

GRADUATE PROGRAM REQUIREMENTS

Effective Fall 2019

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PennState

Civil Engineering Environmental Engineering

Master of Engineering (M.Eng.)

Master of Science (M.S.)

Doctor of Philosophy (Ph.D.)

Department of Civil and Environmental Engineering

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PART 1: INTRODUCTION

PROGRAM OVERVIEW

The Penn State Civil and Environmental Engineering (CEE) Department, established in 1881, is internationally recognized for excellence in the preparation of undergraduate and graduate engineers through the integration of education, research, and leadership. In 2017, the Civil Engineering undergraduate program was ranked 14th by U.S. News and World Report, the graduate program in Civil Engineering was ranked 21st, and the graduate program in Environmental Engineering was ranked 24th. More than 400 juniors and seniors are enrolled in the undergraduate program, and approximately 90 students are active in the graduate program, with about 60% pursuing doctoral degrees. Penn State is a large research university, and the CEE Department, with its 35 tenure track faculty members and full-time instructors, performs \$15,000,000 of research annually. The Department's faculty members have received prestigious honors including NAE membership and 12 NSF CAREER awards.

The CEE Department offers six graduate degrees: Master of Engineering (M.Eng.), Master of Science (M.S.), and Doctor of Philosophy (Ph.D.) in either Civil Engineering or in Environmental Engineering. Within Civil Engineering, research-oriented graduate students can specialize in one of four areas: Geotechnical and Materials Engineering, Structural Engineering and Mechanics, Transportation Engineering, or Water Resources Engineering. Interdisciplinary programs can also be pursued, particularly at the doctoral level. Each of the graduate degrees requires the student to meet specific requirements of both the Pennsylvania State University Graduate School and the CEE Department. This handbook describes the departmental programs and requirements. For Graduate School degree requirements, students are advised to consult the Graduate Bulletin at: <http://www.psu.edu/bulletins/whitebook>. The most current Graduate School policies are provided at <http://gradschool.psu.edu/graduate-education-policies/>.

Students should direct specific inquiries with respect to the CEE graduate programs to:

Professor-in-Charge of Graduate Programs

Dr. John M. Regan
220 Sackett Building
University Park, PA 16802
814-865-9436
jmr41@psu.edu

Graduate Staff Assistant

Ms. Christine Woytowich
216 Sackett Building
University Park, PA 16802
814-863-3085
cxw17@psu.edu

This handbook is divided into seven parts. Part 1 discusses the CEE graduate program mission and goals, distinctive features of the program and program emphasis areas, graduate studies and research support staff, faculty and areas of study. Part 2 discusses developing a Plan of Study, Academic support, and advisor and student responsibilities. Part 3 describes the Graduate School degree requirements. Parts 4, 5, and 6 describe the graduate degree requirements for each of the programs.

PROGRAM MISSION AND GOALS

The mission of the Department of Civil and Environmental Engineering is to prepare students for professional practice, graduate study, lifelong learning, societal leadership and to improve the scientific and technological basis for civil and environmental engineering practice. To fulfill this mission, the Department seeks to provide a high quality undergraduate program with instruction in all fundamental areas of civil engineering, to conduct a distinguished program of research and graduate study in selected areas of civil and environmental engineering, and to disseminate advanced technical knowledge to engineers, other professionals, and the public.

DISTINCTIVE FEATURES AND PROGRAM EMPHASES

The graduate programs at the Pennsylvania State University in Civil and Environmental Engineering consist of Environmental Engineering, Geotechnical and Materials Engineering, Structural Engineering and Mechanics, Transportation Engineering, and Water Resources Engineering. Graduate enrollment over five years (2009-2014) has averaged 102 Master's students and 109 Doctoral students. The research mission of the graduate program is supported by state of the art facilities located at Civil Infrastructure Testing and Evaluation Laboratory (CITEL), the Kappe Environmental Engineering Laboratories, and the Larson Transportation Institute (LTI) Test Track, in addition to other labs in Sackett and Hammond Buildings. Several institutes and centers support research activities, particularly, the Larson Transportation Institute (LTI), the Penn State Institutes of Energy and the Environment (PSIEE), the Materials Research Institute (MRI), and the Pennsylvania Housing Research Center (PHRC).

GRADUATE STUDIES AND RESEARCH

The CEE Department offers graduate degrees in Civil Engineering and in Environmental Engineering. The Master of Engineering (M.Eng.) degree is designed for students seeking an advanced degree to enter professional practice. The M.Eng. degree is a coursework-only program that students are required to start in the Fall semester and is designed for completion within one year. The M.Eng. degree requires a total of 31 credits of course work including the one-credit colloquium, CE 590. The Master of Science (M.S.) degree is intended for students conducting research in a specialization area within CEE. The M.S. degree requires completion of 24 credits of coursework, a six-credit thesis, and the one-credit colloquium CE 590 (31 total credits). The M.S. degree (including the thesis) is designed for completion within two years. The Doctor of Philosophy (Ph.D.) degree is intended for students seeking in-depth knowledge in a specialization area within CEE, and completing dissertation research at a level above that for an M.S. degree. Ph.D. graduates typically pursue faculty positions, research positions in industry, state, or governmental institutions.

SUPPORT STAFF

The Graduate & Undergraduate Academic Programs Offices manage all Department of Civil and Environmental Engineering undergraduate programs, graduate programs, scholarships and fellowships, course and classroom scheduling, and web page administration. A computer systems technician and assistant provide IT support for the computer network and large number of computers operated within the department. A laboratory supervisor and technician are available to provide support for instruction and research in the departmental laboratories. Additional technical staff provides support for research conducted at other research laboratories housed outside the CEE Department. Additional staff support the departmental central office and research centers housed within the CEE Department.

Table 1.1: Department of Civil and Environmental Engineering Staff

Amy Long	Administrative Coordinator	alh9@psu.edu	215A Sackett Bldg.
Jessica Wilson	Dept. Head Staff Assistant	jrw412@psu.edu	212 Sackett Bldg.
Nicolette Diehl	Finance Staff Assistant	nad172@psu.edu	212 Sackett Bldg.
Christine Woytowich	Graduate Staff Assistant	cwx17@psu.edu	216 Sackett Bldg.
Jena Bogovich	UG Staff Advisor	jzb6652@psu.edu	219A Sackett Bldg.
Brenton Hockenberry	UG Staff Assistant	blh5621@psu.edu	218 Sackett Bldg.
Gary Meyers	IT Consultant	glm108@psu.edu	206K Sackett Bldg.
James Ray	IT Support Specialist	jar5984@psu.edu	206H Sackett Bldg.
David Faulds	Lab Supervisor	dx105@psu.edu	226C Sackett Bldg.
Heather Weikel	Environmental Staff Asst	hmw2@psu.edu	206L Sackett Bldg.
David Jones	Environmental Lab Manager	dwj123@psu.edu	125 Sackett Bldg.
Vince Ferraro	Engineering Support Specialist at CITEC	vjf102@psu.edu	3127 Research Dr, office 107
Brian Wolfgang	PHRC Associate Director	bmw5014@psu.edu	206B Sackett Bldg.
Darrin Wright	PHRC High-Performance Housing Specialist	dtw153@psu.edu	206D Sackett Bldg.
Alayna Kilic	PHRC Meetings & Events	amk7662@psu.edu	206C Sackett Bldg.
Rachel Fawcett	PHRC Housing Affordability Specialist	rfj5092@psu.edu	103 Lidia Manson Bldg.
Christopher Hine	PHRC Residential Design & Construction Specialist	clh399@psu.edu	102 Lidia Manson Bldg.

FACULTY RESEARCH AREAS

Environmental Engineering (EnvE)

The environmental engineering program includes faculty who specialize in the areas of acid mine drainage treatment, bioenergy production, bioremediation, ecological engineering, environmental microbiology, impacts of unconventional oil and gas development, renewable energy production, sustainable environmental technologies, water chemistry, and water and wastewater treatment.

Rachel A. Brennan, Professor, 231K Sackett Bldg., rab44@psu.edu, 814-865-9428. Ecological wastewater treatment (Eco-Machines™); bioremediation of hazardous wastes, emerging contaminants, and acid mine drainage; beneficial reuse of aquatic biomass for the production of fertilizers, feedstocks, and biofuels; self-sustaining aquaponics.

William D. Burgos, Professor, 115 Sackett Bldg., wdb3@psu.edu, 814-863-0578. Bioremediation of soil, sediment and groundwater; Biological metal oxidation in coal mine drainage; Biological iron (III) reduction; Biological uranium (VI) reduction; Environmental impacts of shale gas development.

Christopher Gorski, Associate Professor, 231F Sackett Bldg., cag981@psu.edu, 814-865-5673. Contaminant fate in engineered and natural systems, aquatic geochemistry, environmental redox chemistry.

Li Li, Barry and Shirley Isett Professor, 224A Sackett Bldg., lxl35@psu.edu, 814-867-0151. Water quality modeling, watershed hydrogeochemistry, reactive transport, contaminant transport and fate.

Bruce E. Logan, Kappe Professor and Evan Pugh University Professor, 231Q Sackett Bldg., bel3@psu.edu, 814-863-7908. Bioenergy production using exoelectrogenic microorganisms; renewable energy production using waste heat and salinity gradient energy; environmental and chemical transport processes; bioremediation; and biological wastewater treatment.

John M. Regan, P.E., Professor, 220 Sackett Bldg., jmr41@psu.edu, 814-865-9436. Biological nutrient removal and transformations; conversion of organics into energy carriers through bioelectrochemical systems, anaerobic digestion, and fermentative hydrogen production; molecular microbial ecology; biofilm systems.

Nathaniel Warner, Associate Professor, 231E Sackett Bldg., nrw6@psu.edu, 814-865-9423. Environmental impacts of unconventional oil and gas development, salinization of fresh water resources, and application of geochemistry, including isotopes (Sr, B, Ra) to trace fluid interaction, and treatment of oil and gas wastewater and solids.

Geotechnical and Materials Engineering (GME)

The geotechnical and materials engineering program focuses on a wide variety of topics for development and use of soil and construction materials. Areas for geotechnical engineering include foundations, landslides, retaining walls, soil-structure interaction, geosynthetics, geo-environmental, groundwater flow and transport, subsidence, soil dynamics and earthquake engineering. Areas for materials engineering include a wide range of concrete-related research topics, including durability and sustainability of concrete infrastructure, novel high performance cementitious materials, and non-destructive evaluation of civil infrastructure. Pavement engineering emphasizes advanced modeling and testing of transportation materials, bituminous material characterization, pavement design and management, accelerated and full-scale pavement testing, and pavement construction and rehabilitation.

Tong Qiu, P.E., Professor, 116 Sackett Bldg., tuq1@psu.edu, 814-863-7305. Geotechnical engineering, soil dynamics, flow through porous media, fluid-solid interaction, landslides, and numerical methods in geotechnical engineering.

Aleksandra Radlińska, Associate Professor, 231D Sackett Bldg., azr172@psu.edu, 814-865-9427. Cement and concrete in sustainable design, alternative binders, construction materials with reduced CO₂ emission, durability, shrinkage, cracking of concrete, reliability-based analysis of the behavior of construction materials.

Farshad Rajabipour, Professor, 231M Sackett Bldg., fxr10@psu.edu, 814-863-0601. Concrete materials, durability, alkali-silica reaction, green cements and concretes, novel pozzolans, beneficial use of coal combustion products.

Mansour Solaimanian, Research Professor and Director of the Northeast Center for Excellence in Pavement Technology (NECEPT), 201 Transportation Research Building, mus1@psu.edu, 814-863-1903. Bituminous materials including recycled and new materials in pavements.

Shelley M. Stoffels, P.E., Professor and Associate Dean for Faculty, 208 Sackett Bldg., sms26@psu.edu, 814-865-7254. Pavement design and rehabilitation, infrastructure asset management, geotechnical engineering, engineering economics, professional practice issues.

Ming Xiao, P.E., Associate Professor, 231P Sackett Bldg., mxz102@psu.edu, 814-867-0044. Seepage and erosion, particle transport and multi-phase flow and distribution in porous media, microscopic soil and pore fluid behaviors under in-situ and physicochemically and biologically treated conditions, performance of earth structures for in-service conditions and extreme events, innovative and recycled materials and their engineering applications.

Kaleigh Yost, L. Robert and Mary L. Kimball Early Career Assistant Professor, 231G Sackett Bldg., kmy5305@psu.edu, 814-863-4384.

Structural Engineering and Mechanics (SEM)

Faculty in the structural engineering and mechanics graduate program offer courses in structural mechanics, and analysis and design of structures. The faculty is engaged in research in several fields, including reinforced and prestressed concrete structures, steel structures, bridge engineering, nondestructive bridge evaluation, protective systems, earthquake engineering, structural dynamics, performance based design, structural reliability, building envelope systems, building science and energy efficiency, structural control and health monitoring, multi-hazard risk assessment and mitigation, probabilistic mechanics, solid mechanics, computational mechanics, extreme events modeling and mitigation, inverse methods and optimization, and advanced materials applications.

Pinlei Chen, Assistant Professor, 215C Sackett Bldg., pzc216@psu.edu, 814-863-4026. Interfacial constitutive models for additive manufacturing; interface debonding and damage modeling; multiphysics thermo-mechanical coupled problems.

Ali Memari, Professor, Hankin Chair of Residential Construction and Director of Pennsylvania Housing Research Center (PHRC), 222 Sackett Bldg., amm7@psu.edu, 814-863-9788. Safety and serviceability of residential building systems and components; full-scale mockup testing and evaluation of building envelope systems under natural hazard and environmental loading conditions; experimental and analytical evaluation of light-frame, masonry; and panelized wall systems for commercial and residential buildings.

Kostas Papakonstantinou, Associate Professor, 213C Sackett Bldg., kup31@psu.edu, 814-863-4010. Stochastic mechanics; risk assessment and management; inverse methods and optimization; structural health monitoring; earthquake engineering and structural dynamics; structural reliability; concrete durability.

Sayed Soleimani, Teaching Professor, 225 Sackett Bldg., svs7394@psu.edu, 814-863-8754.

Gordon Warn, Professor, 114 Sackett Bldg., gpw1@psu.edu, 814-863-2786. Structural dynamics; analytical modeling of resilience, earthquake engineering, seismic protective systems.

Transportation Engineering (TE)

The transportation engineering program covers the areas of transportation planning, design, and operations. Research areas include traffic operations, systems planning for freight, transit and non-motorized travel, travel behavior, transportation planning for emergency response and climate change related issues, infrastructure financing and programming, transportation safety, highway design and performance measures, intelligent transportation systems, human factors and driver behavior, pavement marking materials, statistical and econometric analysis of transportation systems, environmental and ecological aspects of transportation network design, and urban simulation.

Eric T. Donnell, Professor and Associate Dean for Research, 231N Sackett Bldg., etd104@psu.edu, 814-863-7053. Highway geometric design; speed management; traffic safety.

Vikash Gayah, Professor, 231L Sackett Bldg., vvg104@psu.edu, 814-865-4014. Traffic operations; transportation network modeling; public transportation systems; urban mobility; traffic safety.

Ilgin Guler, Associate Professor, 231J Sackett Bldg., sig123@psu.edu, 814-867-6210. Multi-modal urban transportation; public transportation; traffic operations; infrastructure management; statistical modeling.

Xianbiao Hu, Assistant Professor, 221B Sackett Bldg., xzh5180@psu.edu, 814-863-0523.

Brian Naberezny, Assistant Teaching Professor, 223A Sackett Bldg., bjn108@psu.edu, 814-865-9433.

Andisheh Ranjbari, Tracy Early Career Assistant Professor, 226A Sackett Bldg., apr5984@psu.edu, 814-863-4291.

Water Resources Engineering (WRE)

Water Resources Engineering faculty work in the areas of hydraulics, hydrology, water resource management, fluid mechanics, and wave mechanics. Research areas include watershed management, river hydraulics, climate and environmental change impacts on water security, hydroinformatics, hydrologic modeling, uncertainty and reliability, and fundamental aspects of wave mechanics.

Roberto Fernández, Assistant Professor, 221A Sackett Bldg., rpf5341@psu.edu, 814-863-0623.

Christine Kirchhoff, Associate Professor and Associate Director of Law, Policy, and Engineering, 213 Hammond Bldg., cjk475@psu.edu, 814-865-2952.

Xiaofeng Liu, Associate Professor, 223B Sackett Bldg., xliu@engr.psu.edu, 814-863-2940. Computational fluid dynamics (CFD), environmental fluid mechanics, sediment transport and erosion control, land surface process and morphodynamics, multiphase flow, water quality modeling.

Lauren McPhillips, Assistant Professor, 226B Sackett Bldg., lxm500@psu.edu, 814-865-4564. Water quality; stormwater management; green infrastructure; urban ecohydrology; biogeochemistry.

Alfonso Mejia, Associate Professor, 215B Sackett Bldg., amejia@engr.psu.edu, 814-865-0639. Hydrometeorology, urban hydrology, eco-hydrology, hydro-geomorphology, and water sustainability.

Cibin Raj, Assistant Professor of Agricultural and Biological Engineering and Civil and Environmental Engineering, 247 Agricultural Engineering Building, cjr58@psu.edu, 814-865-5616. Storm water management; watershed modeling; application of optimization tools in watershed analysis; ecohydrological impacts of climate and land use change.

Chaopeng Shen, Associate Professor, 231C Sackett Bldg., cshen@engr.psu.edu, 814-863-5844. Large scale hydrology, computational hydrology, land surface processes, water-carbon-nutrient interactions under global change, scale issues, subsurface reactive transport modeling, high performance computing.

PART 2: ADMISSION AND ENTRANCE REQUIREMENTS

ADMISSION REQUIREMENTS

For any graduate degree offered by the Department of Civil and Environmental Engineering, applicants should possess a baccalaureate degree in engineering from a regionally accredited institution. Students without a baccalaureate degree in engineering may be admitted on a provisional basis pending successful completion of entrance requirements (completed concurrently with degree requirements and listed below). Students in engineering, physical sciences, or mathematics with a 3.00 grade-point average (on a 4.00 scale) may be considered for admission. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests.

U.S. applicants will upload unofficial copies of their transcripts, a statement of objectives, and three references for letters of recommendation when applying to the program. If admitted, applicants will be required to provide the Graduate School with OFFICIAL transcripts of all their previous course work (in duplicate). In addition, all applicants must submit scores from the General Graduate Record Examinations (GRE) Aptitude Test (verbal, quantitative, and analytical). For the M.Eng. degree, the GRE requirement will be waived for students who have graduated with a degree from the College of Engineering at Penn State with a cumulative grade-point average of greater than 3.30.

International applicants will upload unofficial copies of their transcripts, a statement of objectives, and three references for letters of recommendation when applying to the program. If admitted, applicants will be required to provide the Graduate School with official transcripts (or attested copies), degree, and diploma certificates in **both English and native language**. Photocopies will NOT be accepted. All international applicants whose native language is not English must submit scores for the TOEFL (Test of English as a Foreign Language) or the IELTS (International English Language Testing System). The minimum acceptable score for the TOEFL is 550 for the paper-based test, or a total score of 80 with a 19 on the speaking section for the Internet-based test (iBT). Applicants with iBT speaking scores between 15 and 18 may be considered for provisional admission, which requires completion of specified remedial English courses ESL 114G (American Oral English for Academic Purposes) and/or ESL 116G (ESL/Composition for Academic Disciplines) and attainment of a grade of B or higher. The minimum composite score for the IELTS is 6.5 on all subjects. International applicants who have received a baccalaureate or master's degree from a college, university, or institution in any of the following countries are exempt from the TOEFL requirement: Australia, Belize, British Caribbean and British West Indies, Canada (except Quebec), England, Guyana, Republic of Ireland, Liberia, New Zealand, Northern Ireland, Scotland, the United States, or Wales.

Additional details about the Graduate School requirements for applications and admissions are provided at <http://gradschool.psu.edu/index.cfm/graduate-admissions/how-to-apply/new-applicants/requirements-for-graduate-admission/>.

CHANGE OF DEGREE

Occasionally, a graduate student who has been admitted for an academic degree program may wish to change to another CEE program (i.e., from M.S. to Ph.D.). In that case, the student should:

- discuss with their advisor,
- contact the CEE Graduate Programs office, and
- complete a “Resume Study/Change of Degree or Major” form and submit the request to the Office of Graduate Enrollment Services for approval.

Requests to change degree program are reviewed by department faculty in a similar manner as new applications, but with additional emphasis placed on performance in their current program.

M.ENG. and M.S. ENTRANCE REQUIREMENTS

Students without a baccalaureate degree in engineering must successfully complete entrance requirements (completed prior to or concurrently with degree requirements) that are unique for each area of specialization (Tables 2.1 to 2.4). Students must take all entrance requirements on an A/F basis and earn a B or better. Students may petition to use other related courses to satisfy these requirements or substitute relevant work experience. Students are encouraged to meet with their academic advisor to discuss these requirements or to contact the department prior to application.

PH.D. ENTRANCE REQUIREMENTS

Ph.D. applicants who begin their program after completion of a CE or EnvE Master’s degree (M.Eng. or M.S.) have typically previously met all entrance requirements as well as the core course requirements for their specialization area (detailed in Tables 6.1 to 6.5). Exceptional applicants are encouraged to apply for Direct Entry into the Ph.D. program (i.e. entering the program without first completing a Master’s degree). In that case, the core course requirements (Tables 6.1 to 6.5) will be integrated into the PhD program plan of study, or the student may complete an M.S. “along the way” to the PhD. Direct PhD students must also meet the entrance requirements in Tables 2.1 to 2.4.

ADMISSIONS ASSESSMENT CONSIDERATIONS

The Pennsylvania State University is committed to an equal access policy for all persons, assuring equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Direct all inquiries regarding the nondiscrimination policy to: Affirmative Action Office, 328 Boucke, University Park, PA 16801; Phone 814-863-0471; email aao@psu.edu.

Table 2.1. Entrance requirements for students without a B.S. engineering degree applying for the M.Eng. (Infrastructure) or the M.S. or Direct Ph.D. (Geotechnical and Materials) in Civil Engineering. Entrance requirements for applicants without a B.S. engineering degree applying for the M.S. in Civil Engineering in the Structural Engineering and Mechanics program area will be evaluated on a case-by-case basis.

Course Topics	Equivalent Penn State Courses
Advanced mathematics typical of engineering undergraduate programs (calculus through partial differential equations)	MATH 140 Calculus with Analytic Geometry I; and MATH 141 Calculus with Analytic Geometry II; and MATH 251 Ordinary and Partial Differential Equations
One lecture course and one laboratory course in chemistry	CHEM 110 Chemical Principles I; and CHEM 111 Experimental Chemistry
One year of mechanics (statics and strength of materials)	E MCH 211 Statics; and E MCH 213 Strength of Materials
One course in fluid mechanics	C E 360 Fluid Mechanics
One introductory course each in geotechnical engineering, materials, and structures	CE 335 Engineering Mechanics of Soils; and CE 336 Materials Science for Civil Engineers; and CE 340 Structural Analysis
Laboratory experience in soils and materials	CE 337 Civil Engineering Materials Laboratory

Table 2.2. Entrance requirements for students without a B.S. engineering degree applying for the M.Eng. (Transportation Systems) and the M.S. or Direct PhD (Transportation) in Civil Engineering.

Course Topics	Equivalent Penn State Courses
Advanced mathematics typical of engineering undergraduate programs (calculus through partial differential equations)	MATH 140 Calculus With Analytic Geometry I; and MATH 141 Calculus With Analytic Geometry II; and MATH 251 Ordinary and Partial Differential Equations
One course in matrix algebra	MATH 220 Matrices
One course in introductory computer programming	CMPS 200 Programming for Engineers with MATLAB; or CMPS 201 Programming for Engineers with C++
One course in basic physics	PHYS 211 General Physics: Mechanics
One course in elementary statistics	STAT 401 Experimental Methods; or STAT 415 Introduction to Mathematical Statistics
One course in introductory transportation engineering	CE 321 Highway Engineering

Table 2.3. Entrance requirements for students without a B.S. engineering degree applying for the M.Eng. (Water and Environment) or the M.S. or Direct Ph.D. (Water Resources) in Civil Engineering.

Course Topics	Equivalent Penn State Courses
Advanced mathematics typical of engineering undergraduate programs (calculus through partial differential equations)	MATH 140 Calculus with Analytic Geometry I; and MATH 141 Calculus With Analytic Geometry II; and MATH 251 Ordinary Differential and Partial Equations
One year of physics	PHYS 211 General Physics: Mechanics; and PHYS 212 General Physics: Electricity and Magnetism
One year of mechanics (statics and dynamics)	E MCH 211 Statics; and E MCH 212 Dynamics
One course in Fluid Mechanics	CE 360 Fluid Mechanics
One course in Hydrology	CE 461 Water Resources Engineering

Table 2.4. Entrance requirements for students without a B.S. engineering degree applying to the M.Eng. or the M.S. or Direct Ph.D. in Environmental Engineering.

Course Topics	Equivalent Penn State Courses
Advanced mathematics typical of engineering undergraduate programs (calculus through partial differential equations)	MATH 140 Calculus With Analytic Geometry I; and MATH 141 Calculus With Analytic Geometry II; and MATH 251 Ordinary and Partial Differential Equations
One lecture course and one laboratory course in chemistry	CHEM 110 Chemical Principles I; and CHEM 111 Experimental Chemistry
One year of physics	PHYS 211 General Physics: Mechanics; and PHYS 212 General Physics: Electricity and Magnetism
One course in fluid hydraulics or mechanics	C E 360 Fluid Mechanics
One introductory course in environmental engineering	CE 370 Introduction to Environmental Engineering; or CE 371 Water and Wastewater Treatment

PART 3: ADMISSION TO PROGRAM AND INITIAL PROGRESSION

DEVELOPING A PLAN OF STUDY

All CEE graduate students are required to develop an *Advanced Degree Course Plan* for each of the M.Eng., M.S. and Ph.D. degrees early in the program (by the end of the first semester for M.Eng. and M.S.) and no later than the end of the second semester of study (Ph.D.). In developing the Plan, students are assisted by their academic advisor. Doctoral students must submit an *Advanced Degree Course Plan* by or before their Qualifying Exam. In addition, doctoral students must specialize in a specific area within the field of civil and environmental engineering, develop in-depth understanding of research methods suitable to their area of specialization, and conduct an independent and original research study – the dissertation. Master’s and doctoral students are expected to develop a broad knowledge of the field of CEE, as well as a general knowledge of research designs and methods, demonstrating the suitability of designs and methods for the thesis or dissertation. Requirements for all the graduate degrees are specified in this handbook.

STUDENT ACADEMIC SUPPORT

Upon admission to the CEE graduate program, students are assigned an interim academic advisor by the program coordinator. The eventual advisor will be based on mutual career and research interests of the student and faculty. All academic advisors are full-time CEE faculty with Graduate Faculty status or occasionally full-time faculty in other units with CEE Graduate Faculty status.

ADVISOR AND STUDENT RESPONSIBILITIES

The academic advisor acts as the student’s primary academic and career mentor at Penn State. The advisor’s primary responsibilities are to: (1) assist in the development of an *Advanced Degree Course Plan*; (2) advise on and approve selection of course(s) each semester; (3) advise and assist on design and execution of research activities (M.S. and Ph.D.); (4) advise and assist in preparing the student for the qualifying and comprehensive examinations (Ph.D.); (5) assist with professional development activities (internships, attending and presenting at conferences, authorship of journal articles and conference proceedings, developing teaching portfolios, etc.) that would enhance academic preparedness and career prospects; and (6) serve as the chair (or co-chair) of the student’s committee (thesis for M.S.; dissertation for Ph.D.).

Communication between the graduate student, the advisor, and the thesis committee is a key factor in the progression through the graduate program. It is the student’s responsibility to consult with her/his advisor and committee regularly throughout the course of study. Contact may be made by telephone, e-mail, or in person by appointment.

It is the responsibility of the student to read, understand, and discuss Penn State’s Graduate Education policies, as well as the CEE Department procedures and policies presented in this Handbook, with their advisor. The most current Graduate School policies are provided at <http://gradschool.psu.edu/graduate-education-policies/>.

CHANGING ADVISORS

A student may change her/his academic advisor. Either the student or the academic advisor may suggest this change. Proposed changes should be discussed between the affected parties prior to any official action. An advisor change must be made with the consent of the student, the new advisor, and the current advisor. Notification will need to be made to the Graduate Staff Assistant in the Academic Programs office, 216 Sackett.

SARI REQUIREMENTS

Since the Fall of 2009, all graduate students (M.Eng., M.S., and Ph.D.) must complete Scholarship and Research Integrity (SARI) training requirements. The SARI program at Penn State is designed to offer graduate students comprehensive, multilevel training in the responsible conduct of research (RCR) through a two-part program: (1) an online course to be completed in the first semester of graduate study and (2) five hours of discussion-based RCR training prior to degree completion. Of the five hours of discussion-based RCR training, a maximum of two hours can be completed through Office of Research Protection (ORP) seminars and a minimum of three hours are to be completed through College or Departmental seminars.

In the CEE department, all graduate students must register for CE 590 Colloquium during their first semester. Successful completion of CE 590 will include both SARI components.

SUPPORT SERVICES

The Commission for Adult Learners (CALs) provides assistance to adult students who wish to improve their skills in areas such as computers, math, and writing. Detailed information about CALs is located at: <http://cal.psu.edu/>

The Graduate & Professional Student Association (GPSA) provides graduate students with information on topics such as taxes and health care options, babysitters and typists/editors. Detailed information about GPSA is located at: <http://gpsa.psu.edu/about-the-gpsa/>

Penn State Human Resources provides services for students with a family. Descriptions of the programs offered are available at: <https://ohr.psu.edu/employee-and-family-resources>

The Gender Equity Center (GenEQ) supports students who have been impacted by sexual violence, relationship violence, stalking, harassment, and other campus climate issues. More information on the GenEQ is located at: <http://sites.psu.edu/genderequity/>

The Women in Engineering Program (WEP) actively promotes an equitable and productive academic environment in the College of Engineering. More information on WEP is located at: <http://psuengineeringdiversity.com/wep/>

Information pertaining to other student services are available on the Graduate School website: <http://bulletins.psu.edu/bulletins/whitebook/>

PART 4: GRADUATE SCHOOL DEGREE REQUIREMENTS

The Pennsylvania State University Graduate School publishes minimum requirements for all graduate degrees awarded by the University. Additional graduate degree requirements are established by the College of Engineering, the Department of Civil and Environmental Engineering, and programs within CEE. Graduate School graduate degree requirements are published on the Graduate School website in the Graduate Degree Bulletin at <http://www.psu.edu/bulletins/whitebook/>

The published Bulletin contains comprehensive Penn State University Graduate School requirements that must be met by M.Eng., M.S., and Ph.D. students to complete the respective degree. **It is the responsibility of the student to read, understand, and discuss these requirements, as well as the CEE Department requirements presented in this Handbook, with their academic advisor, and if applicable, thesis advisor.** The Penn State University Graduate School graduate degree requirements supersede any conflicting requirements. In summary, the Penn State University Graduate School requirements address issues related to the following:

M.Eng. & M.S. specific requirements:

- minimum grade-point average required for graduation
- maintaining good academic standing
- M.Eng. time limitation
- M.S. time limitation
- advanced standing and transfer credits

Ph.D. specific requirements:

- general requirements
- time limitation to complete the program
- off campus and transfer credit
- advisors and doctoral committees
- English competency
- qualifying, comprehensive, and final examination
- thesis acceptance
- residence requirements
- continuous registration requirements

SARI (Scholarship and Research Integrity) requirements for all graduate students:

- Online CITI Exam (completed the first semester of study)
- 5 hours of seminars (maximum of 2 hrs of ORP seminars; remaining hrs from CE 590 and College of Engineering seminars)

The above summary is not exhaustive and does not include Departmental and program requirements that may be in addition to the Graduate School requirements. All graduate students in the Department of Civil and Environmental Engineering are strongly encouraged to familiarize themselves with all Graduate School degree requirements.

PART 5: MASTER OF ENGINEERING REQUIREMENTS

The following policies and procedures have been adopted by the Department of Civil and Environmental Engineering to supplement the *Procedures and Regulations* contained in the *Graduate Degree Programs Bulletin*. These requirements apply to all Master of Engineering (M. Eng.) degree students in the fields of Civil Engineering and Environmental Engineering.

DEGREE DESCRIPTION AND CREDIT REQUIREMENTS

The M.Eng. degree is a non-thesis professional master's degree. The program provides training for advanced professional practice. A minimum 31 graduate credits (400 level and above) of course work are required. At least 18 credits must be earned in graduate courses (500 level and above) and at least 12 credits must be earned in courses with the CE prefix. A minimum of 20 credits must be earned at an established campus of the University. All students are required to take CE 835 Integrated Project Management for Civil Engineering (offered Spring only) to fulfill the requirement for a culminating experience. Students are allowed to take up to 3 credits of CE 596 Independent Study with the agreement of a supervising faculty member. All students are required to take the 1-credit CE 590 Colloquium (Fall only) during their first semester and complete all requirements for Scholarship and Research Integrity (SARI) training.

The M.Eng. degree is designed as a one-year Master's degree program, but students may extend the duration if required employment or other circumstances. To complete in one year, students are required to start their degree in the Fall semester. The one-year plan of study is as follows:

- **Fall semester:** 12-15 credits of course work plus one credit of CE 590 (note that special permission is required to register for >15 credits)
- **Spring semester:** 12-15 credits of course work, including CE 835 (3 credits)
- **Summer semester:** 0-6 credits of course work

AREAS OF SPECIALIZATION FOR M.ENG. IN CIVIL ENGINEERING

All students entering the M.Eng. degree in Civil Engineering must select an area of specialization; each area has specific core course requirements (Table 5.1). This area of specialization must be declared on the *Advanced Degree Course Plan*. The three areas of specialization are Infrastructure, Transportation Systems, and Water and Environment. Specific course offerings and availability vary between academic years.

M.ENG. IN ENVIRONMENTAL ENGINEERING

The M.Eng. in Environmental Engineering has no further area of specialization. Core course requirements for all M.Eng. Environmental Engineering students are presented in Table 5.2. Specific course offerings and availability vary between academic years.

Table 5.1. Core course requirements for areas of specialization for the M.Eng. in Civil Engineering.

	Infrastructure	Transportation Systems	Water and Environment
Core Required Courses	<i>Complete 3 of 5:</i> CE 512 Advanced Soil Mechanics CE 544 Design of Reinforced Concrete Structures CE 548 Structural Design for Dynamic Loads CE 584 Concrete Materials and Properties CE 597x Transportation Infrastructure Asset Management	<i>Complete 3 of 3:</i> CE 523 Analysis of Transportation Demand CE 525 Transportation Operations CE 528 Transportation Safety Analysis	<i>Complete 2 of 3:</i> CE 555 Groundwater Hydrology CE 561 Surface Hydrology CE 570 Environmental Aquatic Chemistry
Additional Required Courses	CE 835 Integrated Project Management for Civil Engineers CE 590 Colloquium	CE 835 Integrated Project Management for Civil Engineers CE 590 Colloquium	CE 835 Integrated Project Management for Civil Engineers CE 590 Colloquium
Elective Courses	several from CE, EMCH, and STAT	several from CE, IE, and STAT	several from CE, GEOSC, MATH, and METEO

Table 5.2. Core course requirements for the M.Eng. in Environmental Engineering.

Core Required Courses	<i>Complete 3 of 6:</i> CE 479 Environmental Microbiology CE 570 Environmental Aquatic Chemistry CE 571 Physical-Chemical Treatment Processes CE 572 Biological Treatment Processes CE 573 Environmental Organic Chemistry CE 576 Environmental Transport Processes
Additional Required Courses	CE 835 Integrated Project Management for Civil Engineers CE 590 Colloquium
Elective Courses	several from CE, GEOSC, SOILS, EME

ADVISOR/ADVANCED DEGREE COURSE PLAN

The general guidance of an M.Eng. degree student is the responsibility of the advisor who will be recommended by the program coordinator. The advisor will assist the student in planning a plan of study. A Master of Engineering Plan of Study should be approved by the student's academic advisor and the Professor-in-Charge (Graduate Programs Officer) during the first four weeks of enrollment in the program. The Master of Engineering Plan of Study must be completed by the end of the first semester, although earlier completion is strongly encouraged. If needed, the Plan of Study may be revised until the end of the add/drop period during the final semester

A recent version of the M.Eng. Plan of Study is shown in Figure 5.1. Students should obtain the current version of the plan of study form from the CEE Graduate Programs Office (216 Sackett). It is also available as a fillable form that can then be printed for signatures.

CONTINUOUS REGISTRATION

Applicants admitted to the Civil or Environmental Engineering graduate programs must maintain continuous registration by registering for at least one credit each semester from the date of admission until all degree requirements have been satisfied. Students utilizing the resources of the University (i.e., faculty, facilities, etc.) during the summer must also register for the summer session. Degree requirements are only satisfied when the student has completed the required course work.

MASTER OF ENGINEERING TIME SCHEDULE

Table 5.3. Schedule of key administrative steps for CE and EnvE M.Eng. students.

Upon admission:	Confer with the respective program coordinator, who will recommend an advisor to formulate a plan of study.
No later than the end of the first semester:	Submit proposed Master of Engineering Plan of Study for approval by the academic advisor and the Professor-in-Charge of Graduate Programs (Graduate Programs Officer).
First semester of study:	Complete CE 590 and CITI online exam for SARI requirements
Final certification:	Students who have completed all of the requirements for the degree will be approved for graduation.



PennState DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
Master of Engineering Plan of Study

Student Name _____ PSU ID _____

Student Signature _____ Access ID/PSU e-mail _____

Advisor: _____

Program: _____ Environmental Engineering

_____ Civil Engineering Area: ___ INFRASTRUCTURE ___ TRANS ___ WATER

COURSE NO	TITLE	Semester to be Taken	Credits	Graduate Course Credits (5xx and 8xx)	CE Course Credits (4xx, 5xx and 8xx)	Area Specialization REQ
CE 590	Colloquium	Fall ' __	1			
CE 835	Integrated Project Management for Civil Engineers	Spring' __	3			
<i>Total MEng Program Credits for each Column:</i>				(≥31)	(≥18)	(≥12)

For students without BS in CEE, list courses required to meet minimum entrance requirements for specialty area

COURSE NO	TITLE	Credits

Draft Plan Approvals (submitted during first semester)

Advisor: _____ Date: _____

Graduate Program Officer: _____ Date: _____

Final Plan Approvals (only if needed—mark up any changes and submit prior to classes for final semester)

Advisor: _____ Date: _____

Graduate Program Officer: _____ Date: _____

Revised: 11/2019

Figure 5.1. Illustration of CE and Enve Master of Engineering Plan of Study Form.

PART 6: MASTER OF SCIENCE REQUIREMENTS

The following policies and procedures have been adopted by the Department of Civil and Environmental Engineering to supplement the *Procedures and Regulations* contained in the *Graduate Degree Programs Bulletin* as well as those published on the Graduate School website. These requirements apply to all Master of Science (M.S.) degree students in the Civil Engineering and Environmental Engineering graduate programs.

DEGREE DESCRIPTION AND CREDIT REQUIREMENTS

The M.S. degree program is strongly oriented towards research. A thesis is required and at least 6 credits of thesis research (C E 600 or 610) must be included in the student's academic course plan. A minimum of 31 graduate credits (400-level and above) are required, of which 20 must be earned at an established campus of the University. A minimum of 24 credits of course work are required, with at least 12 credits of course work (400 and 500 level) completed within the major (i.e., with C E courses prefixes). At least 18 credits must be included in the program at the graduate level (500 level or above). Specific core courses are required depending on the specialization within the department. Students are not permitted to count audited credits toward the minimum credits required for the degree. All students are also required to take the 1-credit CE 590 Colloquium (Fall only) and complete all requirements for Scholarship and Research Integrity (SARI) training.

A minimum of 6 credits is required in any general studies area outside the research focus area. Course work taken outside the major program area of emphasis can be used to satisfy the general studies area (also referred to in older documents as an informal minor). The general studies area may be in another program focus area within the CEE Department or may be from another program. As an example of meeting the requirement within the department, an SEM-focused student might take two GME courses to satisfy the requirement. As an example of meeting the requirement outside the department, a student might take two statistics courses.

M.S. students may also choose a formal **graduate minor**. A formal graduate minor will also satisfy the general studies requirement. A formal minor program must meet the approval of the departments or committees responsible for both the major and minor fields. Completion of a formal graduate minor is not a requirement for the M.S. degree. A list of graduate minors available can be found in the Graduate Bulletin.

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

The M.S. thesis should explore new ideas and techniques. Thus, the research topic is expected to investigate as yet unexplored areas of engineering, to extend the knowledge available, and advance the level of understanding of a relevant issue. Emphasis should be placed on the generalization of research findings and overall transferability to engineering problems.

M.S. IN CIVIL ENGINEERING

All students entering the M.S. degree in Civil Engineering must select and declare a program area aligned with their research interests. The four program areas are Geotechnical and Materials Engineering, Structural Engineering and Mechanics, Transportation Engineering, and Water Resources Engineering. Each program area has specific core course requirements (Tables 6.1 to 6.4).

Table 6.1. Core course requirements for the M.S. in Civil Engineering in the Geotechnical and Materials Engineering program. All students must take a minimum of one course associated with each topic area.

Topic	Course Options
Geotechnical Engineering	CE 511 Engineering Characteristics of Soils; or CE 512 Advanced Soil Mechanics; or CE 513 Advanced Foundation Engineering
Pavement Engineering or Infrastructure Mgmt	CE 582 Pavement Design and Analysis; or CE 597x Transportation Infrastructure Asset Management
Materials Engineering	CE 583 Bituminous Materials and Mixtures; or CE 584 Concrete Materials and Properties
Experimental Testing	CE 597x Experimental Methods in Geotechnical and Materials Engineering

Table 6.2. Core course requirements for the M.S. in Civil Engineering in the Structural Engineering and Mechanics program. All students must take, at a minimum, 3 of the 6 courses listed below with at least one course each from the Analysis and Design topic areas.

Topic	Course Options
Structural Analysis	CE 597x Nonlinear Structural Analysis; or CE 541 Structural Analysis; or CE 548 Structural Design for Dynamic Loads
Structural Design	CE 543 Prestressed Concrete Behavior and Design; or CE 544 Design of Reinforced Concrete Structures; or CE 545 Metal Structures Behavior and Design

Table 6.3. Core course requirements for the M.S. in Civil Engineering in the Transportation Engineering program. All students are expected to take a minimum of one course associated with each topic area; however, exceptions can be discussed with each student's academic advisor.

Topic	Course Options
Operations	CE 525 Transportation Operations
Safety	CE 528 Transportation Safety Analysis
Design	CE 526 Highway and Street Design; or CE 527 Roadside Design and Management; or CE 421W Transportation Design

Table 6.4. Core course requirements for the M.S. in Civil Engineering in the Water Resources Engineering program. All students must take a minimum of one course associated with each topic area.

Topic	Course Options
Hydraulics	CE 462 Open Channel Hydraulic; or CE 564 Sediment Transport in Alluvial Streams; or CE 567 River Engineering
Hydrology	C E 555 Groundwater Hydrology; or C E 561 Fundamentals of Surface Hydrology

M.S. IN ENVIRONMENTAL ENGINEERING

All students entering the M.S. degree in Environmental Engineering must develop a plan of study that satisfies the core course requirements listed in Table 6.5 and prepares the student for their research activities. Students are encouraged to take courses outside of the environmental engineering specialty. Courses in hydrology, geochemistry, agronomy, chemical engineering, chemistry, biotechnology, mineral processing, and materials science are of particular interest. The plan of study should be developed in consultation with the student's thesis advisor.

Table 6.5. Core course requirements for the M.S. in Environmental Engineering. All students must take a minimum of one course associated with each topic area.

Topic	Course Options
Biology	CE 479 Environmental Microbiology
Chemistry	CE 570 Environmental Aquatic Chemistry; or CE 573 Environmental Organic Chemistry
Chemical Transport	CE 574 Transport Processes in Porous Media; or CE 576 Environmental Transport Processes
Process Engineering	CE 571 Physical-Chemical Treatment Processes; or CE 572 Biological Treatment Processes

ACADEMIC ADVISOR/PLAN OF STUDY FORM

The general guidance of a M.S. degree student is the responsibility of the academic advisor through mutual agreement with the student. The advisor's role is to assist the student in planning a plan of study. A Master of Science Plan of Study should be approved by the student's academic advisor and the Professor-in-Charge of Graduate Programs (Graduate Programs Officer) during the first semester of enrollment in the program. If needed, the Master of Science Plan of Study may be revised until the end of the add/drop period during the final semester.

A recent version of the M.S. Plan of Study is shown in Figure 6-1. Students should obtain the current version of the plan of study form from the CEE Graduate Programs Office (216 Sackett). It is also available as a fillable form that can then be printed for signatures.



PennState DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
Master of Science Plan of Study

Student Name _____ PSU ID _____

Student Signature _____ Access ID/PSU e-mail _____

Chair/Thesis Advisor(s): _____

Program: _____ Environmental Engineering

_____ Civil Engineering

Area: __ WRE __ GME __ TRANS __ SEM

General Studies/Informal Minor Area (Required): _____

Formal Minor (Optional; attach approval/plan from the minor program): _____

COURSE NO	TITLE	Credits	Graduate Course Credits (5xx and 6xx)	CE Course Credits (4xx, 5xx and 8xx)	General Studies/ Informal Minor Credits	Formal Minor Credits
CE 600	Research	6				
CE 590	Colloquium	1				
<i>MS Program Credits for each Column:</i>			(≥31)	(≥18)	(≥12)	(≥6)

For students without BS in CEE, list courses required to meet minimum entrance requirements for specialty area

COURSE NO	TITLE	Credits

Draft Plan Approvals (submitted during first semester)
 Advisor: _____ Date: _____

Graduate Program Officer: _____ Date: _____

Final Plan Approvals (only if needed--mark up any changes and submit prior to classes for final semester)
 Advisor: _____ Date: _____

Graduate Program Officer: _____ Date: _____

Revised: 11/2019

Figure 6.1. Illustration of CE and EnvE Master of Science Plan of Study Form.

SELECTION OF THESIS SUPERVISOR

The academic advisor will normally also serve as the thesis supervisor. However, upon mutual agreement between the academic advisor and the student, another graduate faculty member may be appointed to supervise the student's thesis, preferably before the start of the second semester. The thesis supervisor will recommend coursework supporting the research program, oversee the conduct of the research program, and supervise the development of the master's thesis.

ADVISORY COMMITTEE/THESIS PROPOSAL

When the student is ready to begin working on the thesis, an advisory committee must be selected in consultation with the student's advisor and approved by appointed by the Professor-in-Charge of CEE Graduate Programs. Normally the advisory committee is appointed near the end of the first semester of study. The advisory committee consists of a minimum of three members of the graduate faculty, including the student's advisor and thesis supervisor. When appropriate, one of the committee members may be from outside the Department of Civil and Environmental Engineering. The student's thesis supervisor chairs the advisory committee. The Graduate Academic Programs Office must be notified as soon as the committee is formed so that committee members can be officially recorded and notified.

The advisory committee is responsible for:

- (a) approving the thesis topic,
- (b) monitoring the research progress,
- (c) reviewing the final draft of the thesis prior to the oral examination, and
- (d) conducting the oral examination of the student.

The official initiation of the thesis and research should begin with a proposal meeting that includes the advisory committee and the student. The proposal meeting should include a discussion of the research topic, research plan, and anticipated results of the research to allow a determination of the research program suitability. The need for a written thesis proposal is determined by the advisor, although it is recommended.

FINAL THESIS DEFENSE

Every CEE M.S. degree student must undergo a public oral examination before the advisory committee. The student is responsible for scheduling the examination (date, time, and place) and informing the CEE Graduate Academic Programs Office staff of the arrangements at least two weeks in advance. A notice announcing the defense will be posted for all faculty, graduate students, and interested members of the public; the notice should be prepared by the student with the approval of their advisor. The notice must include the thesis title.

The student is expected to summarize the research in a presentation that will include:

- (a) a statement of the problem,
- (b) the motivation and justification for the research (i.e., relative importance of the subject to the profession),
- (c) a statement of research objectives,
- (d) a distinction between the contribution that originates from the student and that which has been taken from other sources,
- (e) a concise presentation of the research methodologies,
- (f) a presentation of key research results,
- (g) interpretation of the results, and
- (h) conclusions that are based on the research findings.

The student should expect to defend the research at the conclusion of the presentation and should be prepared to defend any portion of the thesis. Typically, there will be a period of questioning open to the general public followed by a closed meeting with the advisory committee.

THESIS SUBMISSION REQUIREMENTS

Students must follow the *Thesis and Dissertation Guide* for the development and formatting of the master's thesis, which can be obtained at: <http://gradschool.psu.edu/current-students/etd/>. This publication contains information regarding format, paper, illustrations, etc. Students who have activated their intent to graduate must submit a draft (no signatures required) of their thesis to the Graduate School Thesis Office by the published thesis format review deadline.

The final thesis must meet the approval of the Department Head, in whom the Graduate Faculty of the department has vested the responsibility to ensure that all theses conform to established standards and that the thesis supervisor and advisory committee have fulfilled all obligations with regard to the thesis. In addition, the thesis must be approved by the Graduate School Thesis Office.

Students whose theses have been approved by their committee and the department then upload the final electronic thesis by the published thesis final submission deadline. **No changes can be made after this submission, so it is essential that the students have the approval before uploading.** After uploading, the Graduate School will obtain official electronic approvals from committee members and the department. A final copy of the thesis must also be provided to the advisor and committee members as requested upon completion of the program.

CONTINUOUS REGISTRATION

The M.S. degree is designed to be completed in four semesters, although it is possible to finish sooner. Applicants admitted to the Civil or Environmental Engineering graduate programs must maintain continuous registration by registering for at least one credit each semester from the date of admission until all degree requirements have been satisfied. Degree requirements have been satisfied when the student has completed the required course work and the M.S. thesis has

been approved by the advisor, the thesis committee, and the Department Head. Students accessing the resources of the University during the summer must also register for the summer session.

MASTER OF SCIENCE TIME SCHEDULE

Table 6.6. Schedule of key administrative steps for CE and EnvE M.S. students.

Upon admission:	Confer with the respective program coordinator, who will recommend an advisor to formulate a plan of study.
No later than the end of the first semester:	Submit proposed Master of Science Plan of Study for approval by the academic advisor and the Professor-in-Charge of Graduate Programs (Graduate Program Officer).
No later than the tenth week of the second semester:	<ul style="list-style-type: none"> • Appointment of advisory committee (inform Graduate Programs Office via e-mail). • Approval of thesis proposal.
During published period:	Activate intent to graduate on LionPATH
By published thesis format review deadline:	Submit a complete draft (no signatures required) to the Graduate School Thesis Office (115 Kern Building) for format review.
Two weeks prior to the thesis defense:	<ul style="list-style-type: none"> • Notify the CEE Graduate Programs Office of defense schedule and location (via e-mail). • Provide a notice to post of the public defense. • Provide a copy of the final thesis draft to each advisory committee member.
Not less than two weeks following submission of the final draft to the committee:	Oral examination (thesis defense).
By published thesis final submission deadline:	<ul style="list-style-type: none"> • Obtain final approval of advisory committee members (typically after revisions) <i>before</i> submission to Thesis Office. • Submit final, corrected, electronic copy of thesis to the Thesis Office. No changes can be made after this submission. • Provide final thesis copies to the thesis advisor and committee members as requested.
Final certification:	Students who have completed all of the requirements for the degree will be approved for graduation.

PART 7: DOCTORAL REQUIREMENTS

The following policies and procedures have been adopted by the Department of Civil and Environmental Engineering to supplement the *Procedures and Regulations* contained in the *Graduate Degree Programs Bulletin* <http://bulletins.psu.edu/graduate/degreerequirements/> as well as those published on the Graduate School website. These requirements apply to all Doctor of Philosophy (Ph.D.) degree students in the fields of Civil Engineering and Environmental Engineering.

DEGREE DESCRIPTION AND CREDIT REQUIREMENTS

The Ph.D. is the highest degree offered by the Department and is designed to conduct the most advanced research in an area of specialization. A dissertation is required. All students in the Direct Entry program (i.e., without first completing a M.Eng. or M.S. degree) should complete at least 24 to 39 credits of coursework (400 and 500 level) beyond the B.S. degree, including all core course requirements for their area of specialization (Tables 6.1 to 6.5). Students are not permitted to count audited credits toward the minimum credits required. All students are required to take the 1-credit CE 590 Colloquium (Fall only) and complete all requirements for Scholarship and Research Integrity (SARI) training. Prior to completion of the Ph.D. program, the student must spend at least two consecutive semesters as a registered full-time student.

The CEE Ph.D. degree programs are normally completed in four years by full-time students. However, time to complete the degree varies depending on individual effort and success in research and writing. The doctoral degree program typically consists of six stages: 1) core course work; 2) course work related to an area of specialization; 3) qualifying and English competency examinations; 4) naming of the doctoral committee and the comprehensive examinations; 5) research activities; and 6) writing and defending the doctoral dissertation.

All CEE Ph.D. students should develop a draft Plan of Study in consultation with their advisor during their first semester; the draft plan should be submitted to the CEE Graduate Programs Office for review and preliminary approval. A recent Plan of Study form is shown in Figure 7.1. When needed, the most recent form should be obtained from the CEE Graduate Programs Office. A fillable pdf is available which can subsequently be printed for submission and signatures.

PH.D. IN CIVIL ENGINEERING

All students entering the Ph.D. degree in Civil Engineering must select and declare a program area aligned with their research interests. The four program areas are Geotechnical and Materials Engineering, Structural Engineering and Mechanics, Transportation Engineering, and Water Resources Engineering. In Structural Engineering and Mechanics, Geotechnical and Materials Engineering, and Transportation Engineering, 15 credits of graduate course work (400 level and above) are suggested beyond the Master's degree or beyond the 24 suggested credits for those in the Direct Entry program (i.e., 39 total credits of graduate coursework). For all PhD students, the final course requirements are finalized and approved by the qualifying exam committee after the oral exam is passed.

PH.D. IN ENVIRONMENTAL ENGINEERING

In Environmental Engineering, a minimum of 21 credits of graduate course work (400 level and above) is suggested beyond the Master's degree. For Ph.D. students who have completed a Master's degree in Environmental Engineering at Penn State, a minimum of 15 credits of graduate course work (400 level and above) is suggested. For those in the Direct Entry program, a minimum of 39 total credits of graduate coursework is suggested beyond the B.S. For all PhD students, the final course requirements are finalized and approved by the qualifying exam committee after the oral exam is passed.

QUALIFYING EXAMINATIONS

Official status as a doctoral student is granted when the qualifying examination has been passed. The qualifying examination serves three purposes: 1) to determine the compatibility between the student's academic and professional aspirations and the graduate program goals; 2) to assess the student's competence in areas critical to completion of the dissertation, including communication skills of writing, critical thinking, and conduct of research; 3) to confirm that the student should continue in the CEE Ph.D. program; and, 4) to finalize and approve the Ph.D. Plan of Study form. If the student is pursuing an approved dual-title graduate degree, the dual-title field must be integrated into the qualifying examination of the student's major program (i.e., a single qualifying examination is administered, which incorporates both the graduate major field and the dual-title field).

The qualifying examinations should be taken during the second semester of study, however, must be taken within three semesters (excluding summer sessions) of entry into the doctoral program. Qualifying examination requests must be formally submitted via e-mail to the Graduate Academic Programs Office no less than three weeks prior to the scheduled examination. The CEE Academic Programs Office will submit the examination results to the Graduate School for approval and recording. To be eligible for the qualifying examination, the student must meet the following criteria:

- have a minimum grade-point average of 3.00 at the time the examination is given, for graduate work done at Penn State.
- have no deferred grades, missing grades, or exceed 12 quality graded research credits.
- have completed at least 18 credits beyond the bachelor of science.
- be registered during the semester the examinations are administered, *excluding* summer (summer is excluded only if the student was registered the preceding spring semester).

The qualifying exam committee is appointed by the Area Coordinator. The committee typically consists of at least four members of the Graduate Faculty, including at least three members from the student's major program area.

Written English Examination

The written English examination is administered and evaluated by the qualifying exam committee. The English examination consists of a student response in the form of a concisely

written 3-to 5-page essay (600 to 1000 words) on a topic selected by the committee. The written English examination is typically administered no more than two weeks prior to the written qualifying examination. The examination is evaluated on the basis of syntax, grammar, spelling, and organization. If the student is unable to meet committee expectations for written English, one appeal for re-examination may be honored at the discretion of the qualifying exam committee.

Students who fail the written English examination must complete an English writing course, such as ENGL 202C (Effective Writing: Technical Writing). International students may schedule ESL 116G (ESL Composition for Academic Disciplines). A grade of "B" or better must be achieved for the student to satisfy the written English requirement. Students are permitted to complete remedial English writing courses a maximum of two times.

Written Qualifying Examination

The written qualifying examination is designed to test the student's retained knowledge from previous and current course work. The chair of the qualifying exam committee will solicit examination questions from each of the qualifying exam committee members covering specific areas of competence. The committee will determine the final composition of the written qualifying exam in cooperation with the committee chair. The student must successfully complete the written qualifying exam in order to continue to the oral qualifying examination. The oral qualifying examination is typically conducted within 2 weeks after the written qualifying examination.

Oral Qualifying Examination

The oral qualifying examination consists of a short oral presentation by the student followed by committee questions related to the presentation and the written qualifying examination. The oral qualifying examination will normally be 2 hours in length. The oral presentation duration is normally 10-15 minutes in the style of a conference presentation. The topic is determined by the student in consultation with the advisor. Committee evaluation of the presentation is conducted on the basis of organizational structure, delivery, and use of visual aids. The oral examination will continue with committee questions on the subject of the oral presentation. The primary focus of committee questions following the oral examination will be the subject material of the written qualifying examination and other important areas of required competence.

The qualifying exam committee may require students to enroll in ESL 114G (American Oral English for Academic Purposes) to improve speaking competency and achieve a grade of "B" or better. Students may take remedial speaking courses a maximum of two times to meet this requirement.

Qualifying Examination Results

The qualifying exam committee will meet to formulate a final, overall decision within one week of the oral qualifying examination. A favorable vote of at least two-thirds of the committee is required for passing both the oral and written components of the English and qualifying

examinations. The committee may require the student to schedule courses to remediate academic and language deficiencies that were discovered during the qualifying examinations. Immediately following the qualifying exam committee meeting, the committee will meet with the student to discuss the results. The results will take the form of one of the three following:

- Qualify the student to continue for the Ph.D. degree. From this point on the student will take the coursework outlined in the PhD Plan of Study as amended by the qualifying exam committee and begin preparing for the comprehensive examination. This is the date set to begin the eight-year time limitation to complete the PhD degree.
- Postpone a qualifying decision until further conditions are met. These conditions may include additional technical course work or remedial writing or speaking course work as described under the written English and oral qualifying examinations above. The program committee will set forth all further conditions in writing to the student and file them with the Graduate Academic Programs office.
- Do not qualify the student to continue for the PhD. If this option is selected, alternative steps that may help the student achieve her/his academic and professional goals will be discussed prior to adjournment. If the student fails the oral qualifying examination, one appeal for re-examination may be honored at the discretion of the qualifying exam committee.

The chair of the qualifying exam committee shall forward the decisions, using the departmental evaluation form and the Graduate School “Report on Doctoral Qualifying Exam” form to the Academic Programs office, 216 Sackett. The student becomes an official doctoral student only when positive qualifying examination results are recorded by the Graduate School.

DOCTORAL COMMITTEE

This stage begins with the formation of a doctoral committee and culminates with a comprehensive examination. Following successful completion of the qualifying examinations and formation of the doctoral committee, the student conducts an in-depth exploration of a chosen area of study. During this stage, the student sharpens the subject and focus of the research undertaking, and develops theoretical frameworks/perspectives, and research methods and techniques suitable for studying a wide range of problems associated with the area of specialization. This is a highly individualized phase with students pursuing interests that are representative of faculty expertise, of the broader field of engineering, and with the potential for original contribution to the scientific area of inquiry.

The Doctoral Committee

The student should carefully select a doctoral committee as soon as possible, but no more than six months after successfully completing the qualifying examinations. Upon notification from student’s academic advisor, the Department Head will recommend the student’s doctoral committee to the Graduate School. Upon approval of the doctoral committee by the Graduate School, the committee will be recorded. The chair of the doctoral committee is also the student’s permanent academic and thesis advisor and will, along with the doctoral committee, provide

overall guidance for the student's doctoral program. The committee will direct the student in the preparation of the research proposal, conduct of the research, and the development and defense of the thesis. Doctoral committee members should bring different but complementary strengths to the student's research program. The student is advised to choose individuals who can provide expertise in the chosen area(s) of specialization, the general field of engineering, and the research methods specific to the dissertation.

Establishing the Doctoral Committee

The doctoral committee consists of four or more active members of the Graduate Faculty. In addition, the Doctoral Committee satisfies the following guidelines:

- At least two members are from the CEE Department; at least one is from the campus at which the student is enrolled
- The dissertation advisor usually serves as chair
- If the student is also pursuing a dual-title field of study, a co-chair representing the dual-title field must be appointed
- At least one member must represent a field outside the student's major field of study. This member is referred to as the "Outside Field Member." A dual-title representative may serve as the Outside Field Member.
- At least one member must be in an administrative unit from outside CEE Department. This member is referred to as the "Outside Unit Member."
- If applicable, the "Outside Field Member" and the "Outside Unit Member" may be one person.
- If the student has a minor, that field must be represented on the committee by a "Minor Field Member."

Students should formally request a doctoral committee appointment from the CEE Graduate Programs Office within six months of passing the qualifying examinations. The doctoral committee request is then forwarded by the CEE Graduate Programs office to the Graduate School for approval and recording. Additional specific doctoral committee composition requirements are presented in the *Graduate Degree Programs Bulletin*.

Committee Responsibilities

The appointment of a doctoral committee constitutes a major shift in program orientation, requiring the student to consult regularly with at least three faculty advisors. The doctoral committee approves the graduate study plan, periodically reviews academic progress, advises the student on her/his area of specialization, guides the student's dissertation research, prepares and administers the comprehensive and final oral examination (the dissertation defense), and evaluates the student's doctoral dissertation. Continuing communication between the student and her/his doctoral committee members is strongly recommended so as to allow a mentoring process to develop and to preclude misunderstandings during the final stages of study.

The doctoral committee is also responsible for conducting annual evaluations of the doctoral student. It is recommended that these evaluations be performed via a meeting of the entire

committee (physical or virtual presence), although asynchronous meetings with individual members may suffice, if necessary for scheduling purposes. These meetings must be separate from the comprehensive examination. The annual evaluations must be signed by all committee members and submitted to the CEE Graduate Programs Office. The annual meetings should commence within one year of the qualifying exam. For consistency and monitoring, it is requested that the annual reviews be conducted and submitted in March or April each year, beginning with the spring semester following qualifying exam completion.

Thesis Advisor

The student must designate a thesis advisor, normally the doctoral committee chair or co-chair serve as thesis advisor(s). The thesis advisor directs the student's dissertation research. As such, she/he must specialize in the area of the chosen thesis.

Replacing Committee Members

A student may replace any or all members of the doctoral committee. To make committee changes, the student must complete a new *Doctoral Committee Appointment Signature Form*, have it signed by the new committee member(s), and submit it to the CEE Graduate Programs office who will forward it to the Graduate School. Either the student or the incumbent (committee member) may suggest a replacement, however, all affected parties should meet and agree prior to formal action. The student must consult with her/his committee chair before replacing a committee member; the consensus of any removed members should be indicated by the chair.

It is the responsibility of the Professor-in-Charge to periodically review the membership of doctoral committees to ensure that its members continue to qualify for service on the committee in their designated roles. For example, if budgetary appointments or employment at the University have changed since initial appointment to the committee, then changes to the committee membership may be necessary.

THESIS PROPOSAL AND COMPREHENSIVE EXAMINATION

A formal, written proposal detailing the proposed doctoral research must be developed independently by the student. The research proposal serves as the first formal step in the thesis research. It documents a personalized plan for conducting the study, and, in addition, serves as a contract between the student and the doctoral committee regarding what is expected in the ensuing research. Led by the thesis advisor, the doctoral committee supervises the development of the student's proposal, conducts the proposal hearing and approves the proposal. Regular consultation with committee members is strongly encouraged. The research proposal must be submitted to the doctoral committee at least two weeks prior to the Oral Comprehensive Examination.

The typical research proposal includes:

1. a brief topic background, research motivation, and a concise statement of the problem;

2. a clear articulation of research objectives and a defined research scope;
3. a literature review to justify the research problem and establish the state-of-the-art;
4. a work plan, including scheme for data collection, data analysis, and hypothesis testing;
5. preliminary results;
6. anticipated results and expected presentation methods;
7. engineering significance;
8. chart showing the key activities and time schedule; and
9. references critical to the research.

The purpose of the oral comprehensive examination is to evaluate the student's competence and potential for conducting independent research. The student is expected to demonstrate competence consistent with the student's intended thesis research. The student is encouraged to discuss with individual doctoral committee members the material upon which the student will be examined. The Graduate Academic Programs Office must be notified a minimum of one month in advance of the Oral Comprehensive Examination so that Graduate School notification and approval can be completed; difficulties in approval sometimes arise and must be resolved at least two weeks prior to the examination.

The student will orally present and defend the research proposal as part of the oral comprehensive examination. The research proposal will be evaluated by the doctoral committee based on technical merit and other criteria deemed critical to the research by the doctoral committee. Approval of the proposal must have at least two-thirds favorable vote from the committee.

To be eligible for the comprehensive examination, the student must meet the following criteria:

- complete all core courses, and other requirements as determined by the doctoral committee;
- achieve a minimum graduate coursework grade-point average of 3.00;
- have no deferred or missing grades;
- satisfy the English Competence requirement; and
- be registered as a full-time or part-time student for the semester in which the examination is taken.

Upon successful completion of the comprehensive examination, students are formally admitted to candidacy for the PhD.

CONTINUOUS REGISTRATION AND SATISFACTORY SCHOLARSHIP

PhD students must maintain continuous registration (normally excepting summers) from the date of admission until all degree requirements have been satisfied. Students who do not maintain continuous registration may be dropped from the program and must apply for a resumption of study.

Research credits (CE 600 or CE 610) should reflect the time and effort spent in the laboratory, analyzing data, writing the thesis, or other activities specific to the thesis. Although permitted for

up to 12 credits by the Graduate School, the CEE Department does not assign quality grades for CE 600 or CE 610. Advisors report an “R” (Research) grade for all credits of CE 600 and CE 610.

Students who have passed the oral comprehensive examination can maintain continuous registration by registering for credits in the usual manner or by enrolling for noncredit CE 601 (full-time thesis preparation) or 611 (part-time thesis preparation).

Satisfactory scholarship and acceptable progress toward the doctoral degree is required for continuance in the program. One or more failing grades or a cumulative grade-point average below 3.00 for any semester or session (or a combination thereof), may be considered as evidence of failure to maintain satisfactory scholarship.

CONDUCTING RESEARCH

Conducting research and writing a dissertation typically takes between two and three full years depending on the candidate’s expertise and efforts, and the types of research methods employed. The candidate must accomplish the research according to the plan set forth in the proposal as presented to the doctoral committee. While conducting the research, the candidate will be in regular communication with her/his thesis advisor and doctoral committee members. Major changes require approval of the doctoral committee.

WRITING AND DEFENDING THE DOCTORAL DISSERTATION

Writing Final Thesis Draft

The thesis advisor will ensure that the final draft includes all appropriate sections, is prepared according to an acceptable style, and is ready to be submitted to the doctoral committee. The candidate is responsible for the content and style. In addition, the candidate must follow the rules and deadlines of the Graduate School concerning thesis preparation which are detailed in the *Thesis and Dissertation Guide* at: <http://gradschool.psu.edu/current-students/etd/>.

Both the thesis advisor and the candidate are responsible for ensuring the completion of a draft of the thesis and for adequate consultation with members of the thesis committee well in advance of the oral examination. Major revisions to the thesis must be completed before the final oral examination. The thesis should be in its final draft, with appropriate notes, bibliography, tables, etc., at the time of the oral examination; both the content and style must be correct and polished by the time this final draft of the Thesis is in the hands of the committee.

Final Oral Examination Dissertation Defense

The final oral examination for CEE doctoral students is a public, oral examination administered and evaluated by the candidate’s entire doctoral committee. The meeting is chaired by the student’s doctoral committee chair. The final oral examination will consist of an oral presentation of the doctoral candidate’s thesis and a public period of questions and candidate responses. Questions will normally relate directly to the thesis, but may cover the candidate’s entire plan of study because the major purpose of the examination is also to assess the student’s

general scholarly attainments. The portion of the examination in which the thesis is presented is open to the public.

Scheduling the Final Oral Examination

The length of the final oral examination is normally 2 to 3 hours and may be scheduled any time during the semester. However, the examination may not be scheduled until at least 90 days have elapsed after the comprehensive examination was passed. The examination is officially scheduled by the Office of Graduate Enrollment Services, on the recommendation of the Professor-in-Charge of the CEE program. An e-mailed formal request for the final oral examination must be received by the CEE Graduate Programs Office at least one month prior to the scheduled examination. The doctoral candidate is responsible for scheduling the examination.

To schedule the final oral examination the candidate must:

- be registered and in good standing for the semester in which the final oral examination is taken;
- ensure that at least 90 days have elapsed between passing the comprehensive examination and the proposed final oral examination date;
- satisfy all other requirements for the degree;
- gain thesis advisor approval of the thesis draft;
- negotiate, with all doctoral committee members, a final oral examination date;
- notify the Graduate Academic Programs office at least three weeks prior to the proposed examination date; and
- Additional Graduate School requirements for the conduct of the final oral examination are presented at: <http://bulletins.psu.edu/graduate/degree/requirements/>

Final Oral Examination Results

Immediately following the oral examination the doctoral committee will meet to formally evaluate the candidate's work and cast votes. A favorable vote of at least two-thirds of the members of the committee is required to pass the final oral examination. If the student fails, it is the responsibility of the doctoral committee to determine whether a second final oral examination will be granted. A candidate may not be allowed more than two attempts at the final oral examination. The Graduate Academic Programs office will communicate the results to the Office of Graduate Enrollment Services.

FINAL DISSERTATION DOCUMENT

After passing the final oral examination, doctoral candidates must make the necessary corrections or revisions suggested by the committee members and prepare the thesis in final form. Candidates must allow sufficient time to make revisions in order to meet the deadlines of the CEE program and the Graduate School.

Students must follow the *Thesis and Dissertation Guide* for the development and formatting of the master's thesis, which can be obtained at: <http://gradschool.psu.edu/current-students/etd/>. This publication contains information regarding format, illustrations, etc. Students who have activated their intent to graduate must submit an electronic draft (no signatures required) of their thesis to the Graduate School Thesis Office by the published thesis format review deadline.

The final thesis must meet the approval of the Department Head, in whom the Graduate Faculty of the department has vested the responsibility to ensure that all theses conform to established standards and that the thesis supervisor and advisory committee have fulfilled all obligations with regard to the thesis. In addition, the thesis must be approved by the Graduate School Thesis Office.

Students whose theses have been approved by their committee and the department then upload the final electronic thesis by the published thesis final submission deadline. **No changes can be made after this submission, so it is essential that the students have the approval before uploading.** After uploading, the Graduate School will obtain official electronic approvals from committee members and the department. A final copy of the thesis must also be provided to the advisor and committee members as requested upon completion of the program.

It has been historically customary for the student to present a library-bound copy to the thesis advisor and committee members. However, many faculty members may prefer a final electronic file.

GRADUATION

To graduate, students must also activate their intent to graduate on LionPATH and pay the thesis fee during the semester in which they wish to graduate.

MILESTONES, DEADLINES, AND PAPERWORK REQUIRED FOR CEE PHD PROGRAMS

A summary of the key milestones, deadlines, and paperwork requirements is provided in Table 7.1. It is also important to note that:

- The student has primary responsibility for all requirements and deadlines.
- All forms **MUST** be completed through the CEE Academic Programs Office in 216 Sackett Building.
- The Comprehensive and Final Oral exams must first be approved by the Graduate School **before** the exam is held.
- Semester counts cited in the table below do not include summer terms.
- Failure to meet deadlines may have financial and completion date consequences beyond the control of the department.

Table 7.1. Schedule of key milestones, deadlines and paperwork required for CEE Ph.D. programs.

	WHEN	WHAT	OVERVIEW
YEAR ONE	By Nov 1 of First Semester (April 1)	Submit Signed Draft Plan of Study	Developed in consultation with adviser. Submit to the CEE Academic Programs Office with adviser signature.
	By End of First Semester	SARI Exam and Seminar Hours	Must complete Research Integrity training including the online CITI Exam and 5 hours of seminars. The Qualifying Exam will not be scheduled until these research integrity requirements have been completed.
	By End of Second Semester <i>and</i> At least 18 credits completed beyond the BS degree <i>and</i> SARI completed	Schedule and Take Qualifying Exam Must have: <ul style="list-style-type: none"> • Minimum GPA of 3.0 • No deferred or missing grades • Be registered at the time of the exam (<i>except summer if reg for spring</i>) 	The Report on the Doctoral Qualifying Exam is prepared through the CEE Academic Programs Office before the exam and sent to the Graduate School after the exam. The Report includes the Written English Exam, Oral English Exam, Written Technical Exam and Oral Technical Exam. The Qualifying Exam must be passed by the end of the 3 rd semester.
YEAR TWO	By End of Third Semester	Pass all portions of the Qualifying Exam Submit Signed and Approved Final Plan of Study	The qualifying exam committee (including advisor and area faculty) also reviews the student's transcripts and approves a Final Plan of Study that is submitted to the CEE Academic Programs Office with the Report on the Doctoral Qualifying Exam. The final Plan of Study may be modified in future semesters, if needed.
	By End of Fourth Semester <i>and</i> At least One Month before the Comprehensive Exam	Form the Doctoral Committee	The Committee Appointment Form will be prepared by the CEE Academic Programs Office upon request of the student. The form must be signed by all committee members and submitted to the Academic Programs Office for approval by the Professor-in-Charge. The form is then submitted to the Graduate School for approval. The requirements for the Outside Field and Outside Unit committee member(s) must be followed according to Policy GCAC-602. The doctoral committee may be modified in future semesters, if needed.
INTERMEDIATE YEARS	Annually by May 30	Meet with the Doctoral Committee for annual review of progress	According to GCAC-603, PhD students should have an annual review of progress conducted by the doctoral committee. These meetings are <i>in addition</i> to any meetings for exams and may include remote participation by some committee members. A copy of the completed evaluation should be submitted to the CEE Academic Programs Office by May 30 each year.

	WHEN	WHAT	OVERVIEW
	One month prior to the Comprehensive Exam date	Request the Comprehensive Exam Must have: <ul style="list-style-type: none"> • Minimum GPA of 3.0 • No deferred or missing grades • Be registered at the time of the exam 	The comprehensive exam date must be approved by the Graduate School an absolute minimum of two weeks before the exam date. To allow time for signatures and adjustments, the Comprehensive Examination Request form must be requested from the CEE Academic Programs Office at least one month prior to the exam date. Upon passing this exam, the student is officially a PhD Candidate.
	Two weeks prior Comprehensive Exam	Submit Research Proposal to the doctoral committee	
FINAL SEMESTER	Beginning of Last Semester	File Intent to Graduate	Complete in Lionpath
	By 2 nd week of Last Semester	Update Plan of Study and Committee	Check that paperwork has been completed for any changes in coursework, including minors or certificates. Make sure form is submitted and approved for any changes or additions to the doctoral committee.
	Early in the final semester	Submit Draft Thesis to Graduate School for format review	Exact deadline set each semester by the Graduate School. This step must be taken by the deadline or removal from the graduate list is executed.
	One month prior to the Final Oral Exam (Defense) At least 90 days between the Comprehensive Exam and the Final Oral Exam	Request the Final Oral Exam	The final oral exam date must be approved by the Graduate School an absolute minimum of two weeks before the exam date. To allow time for signatures and adjustments, the Final Oral Examination Request form must be requested from the Academic Programs Office at least one month prior to the exam date.
	Two weeks prior to the Final Oral Exam (Defense)	Submit Final Draft Thesis to Graduate Committee	
	About a month before the end of the final semester	Submit final thesis to the Graduate School	Allow time to obtain approval before submission; no changes can be made after submission. Formal approvals are electronic. Exact deadline set each semester by the Graduate School. For good cause and upon request to the Graduate School, the student may be able to obtain a one-week extension.