progress in consultation with their adviser and doctoral committee, and as such do not have fixed dates. The prospective dates included in these recommended plans are based on certain assumptions for success in research, which may or may not be met regardless of the level of effort by the individual student. However, most EME PhD students are able to complete their degrees after 4 or 5 years; time to completion of less than 4 years is rare (though possible).

Table 11: Recommended Academic Plan for PhD Students Entering with a MS Degree

Semester 1	3 courses (9 credits) including one core course and 3 credits of EME 600 [12 credits total]
Semester 2	1 course (3 credits) and 9 credits of EME 600 (or courses to satisfy option or minor requirements) [12 credits total]
Summer	Time to conduct research
Qualifying Exam	Occurs during the first week of semester 3.
Semester 3	12 credits of EME 600 (or courses to satisfy option or minor requirements)
Semester 4	12 credits of EME 600 (or courses to satisfy option or minor requirements)
Summer	Time to conduct research
Comprehensive Exam	Timing set by consultation between student, adviser, and doctoral committee
Semester 5	12 credits of EME 601
Semester 6	12 credits of EME 601
Summer	Time to conduct research
Semester 7	12 credits of EME 601
Semester 8	12 credits of EME 601
Final Defense	Timing set by consultation between student, adviser, and doctoral committee

Table 12: Recommended Academic Plan for PhD Students Entering without a MS Degree

Semester 1	3 courses (9 credits) including one core course and 3 credits of EME 600 [12 credits total]
Semester 2	3 courses (9 credits) including one core course and 3 credits of EME 600 [12 credits total]
Summer	Time to conduct research
Qualifying Exam	Occurs during the first week of semester 3.
Semester 3	3 courses (9 credits) including one core course and 3 credits of EME 600 [12 credits total]
Semester 4	3 courses (9 credits) and 3 credits of EME 600 [12 credits total]
Summer	Time to conduct research
Semester 5	12 credits of EME 600
Semester 6	12 credits of EME 600
Comprehensive Exam	Timing set by consultation between student, adviser, and doctoral committee
Semester 7	12 credits of EME 601
Semester 8	12 credits of EME 601
Summer	Time to conduct research
Semester 9	12 credits of EME 601
Semester 10	12 credits of EME 601
Final Defense	Timing set by consultation between student, adviser, and doctoral committee

5.7 Dual Title Degree Program in Operations Research

Students must apply and be admitted to the graduate program in EME and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page. Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in EME, listed above. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EME and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EME and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of an EME and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in EME and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

5.8 Dual Title Degree Program in Human Dimensions of Natural Resources and the Environment

Students must apply and be admitted to the graduate program in EME and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the HDNRE dual-title program. Refer to the Admission Requirements section of the Human Dimensions of Natural Resources and the Environment Bulletin page. Doctoral students must be admitted into the dual-title degree program in EME prior to taking the qualifying examination in their primary graduate program.

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in EME, listed above. In addition, students must complete the degree requirements for the dual-title in HDNRE, listed on the HDNRE Bulletin page.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EME and must include at least one Graduate Faculty member from the HDNRE program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EME and HDNRE. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of an EME and HDNRE dual-title Ph.D. student must include at least one member of the HDNRE Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in HDNRE, the member of the committee representing HDNRE must be appointed as co-chair. The HDNRE

representative on the student’s Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in EME and HDNRE. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

6 Graduate Degree Options

EME students are not required to choose a graduate option and may complete the base program in EME, also generally referred to as the "Base Option". However, MS and PhD students of the EME graduate program who desire disciplinary identity may choose from among the following available graduate options:

- Energy Systems Engineering (ESysE)
- Fuel Science (FSc)
- Mining and Mineral Process Engineering (MMPE)
- Petroleum and Natural Gas Engineering (PNGE)

The mandatory minimum course requirement for each of these options is 12 credits (4 courses) selected from the list of option-specific courses provided. Student may apply the option to either the MS or PhD degrees, or both, provided that new and appropriate substitute courses are taken as approved by the EME graduate program officer.

6.1 Energy Systems Engineering (ESysE)

The ESysE option focuses on computational and data-analytic methods applied to the design and analysis of energy systems and infrastructures. The additional courses in this option provide critical foundations in optimization, simulation, statistical analysis, and systems-based approaches. The option will provide a consistent and rigorous track for graduate students whose research focuses on methodological innovations at the interface of energy science/engineering, energy economics, operations research methods, and statistical and data-analytic methods.

Possible examples of research projects include game-theoretic models of electricity markets that present the physical constraints of electricity flow, uncertainty in system parameters, and require innovative mathematical programming solution techniques; machine learning algorithms for characterizing toxicological risks; designs for integrating renewable generation technologies into the electric power system that account for the time and weather dependent performance of the renewable technologies, explicitly consider uncertainties in system properties, and represent the operations and constraints of the other generation and demand resources in the grid to balance cost-effectiveness, reliability, and resilience to range of potential system shocks.

Table 13: Energy Systems Option Courses. Students must complete 4 of these courses to complete the option.

Code	Title
EME 522	Computational Methods for Electric Power Systems Analysis
EME 523	Stochastic Optimization Methods of Energy and Environmental Systems
EME 524	Machine Learning for Energy and Mineral Engineering Problems
EME 526	Solar Utility and Portfolio Management
EME 527	Stochastic Modeling of Spatial Variability in Energy and Environmental Systems
ENNEC 540	Economic Analysis of Energy Markets
IE 505	Linear Programming
IE 516	Applied Stochastic Processes

6.2 Fuel Science (FSc)

The Fuel Science option provides advanced instruction and research in the characterization and utilization of fuels, with special emphasis on coal, petroleum and carbon-based materials. Graduates will be at the forefront of society's search for environmentally acceptable solutions to the ever-increasing energy problems of today.

The training will prepare students for work in safeguarding the environment and providing society with energy technology choices to meet the ever-growing needs in areas such as fuel processing and use, and technology development. The research focus in the Fuel Science option is the effective conversion and utilization of energy resources and carbon materials. Faculty have a wide variety of interests spanning coal science and technology, fuel conversion, hydrocarbon combustion, air pollution control and carbon materials.

Table 14: Fuel Science Option Courses. Students must complete 4 of these courses to complete the option.

Code	Title
FSC 503 or CHE 510	Analytical Methods in Fuel Science or Surface Characterization of Materials
FSC 504	Problems in Fuels Engineering
FSC 506	Carbon Reactions
CHE 544 or CHE 546	General Transport Phenomena or Transport Phenomena II
ME 523	Numerical Solutions Applied to Heat Transfer and Fluid Mechanics Problems

6.3 Mining and Mineral Process Engineering (MMPE)

The Mining and Mineral Process Engineering option focuses on the aspects of geological, civil, mechanical, electrical, and industrial engineering, together with business and management skills, that are integrated in the challenge of extracting minerals from the Earth. Mining engineers are involved in all stages of the process: from exploring for new mineral deposits and deciding if they can be mined economically, through designing and constructing mines at and below the ground, to managing and operating mines, to preparing raw mineral products for manufacturing or energy industries.

In order to prepare students for this profession, course work and research opportunities specific to mining engineering include: computer applications, environmental control, geomechanics and rock mechanics, health and safety, innovative mining systems, materials handling, mine equipment maintenance, mine management, mine planning and reclamation, monitoring and control, operations research, surface mining, underground mining, and ventilation. Interests cover coal, metal, and nonmetal mining.

Mineral Process Engineering is concerned with the extraction and purification of valuable commodities from the earth. The raw materials produced by mining are highly impure and must be upgraded before they are of use to society. The refining of mineral commodities involves a broad variety of problems, mostly associated with the production, handling and separation of solid particles. Particle systems are also critical to many of the processes and products of modern industry: materials, chemicals and electronics as well as minerals. Mineral processing engineers are at the forefront of the development of the science and technology of particle systems and many of the techniques and procedures used in mineral processing find direct application in other areas.

Table 15: Mining and Mineral Process Engineering Option Courses. Students must complete 4 of these courses to complete the option.

Code	Title
MNG 541	Surface Mine Equipment Selection Analysis
MNG 554	Rock Mechanics Design
MNG 512	Valuation of Mineral Properties and Mining Projects
MNPR 505	Particle Separation
MNPR 507	Hydrometallurgical Processing
MNG 597	Special Topics

6.4 Petroleum and Natural Gas Engineering (PNGE)

The Petroleum and Natural Gas Engineering option is concerned with the extraction of the two largest sources of energy for industrialized societies: oil and natural gas. As such, petroleum and natural gas engineers work in interdisciplinary teams with other professionals - geologists, geophysicists, environmental/regulatory specialists, safety engineers - and the combined expertise is applied to increasing oil and gas recovery.

Our participation in the Petroleum GeoSystems initiative within the College of Earth and Mineral Science is another mark of our determination and desire to provide the oil industry with much needed broader skills and expertise. Some of the current research topics our EME faculty are engaged in include: underground gas storage, unconventional gas reservoirs, fluid flow dynamics in porous media, gas transmission lines, porous media characterization, numerical simulation of hydrocarbon reservoirs, stripper wells and virtual intelligence applications.

Table 16: Petroleum and Natural Gas Engineering Option Courses. Students must complete 4 of these courses to complete the option.

Code	Title
PNG 501	Flow in Porous Media
PNG 502	Unsteady Flow in Porous Media
PNG 512	Numerical Reservoir Simulation
PNG 518	Design of Miscible Recovery Projects
PNG 520	Phase Relations in Reservoir Engineering
PNG 526	Well Stimulation
PNG 530	Natural Gas Engineering
PNG 555	Unconventional Resources Analysis
PNG 566	Reservoir Characterization
PNG 577	Production and Completions Engineering
PNG 597	Special Topics

7 Graduate Minors

A graduate minor may be taken in any of the approved graduate major degree programs. In addition, there are stand-alone graduate minors which are unaffiliated with a graduate major and approved by Graduate Council. Graduate minors are available for both master's and doctoral degrees. A description of offered graduate minors and links to related policies can be found here:

<https://bulletins.psu.edu/graduate/programs/minors/>

It is not common for EME graduate students to pursue minors, however some students may find the credential associated with in depth training in a particular subject area to be beneficial to their future careers. As with all course selection questions, students need to consult with their academic adviser to determine whether a certain course of study is relevant to their research and other objectives.

7.1 Electrochemical Science and Engineering Minor

This graduate minor, administered by the EME department, is highly relevant to numerous graduate degree programs associated with energy, materials, and environmental sciences offering a unique set of skills that will benefit graduate students to develop expertise in electrochemical systems that complements their primary focus in batteries, fuel cells, or structural design. The minor will also help expand the students' knowledge and capabilities in important topics relating to electrochemical and renewable energy fundamentals, devices and systems.

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies and GCAC-700 Professional Degree Policies.

The doctoral minor will consist of no fewer than five 3-credit courses (15 credits) of integrated or articulated work in electrochemical science and engineering, related to but different from, that of the major, drawn from the two lists (500-level courses and 400-level courses) below, with a preponderance of courses at the 500 level. A minimum of 6 credits must be at the 500 level for the doctoral minor.

The master’s minor will consist of no fewer than two 3-credit courses (6 credits) of integrated or articulated work in electrochemical science and engineering, related to but different from, that of the major, drawn from the two lists above. A minimum of 3 credits must be at the 500 level for the master’s minor.

A student enrolled in this graduate minor must receive a grade of B- or better in all minor courses.

A representative from the Graduate Faculty in the graduate minor (i.e., a “Minor Field Member”) must be appointed to the dissertation committee of each student enrolled in the doctoral minor in Electrochemical Science and Engineering.

Table 17: Graduate Courses Included in the Electrochemical Science and Engineering Minor.

Code	Title
EME 541	Electrochemical Science and Engineering Fundamentals
CHEM 524	Electroanalytical Chemistry
ESC 501	Solar Cell Devices
CHE/MATSE 510	Surface Characterization of Materials
CHE 528	Colloidal Forces and Thermodynamics
MATSE 560/MNPR 507	Hydrometallurgical Processing
MATSE 501	Thermodynamics of Materials
MATSE 503	Kinetics of Materials Processes

Table 18: Advanced Undergraduate Courses Included in the Electrochemical Science and Engineering Minor.

Code	Title
EGEE 420	Hydrogen and Fuel Cells
EGEE 437	Design of Solar Energy Conversion Systems
EGEE 441	Electrochemical Engineering Fundamentals
EME 407	Electrochemical Energy Storage
ESC 455	Electrochemical Methods Engineering and Corrosion Science
MATSE 421	Corrosion Engineering
ME 403	Polymer Electrolyte Fuel Cell Engines

8 Funding, Employment, Assistantships, and Fellowships

Most students in the department are supported through either a teaching or research assistantship according to the needs of the department. Applicants to the department are considered also for college and university fellowships; a student granted such a fellowship is free to pursue an intensive year of studies without any of the additional duties that are associated with an assistantship.

An assistantship appointment for each student is granted on a semester-by-semester basis after the first academic year. Normally, students who maintain regular academic status and who make adequate progress toward completing their degrees can expect continued support. Students who are receiving continued support each semester must sign a university Terms of Offer of a Graduate Assistantship form that is signed by the adviser (for research assistantships) or the Department Head or the Associate Head of the Graduate Program (for teaching assistantships). Also, the department via the student’s adviser will inform the student in writing, after meeting with the student, if financial support is being terminated.

Students holding teaching assistantships and who are making satisfactory progress toward their degree may be appointed at Grade 12 each fall and spring semester. Students who hold teaching assistantships and who also have research advisers with adequate funds, however, may have their salaries incremented by their research advisers from a Grade 12 salary to the highest-grade level for which they qualify at that time.

An assistantship may be terminated if the student blatantly disregards departmental or Graduate School rules, such as the one limiting credit loads per semester, or if the student's program is terminated for unsatisfactory scholarship.

8.1 Teaching Assistantships

Teaching assistantships may be available in the fall and spring semesters for new students who have adequate backgrounds in energy and mineral engineering or in a related field, and for more senior energy and mineral engineering graduate students, regardless of their undergraduate backgrounds. Students supported by teaching assistantships are involved with teaching of energy and mineral engineering regular and laboratory classes for undergraduate courses, grading problems and exams for instructors, holding office hours.

It is Earth and Mineral Science College policy that no graduate student for whom English is a second language may serve as a teaching assistant or may conduct laboratories until he or she has received an NR (No Restriction) rating from the Department of Linguistics. All incoming students are scheduled by the Graduate Assistant to take the test American English Oral Communicative Proficiency Test. Students who do not receive an NR rating may take some or all of the English as second language courses: ESL 115G, 117G, or 118G.

8.2 Research Assistantships

Research assistantships support students as they work on their thesis research. These assistantships, unlike teaching assistantships, are usually funded by outside sources. The professor or professors who have obtained the funding from a particular agency for a given project supervise them. Consequently, the availability of funds for support of new students depends on the success the faculty has had in obtaining research grants. Two years is considered to be the normal duration of a research assistantship for an M.S. student.

8.3 Fellowships

The Graduate School, the College of Earth and Mineral Sciences (EMS), and the EME Department each award a limited number of fellowships to scholastically outstanding students that meet specific fellowship requirements. Fellows may not accept employment during the periods of their appointments, nor are they required to render any service to the University. Fellows receive stipends that vary with the particular award and usually receive grants-in-aid for tuition. For incoming students, the graduate admission application serves as the fellowship application. The University Fellowships Office maintains a searchable compilation of available external fellowships.

Students granted fellowships should carry the same credit loads as those holding regular assistantships except in the summer. Full-time graduate fellows are also required to have medical insurance. Normally and if funds are available, students who are making satisfactory progress will be awarded assistantships once their fellowships expire.

8.4 Summer Tuition Assistance Program (STAP)

The Summer Tuition Assistance Program provides tuition assistance to graduate students who have had assistantships, fellowships, or traineeships for the two preceding semesters (ex.Fall 2019 and Spring 2020) in order to continue graduate studies during the Summer.

Please review the following eligibility criteria and attached EME STAP Policy/FAQ document before applying. You may also, visit the following STAP link for more information:

<https://secure.gradsch.psu.edu/stap/>

8.4.1 Eligibility Criteria

Graduate students must meet at least one of the following:

- Appointed through the University on a teaching or research assistantship – Fall 2020 AND Spring 2021 (for a maximum tuition award of nine credits during summer).

- Appointed through the University on a graduate fellowship or traineeship – Fall 2020 AND Spring 2021 (for a maximum tuition award of nine credits during summer).

8.4.2 Course Requirements

Students must register for appropriate course work or research credits. Courses that qualify for STAP are limited to:

- Those that may be applied towards the credit requirements for a graduate degree (i.e., courses at the 400-level or above).
- English as a Second Language (ESL) skills courses required for international graduate students.
- Foreign language skills courses required by the student's program (resident instruction only).
- In all cases, courses must be required and approved by the student's graduate program.
- No "hobby courses"

Students will be billed for audits, which cannot be used to satisfy degree requirements, and unapproved registrations.

Continuing Education, and Conference and Institutes courses are not STAP eligible. STAP is intended to cover resident and World Campus instruction course work. International students are limited to three World Campus credits (per World Campus policy).

8.5 Tax Withholding

All students on assistantships must file a W-4 form with the Payroll Office at the time their assistantships begin. Current withholding information is printed on both the check stub and the remittance advice for direct deposit. Students having questions may contact the Payroll Office in 101 James M. Elliot Building, at (814) 865-7621, or may send e-mail to payroll@psu.edu. W-4's are available from the Payroll Office, the Payroll window at the Office of the Bursar, and the department office, or they may be printed from the web: <https://controller.psu.edu/payroll-office/forms>.

When students fall below half-time student status, i.e., in the summer when not taking classes, they are no longer exempt from Social Security and Medicare (FICA) taxes. When budgeting, students should plan accordingly.

When a student leaves Penn State, that student must file a new W-4 form so that Penn State has an address on file to send the W-2 for the current tax year. When filling out a new W-4 form, it is important that the student completes the entire form. Whatever information is supplied on this form will replace the current information on file, including blanks. The IRS requires that if the withholding information is left blank, then Penn State must withhold at the rate for "SINGLE" (this is the highest withholding rate) and cannot allow any withholding allowances.

8.5.1 State and Local Taxes

No state and local taxes are withheld for students on graduate research assistantships during the academic year, per University standards. All summer appointments are taxable, however.

9 Course Offerings

The EME department offers graduate and advanced undergraduate courses under a variety of subject codes including EBF, EEFE, EME, EGEE, ENNEC, ENVSE, FSC, MNG, MNPR, and PNG. Course offerings are constantly changing based on available faculty, priorities, and student interest.

All current course offerings can be found in LionPATH:

<https://lionpath.psu.edu/>

The total set of permanent courses offered by the EME department (and other departments) can be found in the University Bulletin:

<https://bulletins.psu.edu/graduate/>

Included in Table 19 is a listing of graduate courses that have been offered by EME faculty during the last 4 years, not including special topics courses (i.e. 597's) or independent study courses (i.e. 596's). Most of these course are offered on an annual basis, but some are offered every other year instead. Courses marked with (WC) are online courses taught through the World Campus, all other courses are conducted through the University Park (UP) campus.

Table 19: Regular EME Graduate Course Offerings. Courses Marked with (WC) are Taught via World Campus; all Other Courses are Taught at the University Park Campus.

Code	Course Title
AE 868	Commercial Solar Electric Systems (WC)
AE 878	Solar Project Development and Finance (WC)
AERSP 886	Engineering of Wind Project Development (WC)
BA 850	Sustainability Driven Innovation (WC)
BIOET 533	Ethical Dimensions of Renewable Energy and Sustainability Systems (WC)
EEFE 511	Econometrics II
EEFE 529	Foundations of Economic Welfare Analysis
EME 501	Design Under Uncertainty in Energy and Mineral Systems
EME 504	Foundations in Sustainability Systems (WC)
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements
EME 521	Mathematical Modeling of Energy and Mineral Systems
EME 531	Thermodynamics of Energy and Mineral Systems
EME 541	Electrochemical Science and Engineering Fundamentals
EME 551	Safety and Environmental Risk Analysis for Energy and Mineral Systems
EME 589	Management and Design of Renewable Energy and Sustainability Systems (WC)
EME 801	Energy Markets, Policy, and Regulation (WC)
EME 802	Renewable and Sustainable Energy Systems (WC)
EME 803	Applied Energy Policy (WC)
EME 805	Renewable Energy and Nonmarket Enterprise (WC)
EME 807	Technologies for Sustainability Systems (WC)
EME 810	Solar Resource Assessment and Economics (WC)
EME 812	Utility Solar Power and Concentration (WC)
ENNEC 540	Economic Analysis of Energy Markets
ENNEC 560	Mineral and Energy Finance I
FSC 503	Analytical Methods in Fuel Science
FSC 504	Problems in Fuels Engineering
MNG 541	Surface Mine Equipment Selection Analysis
MNPR 505	Particle Separation
MNPR 507	Hydrometallurgical Processing
PNG 501	Flow in Porous Media
PNG 502	Coupled Flow and Deformation in Porous Media
PNG 518	Design of Miscible Recovery Projects
PNG 520	Thermodynamics of Hydrocarbon Fluids
PNG 526	Well Stimulation
PNG 555	Unconventional Resources Analysis
PNG 577	Production and Completions Engineering

Students should also investigate the offerings of other departments. Several of the following subject codes have been regularly identified as useful for many EME graduate students. As in all other cases, specific courses should be approved by the student's adviser before taking them to ensure that they will be counted towards one's degree progress, and that they are relevant to any applicable research.

Table 20: Other Useful and Often Applicable Course Subject Codes Originating Outside the EME Department.

Subject Code	Description
CE	Civil and Environmental Engineering
CHE	Chemical Engineering
ECON	Economics
EEFE	Energy, Environmental, and Food Economics
EMCH	Engineering Mechanics
IE	Industrial Engineering
MATSE	Materials Science and Engineering
ME	Mechanical Engineering
STAT	Statistics

Additionally, the EME department conducts a substantial portfolio of advanced undergraduate courses each year. A listing of these courses can be found in Table 21. As mentioned in the MS and PhD degree requirements, graduate students may apply a maximum of 6-credits (2 courses) of advanced undergraduate courses towards their graduate degree requirements.

Table 21: Regular EME Advanced Undergraduate (400-level) Course Offerings. EME Graduate Students May Count a Maximum of 6-Credits of Advanced Undergraduate Courses towards Their Degrees. Laboratory Courses and Capstone Design Courses are Not Included. Courses Marked with (WC) are Taught via World Campus; All Other Courses are Taught at the University Park Campus.

Code	Course Title
EBF 401	Strategic Corporate Finance for the Earth, Energy, and Materials Industries
EBF 473	Risk Management in Energy Industries
EBF 483	Introduction to Electricity Markets
EBF 484	Energy Economics
EGEE 420	Hydrogen and Fuel Cells
EGEE 430	Introduction to Combustion
EGEE 437	Design of Solar Energy Conversion Systems
EGEE 438	Wind and Hydropower Energy Conversion
EGEE 439	Alternative Fuels from Biomass Sources
EGEE 441	Electrochemical Engineering Fundamentals
EGEE 451	Energy Conversion Processes
EGEE 470	Air Pollutants from Combustion Sources
EME 407	Electrochemical Energy Storage
EME 432	Energy Policy (WC)
EME 444	Global Energy Enterprise (WC)
EME 460	Geo-resource Evaluation and Investment Analysis
EME 466	Energy and Sustainability in Society (WC)
ENVSE 400	Safety Engineering
ENVSE 406	Sampling and Monitoring of the Geo-Environment
ENVSE 408	Contaminant Hydrology
ENVSE 427	Pollution Control in the Process Industries
ENVSE 450	Environmental Health and Safety
ENVSE 457	Industrial Hygiene Measurements
ENVSE 470	Engineering Risk Analysis
FSC 431	The Chemistry of Fuels
FSC 432	Petroleum Processing
MNG 404	Mine Materials Handling Systems
MNG 410	Underground Mining
MNG 411	Mine Systems Engineering
MNG 412	Mineral Property Evaluation
MNG 422	Mine Ventilation and Air Conditioning
MNG 441	Surface Mining Systems and Design
MNPR 401	Mineral Process Engineering
MNPR 426	Aqueous Processing
PNG 405	Rock and Fluid Properties
PNG 410	Applied Reservoir Engineering
PNG 420	Applied Reservoir Analysis and Secondary Recovery
PNG 425	Principles of Well Testing and Evaluation
PNG 430	Reservoir Modeling
PNG 440	Formation Evaluation
PNG 450	Drilling Engineering
PNG 475	Production and Completions Engineering
PNG 480	Surface Production Engineering

10 Living in State College, Pennsylvania

10.1 Housing

Most graduate students live off-campus. Information on finding and contracting with rental properties can be found at the following location:

<https://livingoffcampus.psu.edu/>

This website can provide an orientation to the legal and practical essentials when identifying appropriate housing including a registry for identifying roommates. In addition to this resource, many graduate students are able to independently identify housing options and recruit roommates from the local market, messaging boards, and personal graduate student contacts and friends.

Penn State does have one on-campus housing option available for graduate students and families, the White Course Apartments. The "White Course" is the name of the adjacent golf course. Information on the White Course Apartments can be found here:

<https://liveon.psu.edu/university-park/housing/white-course-graduate-family-apartments>

10.2 Transportation

10.2.1 CATA Bus

The Centre Area Transportation Authority (CATA) is the local bus service provider. It is a joint municipal authority formed under the "Municipal Authorities Act of 1945". CATA was first incorporated on May 17, 1974 and then reorganized into its current format on February 5, 1982 by five local municipalities: the Borough of State College and the four surrounding townships: Patton, Ferguson, Harris and College. It was formed for the purpose of providing public transportation services within the boundaries of its member municipalities. Subsequent agreements with the Borough of Bellefonte, Spring Township, and Benner Township have allowed for service extensions to Bellefonte and Pleasant Gap.

<https://catabus.com/>

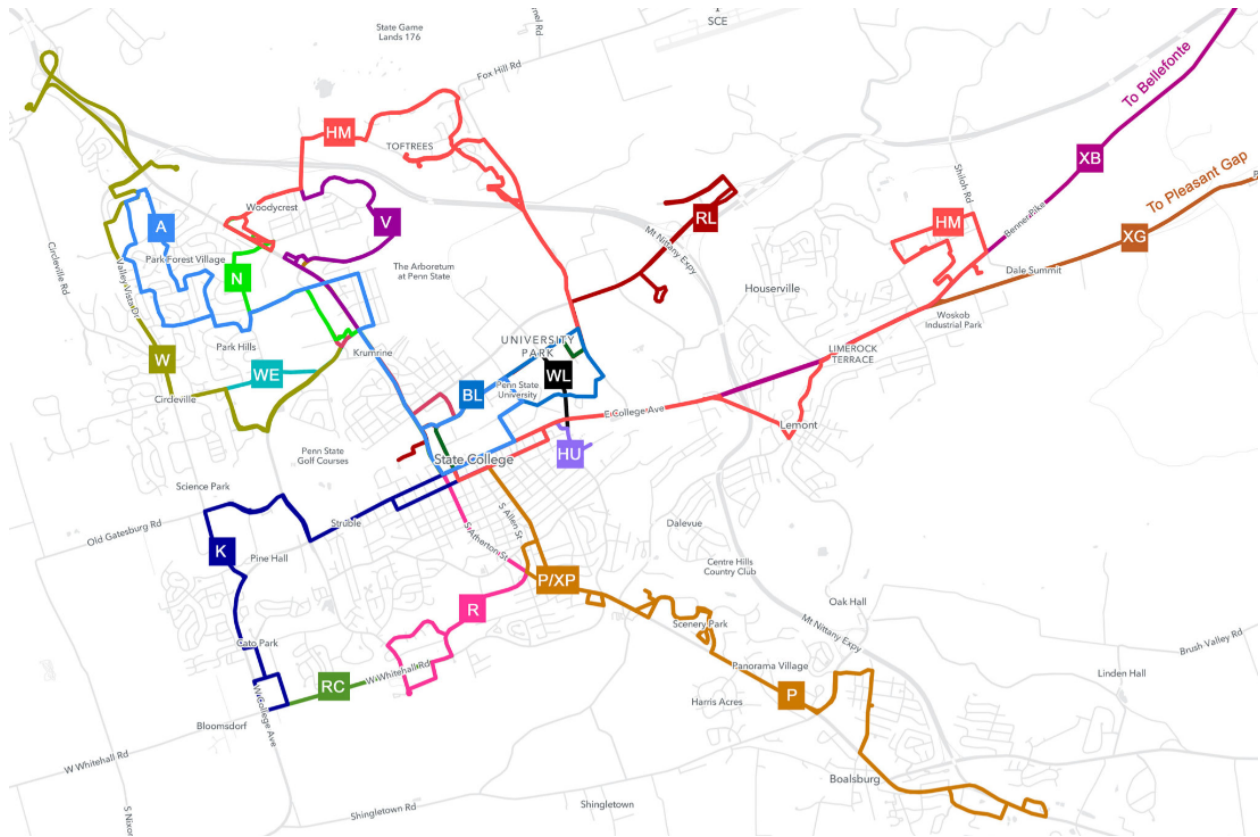


Figure 2: Service Area Map of the CATA Bus Network in and around the Penn State University Campus.

Check the CATA website for information on the schedule and stops of each bus route. Some on-campus routes like the **Blue Loop**, **White Loop**, **Red Link**, and **Green Link** are free to everyone.

Students may purchase a discounted CATA bus pass (called a RidePASS) through the Penn State Transportation Services website:

<https://transportation.psu.edu/ridepass-graduate-students>

10.2.2 Bicycle Infrastructure

With a growing network of mixed-use paths and dedicated bike lanes, bicycle transportation can be a convenient and healthful way to manage transport around the State College Area for commuting, recreation, and other needs. A map of State College area bicycle infrastructure is available at the following website:

<https://centrecog.maps.arcgis.com/apps/webappviewer/index.html?id=b9264927503843b1a0c6836b50d99cc0>

Bicycles stored or ridden on the Penn State campus should obtain a free registration:

<https://bikeindex.org/psu>

Other information about bicycle repair stations on Penn State's campus, bicycle organizations, and other useful information for bicycle users can be found here:

<https://transportation.psu.edu/route-maps-resources>

10.2.3 Parking

Parking at Penn State University is **highly regulated** and **strictly enforced**. Failure to follow posted parking regulations can result in fines or the towing of one's vehicle. Information on parking permits, the parking rules on campus, and other information can be found here:

<https://transportation.psu.edu/student-parking>

10.2.4 Airports

The University Park Airport (call letters: SCE) is the closest airport to the Penn State University Park campus and the State College community. Three major domestic airlines serve this airport: American, Delta, and United with daily flights to Chicago, Detroit, Newark, and Philadelphia. Additional information on the airport and current flight status information can be found at the following website:

<https://www.universityparkairport.com/>

Many passengers find it can be more cost effective to plan departures or arrivals by air from these nearby airports (Table 22).

Table 22: Alternative Airports Near State College, PA

Location	Code	Distance
Harrisburg, PA	MDT	150 km / 93 mi
Pittsburgh, PA	PIT	253 km / 157 mi
Baltimore, MD	BWI	285 km / 177 mi
Philadelphia, PA	PHL	323 km / 201 mi
Washington (Dulles), DC	IAD	338 km / 210 mi
Washington (Reagan), DC	DCA	357 km / 222 mi
Newark, NJ	EWR	375 km / 233 mi
New York (LaGuardia), NY	LGA	399 km / 248 mi
New York (JFK), NY	JFK	418 km / 260 mi

10.2.5 Intercity Buses

For many students, including those who do not have a personal vehicle, intercity bus services can provide the most convenient and economical means to travel from State College to the many surrounding cities and beyond. There are a variety of bus services that service the local population and connect to cities elsewhere in Pennsylvania and in other nearby states.

The bus station for Greyhound and Fullington is located within the Penn State campus on Atherton Street adjacent to the IST Building and across the street from Walker Building. Information on the schedules and tickets for these companies can be found here:

<https://www.greyhound.com/>

<http://www.fullingtontours.com/>

Additionally, intercity express bus services like MegaBus operate outside of traditional bus stations and offer direct service between State College and the downtown regions of other major cities such as Pittsburgh or New York.

<https://us.megabus.com/>

10.2.6 Amtrak

The closest Amtrak stations to State College are in Tyrone (TYR) or Lewisburg (LSB), however Amtrak does offer connecting service via the State College bus station (STC). Connecting service generally transfers passengers by bus to or from the Amtrak stations in Harrisburg (HAR) or Altoona (ALT). Amtrak trains passing through these stations connect passengers to Pittsburgh in the west or to Philadelphia, Newark, and New York in the east. In the east, passengers can transfer to the Northeast Regional trains or other connections. Tickets, route information, and schedules can be found at the following website:

<https://www.amtrak.com/home.html>

10.3 Community Events

State College is a thriving community with a variety of interest-based, art, sports, cultural, and religious groups. The US Census Bureau counts the State College-DuBois Combined Statistical Area or CSA as having a population of 235,632. This fact, given the higher than average level of education in the area due to the presence of Penn State University, means that an above average frequency and quality of visiting and local events take place here.

One can find announcements of local events of all types in a variety of online forums, but these two are common sources:

<https://www.statecollege.com/events/>

<https://radio.wpsu.org/community-calendar>

10.4 Local Governments and Administrative Districts

The State College area is composed of a variety of small administrative districts who share some responsibilities (public transportation, for example), but maintain their own unique administration of other key functions like police, zoning and urban planning, and others. It may be important to understand where their boundaries are.

<https://www.statecollegepa.us/222/Municipal-Boundaries>

11 Student Organizations

11.1 Graduate and Professional Student Association

The Graduate and Professional Student Association (GPSA) is the recognized student government for all graduate and professional students here at Penn State University Park. Additional details about the organization, its officers, and other details can be found at the following location:

<https://gpsa.psu.edu/>

11.2 EMS Graduate Student Council

The graduate student council is a group of representatives from the 5 departments of the College of Earth and Mineral Sciences. The Graduate Student Council's purpose is to advocate in the best interests of the graduate student body as a whole and to facilitate the implementation of policies deemed beneficial to the graduate student population. Further, the council fosters collaboration of ideas and policies between the various departments within the college.

<https://www.ems.psu.edu/graduate/student-resources/graduate-organizations/graduate-student-council>

11.3 EME Graduate Student Council

The EME graduate student council is a student-led organization that facilitates communications with EME department faculty and administration and organizes social and professional activities for EME department graduate students.

<https://orgcentral.psu.edu/organization/emegradcouncil>

12 University, College, and Department Policies

The Graduate School at Penn State University operates as an overall authority for all graduate programs at the university and sets university-wide academic requirements that must be followed by all departments offering graduate courses, degrees, or certificates. A comprehensive listing of all graduate school policies can be found at the following location:

<https://gradschool.psu.edu/graduate-education-policies/>