STRUCTURAL ENGINEERING AND MATERIALS (SEM) GRADUATE PROGRAM INFORMATION FOR NEW GRADUATE STUDENTS

General Information

(1) Attached are sheets with information regarding courses and policies.
(2) Other information is provided in the:
- University Graduate Catalog, available at http://secure.graduateschool.vt.edu/graduate_catalog/
- Graduate Policies and Procedures Manual of the Department of Civil and Environmental Engineering - https://cee.vt.edu/content/dam/cee_vt_edu/files/Graduate-Policies-and-Procedures-Manual-Departmental.pdf
- Important forms are available from CEE Homepage at https://cee.vt.edu/Graduate-menu/current_G_students.html → Click on "Graduate Information & Forms"
- Timetable of classes at https://apps.es.vt.edu/ssb/HZSKVTSC.P_DispRequest or through Hokie SPA at http://hokiespa.vt.edu, or
- SEM Program homepage at https://sem.cee.vt.edu/ - also accessible from the CEE homepage

Signing-in and Advisor Assignment

(1) Upon arriving, please contact Debbie Cooper at decooper@vt.edu to be assigned an Interim Faculty Advisor who will assist you in the selection of courses during the first semester.
(2) If you will be receiving a Graduate Teaching Assistantship (GTA) or a Graduate Research Assistantship (GRA), you will be contacted by Sarah Martin, the Graduate Student Coordinator, with instructions.
(3) International students should check in online at https://sun-prod-app.db.vt.edu/istart/controllers/start/StartEngine.cfm. If you need additional assistance or information, contact the Cranwell International Center at international@vt.edu.

VT Username (formerly referred to as PID) and Internet Access

Once your enrollment deposit is processed and you are listed as accepting your offer, you will receive an email from admissions@vt.edu with instructions for creating your VT Username and email. If you do not receive the email within 48 hours or encounter issues after following the instructions, please reach out to them at admissions@vt.edu.

To connect to the internet, follow the instructions at:
https://4help.vt.edu/sp?id=kb_article&sys_kb_id=560065991b63d190098aea04604bcba2.

STRUCTURAL ENGINEERING AND MATERIALS GRADUATE PROGRAM IN CIVIL AND ENVIRONMENTAL ENGINEERING

AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

The Structural Engineering and Materials graduate program at Virginia Tech offers the Master of Science and Ph.D. degrees in Civil and Environmental Engineering. There are usually 50 to 80 graduate students in the program, with 10 to 15 students working toward the Ph.D. degree. The objective of the program is to provide a quality education that is well-balanced in structural analysis and design, and in theoretical and practical considerations. Students learn classical structural mechanics, study the behavior of engineering materials, and explore modern computational techniques to prepare them for a consulting or research career path. Students are encouraged to explore supporting courses offered in the Engineering Science and Mechanics Department.

Structural Engineering and Structural Materials Degree Requirements

Requirements for the degree programs are as follows:

Master of Science Non-thesis Option: A minimum of 30 course credits (not including seminar credits) is required. Students may take a maximum of 6 credits of 4000 level courses and must take a minimum of 24 credits at the 5000 level or higher (not including seminar credits). Students following the M.S. non-thesis option have two choices:

(a) Coursework Only: Students may take a written exam covering the coursework taken by the student. If they do not pass this exam, they must take an oral exam. The three faculty members that make up the student's committee grade the written and oral exams. Rules governing the exit exam are attached in Appendix A.

(b) Project and Report: Students may take 3 credits of CEE 5904 Project and Report, and then take an oral examination in which they are asked questions about their report and coursework. If they do not pass this exam, they must wait at least 15 weeks before retaking it. Only two attempts at passing this exam are allowed. Students interested in the project and report option are encouraged to talk to faculty conducting research that align with their interests.

Master of Science Thesis Option: A minimum of 24 course credits (not including seminar or research and thesis credits) is required. Students may take a maximum of 6 credits of 4000 level courses, must take a minimum of 18 credits of courses at the 5000 level or higher, and must take at least 6 credits of CEE 5994 (Research and Thesis). The thesis option is preferred for students with Via fellowships. Upon completion of the thesis, a public oral defense is required. Students interested in the Thesis option are encouraged to talk to faculty to determine what topics are available.

Ph.D. Program: A minimum of 90 semester credit hours (not including seminar credits) beyond the B.S. degree, a Qualifying examination, a Preliminary examination, and a Final oral examination are required. The expectation is that the PhD Plan of Study for most Doctoral students will have fifteen classes beyond their BS degree. Courses taken after the MS degree should primarily consist of a mix of 6000 level courses and interdisciplinary courses outside of CEE. Furthermore, the Plan of Study should align with the research and career interests of the PhD student The Plan of Study must be developed in coordination with the student's Advisor and graduate committee.

The Qualifying Exam is a combined written/oral exam which is offered twice each year in January and May/June. Students must pass the exam by the end of their second semester. Students may elect to

take the exam in their first semester, and if they pass, they may continue in the Ph.D. program. If they fail this attempt, they may take the exam again in their second semester. A student may also elect to wait and take the exam only once at the end of their second semester. Students that do not pass the attempt at the end of the second semester will not be allowed to continue in the Ph.D. program.

The Ph.D. Qualifying Exam shall consist of a *written* part and an *oral* part. The decision of pass/fail is made based on the overall performance of the student on both parts of the exam.

The *Written Exam* is a four-hour exam, consisting of six questions in the following subject areas:

- Mechanics of Materials
- Structural Analysis (Classical or Matrix Methods)
- Structural Dynamics
- Design of Reinforced Concrete or Prestressed Concrete Structures
- Design of Steel Structures
- Mathematics

A sample instruction sheet for the written Qualifying exam is attached. Students are expected to solve all problems. The mathematics question may be given as a set of two or three short problems, with each part covering a different subject. A list of subjects covered in the math problem will be provided to the student.

The *Oral Exam* is 90 minutes in duration and covers the same subject matter as the written exam. This exam should be scheduled no later than two weeks after the written exam. Usually, questions on the oral exam will be based on the student's performance in the written exam. Students may not bring material (e.g., written notes) to the oral exam.

A student who has failed the Qualifying Exam at the end of their second semester may re-apply to the PhD program in the SEM program area at a future date. At least two years must elapse between the end of their second semester and the semester for which they are re-admitted. After re-admittance, the student is allowed the same opportunities to pass the qualifying exam as a newly admitted PhD student.

The Preliminary Exam consists of a written part and an oral part. The written part consists of the research proposal, which is a preliminary draft of the dissertation with complete literature review, scope and objectives, methods and preliminary results. The committee may also present questions to the student for take-home written solution one week prior to the date of the oral exam. The oral part includes a presentation of the Student's Research Proposal, general technical questions from the exam committee, and questions related to the written take-home problems if applicable. The Preliminary exam should be taken by the end of the second year in the Ph.D. program and at least six months must elapse between the Preliminary exam and the final defense date. Students are given two chances to pass the Preliminary Exam.

The Final exam consists of an oral defense of the Ph.D. Dissertation. Graduate School rules should be followed for the timing of this exam. In the rare circumstance that a student fails the Final exam, a second opportunity to pass the exam will be given no later than two academic semesters after the first attempt. Students that do not pass on the second attempt will not be allowed to continue in the Ph.D. program.

Alternative Format for Thesis or Dissertation

Most graduate students elect to prepare a traditional monograph thesis or dissertation consisting of a unified text describing a specific research area. Theses and dissertations may also consist of a collection of manuscripts prepared by the student. Submission, acceptance, and publication of the manuscripts are not evaluation criteria for the alternative thesis or dissertation format. The manuscripts may be in whole or in part previously published, published concurrently with the submission of the thesis or dissertation, or published after completing the graduate degree. The publication status of each manuscript must be clearly indicated. For manuscripts prepared by multiple authors, the student should

include an explicit statement describing their original contributions to the manuscript in detail and justifying the inclusion of the paper in the thesis or dissertation. Where there may be two students who will include the same manuscript in two separate theses, each student should acknowledge the existence of the other thesis, and the fact that the manuscript appears in both theses.

The student's graduate committee will discuss and approve the number and focus of manuscripts at the proposal stage with modifications permitted by agreement of the committee as the research progresses. Each manuscript will comprise a chapter of the thesis or dissertation preceded by an introduction of the research, a review of the literature, and a description of the research methodology. A closing chapter should summarize the manuscripts and provide recommendations for future research. Theses and dissertations using the manuscript format must also follow the requirements in the CEE Graduate Policies and Procedures Manual and the format of the individual chapters must conform to the University Guidelines for Electronic Thesis and Dissertations.

Other General Information:

If a student fails to make satisfactory progress toward the degree, permission may be denied to continue the program. Students whose cumulative GPA falls below 3.0 are placed on probation and become ineligible for assistantships.

The Graduate Honor Code establishes a standard of academic integrity. Compliance with the Graduate Honor Code requires that all graduate students exercise honesty and ethical behavior in all their academic pursuits at Virginia Tech. The Constitution of the Graduate Honor System is given in an Appendix of the Graduate Catalog, which can be accessed from the CEE web page. It describes violations such as cheating, plagiarism, and falsification, and the associated penalties.

Duties of students receiving assistantships are described in the letter giving the offer of aid and in the contract signed by the student, and by the supervising faculty member.

Master's theses and Ph.D. dissertations are submitted to the university electronically. Instructions are given on the Electronic Thesis and Dissertation (ETD) homepage located at http://scholar.lib.vt.edu/theses. Workshops on ETD are given periodically by the Graduate School.

During the academic year, students who have a fellowship, scholarship, or graduate assistantship (GA), including teaching and research assistantships, must take a minimum of 12 credits hours per semester. Unfunded students must take a minimum of 9 credit hours per semester. Audited courses are not counted toward the minimum. Graduate students are not required to enroll during summer sessions unless they are taking courses (e.g., students working on research during the summer are not required to sign up for CEE 5994 or 7994). Students registered for 12 or more credits may audit one course; students registered for 9-11 credits may audit two courses.

Lab Safety Training

If a student will be conducting work at the Thomas M. Murray Structural Engineering Laboratory, they will be required to undergo safety training. Before beginning work at the Murray Structural Engineering Laboratory all graduate students will accompany their advisor/principal investigator for an introduction to the laboratory director and laboratory technical staff. During this initial visit, the graduate student will be asked to fill out a Student Information form and a student file will be created.

After a file is created, the student will be instructed on the procedure for online safety training. There are nine online safety modules and all nine must be completed before the student is allowed to perform any work on the laboratory floor. Additional training may be required depending on the needs of the project.

Upon completion of the safety training, the student will be given a formal tour of the laboratory. During this time, a copy of the laboratory safety policies and procedures will be discussed and required safety equipment will be issued to the student.

Requirements for Structural Engineering Majors

For a Structural Engineering major, each student's Master's or Ph.D. program must include the following basic requirements:

(1) Fulfill required background courses listed in Graduate Policies and Procedures Manual of the Department of Civil and Environmental Engineering.
(2) CEE 5944 Seminar, one Fall and one Spring semester consecutively.
(3) Referring to Table 1, all M.S. and Ph.D. students are required to take at least three courses from the Structural Mechanics and Structural Analysis categories (including at least one from each of these two categories) and at least two courses from the Structural Design category. A course from the Structural Materials category can be substituted for one of the Structural Design courses. After these requirements are met, the student can work with their advisor to tailor their plan of study to meet their own interests and professional goals.

Table 1

Structural Mechanics	Structural Analysis	Structural Design	Structural Materials
□ (1 course required)	□ (1 course required)	□ (1 course required)	
□ (1 course required)		□ (1 course required)	
** 5464 Structural Dynamics & Earthquake Engineering	** 5414 Finite Element Analysis of Structures	4454 Masonry Structural Design	4614/5664 Advanced Structural Concretes
5490 Advanced Structural Mechanics	** 5420 Computer Analysis of Structures I	** 5400 Design of Prestressed Concrete	5484 Concrete Microstructure
5494 Reliability Methods in Structures & Mechanics	5440 Instrumentation & Signal Processing	** 5410 Intermediate Reinf. Concrete Structures	MSE 4055 Materials Selection and Design
5610 Advanced Mechanics of Composite Materials	5444 Stability of Structures	** 5430 Intermediate Design of Steel Buildings	MSE 4304 Metals and Alloys
ESM 5024 Solid Mechanics	6414 Nonlinear Finite Element Analysis	4824/5450 Forensic Structural Engineering	MSE 5164 Corrosion and Electrochemical Processes
ESM 5134 Advanced Mechanics of Materials		5454 Blast Analysis & Protective Design	ESM 5144 Deformation and Fracture of Materials
		5470 Design for Seismic Load Effects	
		5474 Advanced Reinf. Concrete Design	
		** 5744 Topics in Steel Design	
		5984 Wind Engineering	
		6424 Advanced Prestressed Concrete	
		6434 Advanced Steel Design	
		SBIO 4314 Design of Wood Structures	
		SBIO 5324 Timber Engineering	
** Course is strongly recommended for graduate degree			

Requirements for Structural Materials Majors

For a Structural Materials major, each student's Master's or Ph.D. program must include the following basic requirements:

(1) Fulfill required background courses listed in Graduate Policies and Procedures Manual of the Department of Civil and Environmental Engineering.
(2) CEE 5944 Seminar, one Fall and one Spring semester consecutively.
(3) Referring to Table 2, all M.S. and Ph.D. students are required to take at least two courses in the Structural Materials area, at least one course in the Structural Mechanics and Analysis area, at least one course in the Structural Design area, and at least one course in Materials and Physical Sciences area. After these requirements are met, the student can work with their advisor to tailor their plan of study to meet their own interests and professional goals.

Table 2

Structural Materials	**Structural Mechanics and Analysis**	**Structural Design**	**Materials and Physical Sciences**
□ (1 course required) □ (1 course required)	□ (1 course required)	□ (1 course required)	□ (1 course required)
4614/5664 Advanced Structural Concrete	5414 Finite Element Analysis of Structures	4454 Masonry Structural Design	MSE 4034 Thermodynamics of Materials Systems
4634 Infrastructure Condition Assessment	5420 Computer Analysis of Structures I	5400 Design of Prestressed Concrete	MSE 5034 Structure & Properties of Materials
5484 Concrete Microstructure	5440 Instrumentation & Signal Processing	5410 Intermediate Reinf. Concrete Structures	MSE 5114 Introduction to Materials Characterization
5764 Asphalt Technology	5444 Stability of Structures	5430 Intermediate Design of Steel Buildings	MSE 5144 Deformation & Fracture of Materials
5834 Asphalt and Pavement Modeling	5464 Structural Dynamics & Earthquake Engineering	4824/5450 Forensic Structural Engineering	MSE 5234 Materials Science of Surfaces and Interfaces
MSE 4055 Materials Selection and Design I	5490 Structural Mechanics	5454 Blast Analysis & Protective Design	MSE 5334 Advanced Applied Materials Analysis
MSE 4304 Metals & Alloys	5494 Reliability Methods in Structures & Mechanics	5470 Design for Seismic Load Effects	MSE 5394 Molecular Dynamics Simulation
MSE 4604 Composite Materials	5610 Advanced Mechanics of Composite Materials	5474 Advanced Reinf. Concrete Design	CHEM 5124 Analytical Spectroscopy
MSE 5164 Corrosion and Electrochemical Processes	6414 Nonlinear Finite Element Analysis	5744 Topics in Steel Design	CHEM 5614 NMR Methods
	ESM 5014 Introduction to Continuum Mechanics	5984 Wind Engineering	STAT 5615 Statistics in Research I
	ESM 5024 Introduction to Solid Mechanics	6424 Advanced Prestressed Concrete	STAT 5616 Statistics in Research II
	ESM 5134 Advanced Mechanics of Materials	6434 Advanced Steel Design	GEOS 5535 X-Ray Crystallography I
		SBIO 4314 Design of Wood Structures	GEOS 5536 X-Ray Crystallography II
		SBIO 5324 Timber Engineering	

STRUCTURAL ENGINEERING AND MATERIALS PROGRAM

Courses Scheduled for 2023-2024

All courses are 3 credit hours unless noted. Note that 3000-level courses cannot be taken for graduate credit.

Fall 2023

CEE 3404	Theory of Structures	Koutromanos, Sarlo
CEE 3424	Reinforced Concrete Structures I	Roberts-Wollmann
CEE 3434	Design of Steel Structures I	Phillips
CEE 3684	Civil Engineering Materials	Mokarem
CEE 4610	Mechanics of Composite Materials (w/ CEE 5610)	Case
CEE 4614	Concrete Materials (w/ CEE 5664)	Brand
CEE 5410	Intermediate Reinforced Concrete Structures	Jacques
CEE 5420	Computer Analysis of Structures I	Arul
CEE 5430	Intermediate Design of Steel Buildings	Eatherton
CEE 5440	Instrumentation and Signal Processing	Sarlo
CEE 5470	Design for Seismic Loads	Eatherton
CEE 5484	Concrete Microstructure	Brand
CEE 5610	Adv. Mechanics of Composite Materials (w/ CEE 4610)	Case
CEE 5664	Advanced Structural Concrete (w/ CEE 4614)	Brand
CEE 5944	Graduate SEM Seminar (1 credit)	Arul
CEE 6424	Advanced Prestressed Concrete	Roberts-Wollmann

Spring 2024

CEE 3404	Theory of Structures	Arul, Case
CEE 3424	Reinforced Concrete Structures I	Jacques
CEE 3434	Design of Steel Structures I	Eatherton, Phillips
CEE 3684	Civil Engineering Materials	Brand
CEE 3954	Bridges, Builders, & Societies	Roberts-Wollmann
CEE 4404	Theory of Structures II	TBD
CEE 4824	Forensic Engineering (w/ CEE 5450)	Leon
CEE 5400	Design of Prestressed Concrete	Roberts-Wollmann
CEE 5414	Finite Element Analysis of Structures	Koutromanos
CEE 5450	Forensic Engineering (w/ CEE 4824)	Leon
CEE 5464	Structural Dynamics and Earthquake Engineering	Sarlo
CEE 5744	Topics in Structural Steel Design	Leon
CEE 5984	Wind Engineering	Arul
CEE 5944	SEM Seminar (1 credit hour)	Leon

Tentative Courses Planned for 2024-2025

Note: these offerings may be subject to change.

Fall 2024

CEE 3404	Theory of Structures	Sarlo, Koutromanos
CEE 3424	Reinforced Concrete Structures I	TBD
CEE 3434	Design of Steel Structures I	Leon
CEE 3684	Civil Engineering Materials	Brand
CEE 4610	Mechanics of Composite Materials (w/ CEE 5610)	Case
CEE 4614	Concrete Materials (w/ CEE 5664)	TBD
CEE 5410	Intermediate Reinforced Concrete Structures	Jacques
CEE 5420	Computer Analysis of Structures I	Arul
CEE 5430	Intermediate Design of Steel Buildings	Phillips
CEE 5454	Blast Resistant Design of Structures	Jacques
CEE 5470	Design for Seismic Loads	Eatherton
CEE 5490	Advanced Structural Mechanics	Case
CEE 5610	Advanced Mechanics of Composite Materials (w/ CEE 4610)	Case
CEE 5944	SEM Seminar (1 credit hour)	Koutromanos

Spring 2025

CEE 3404	Theory of Structures	Case, Arul
CEE 3424	Reinforced Concrete Structures I	Jacques
CEE 3434	Design of Steel Structures I	Eatherton, Phillips
CEE 3684	Civil Engineering Materials	Mokarem
CEE 3954	Bridges, Builders, & Societies	Roberts-Wollmann
CEE 4404	Theory of Structures II	Leon
CEE 4824	Forensic Engineering (w/ CEE 5450)	Leon
CEE 5400	Prestressed Concrete	Roberts-Wollmann
CEE 5414	Finite Element Analysis of Structures	Koutromanos
CEE 5444	Stability of Structures	Koutromanos
CEE 5450	Forensic Engineering (w/ CEE 4824)	Leon
CEE 5464	Structural Dynamics and Earthquake Engineering	Sarlo
CEE 5744	Topics in Structural Steel Design	Phillips
CEE 5944	SEM Seminar (1 credit hour)	Arul

Related Courses

Students in the Master's degree program are encouraged to take courses outside of the structures program to broaden their background. Many alternatives are available, especially in the engineering science and mechanics, construction, geotechnical, materials, mathematics, and statistics. At the Ph.D. level it is desirable for the student to develop additional depth in structural mechanics, mathematics, and continuum mechanics.

Civil Engineering

CEE 4014	Estimating, Production, and Cost Engineering
CEE 4024	Construction Control Techniques
CEE 4534	Earth Pressures and Foundation Structures
CEE 5060	Built Environment Information Modeling and Processing
CEE 5504	Risk Analysis in Geotechnical Engineering
CEE 5534	Foundation Engineering I
CEE 5544	Foundation Engineering II
CEE 6984	Advanced Soil Dynamics

Engineering Science and Mechanics

ESM 4024	Adv Mechanical Behavior Materials
ESM 4084	Engineering Design Optimization
ESM 4614	Probability-based Modeling, Analysis, and Assessment
ESM 5014	Introduction to Continuum Mechanics
ESM 5124	Theory of Elasticity
ESM 5144	Deformation and Fracture of Materials
ESM 5304	Mechanical and Structural Vibrations

Mathematics

Math 4425	Fourier Series and Partial Differential Equations
Math 4445-4446	Introduction to Numerical Analysis
Math 4454	Applied Mathematical Modeling
Math 4564	Operational Methods for Engineers
Math 4574	Vector and Complex Analysis for Engineers

Mechanical Engineering

ME 5514	Mechanical and Structural Vibrations

Statistics

Stat 4004	Methods of Statistical Computing
Stat 4604	Statistical Methods for Engineers
Stat 4705-4706	Probability and Statistics for Engineers
Stat 5615-5616	Statistics in Research

Geological Science

GEOS 5154	Strong Motion Seismology and Seismic Hazard Analysis

Sustainable Biomaterials

SBIO 4315	Design of Wood Structures
SBIO 5324	Timber Engineering

Structural Engineering and Materials Faculty and Their Research

Monica Arul, Assistant Professor, Ph.D., University of Notre Dame. Wind engineering, applications of machine learning to structural engineering, structural health monitoring.

Alexander S. Brand, Assistant Professor, P.E., Ph.D., University of Illinois at Urbana-Champaign. Cementitious composites, materials characterization, materials science, sustainability, pavement design.

Scott W. Case, Reynolds Metals Professor, Ph.D. Virginia Tech. Fiber-reinforced composite materials. Fatigue and Fracture. Structural fire performance.

Matthew R. Eatherton, Professor and SEM Coordinator; P.E., Ph.D., University of Illinois at Urbana-Champaign. Steel structures; high performance seismic force resisting systems; earthquake engineering; experimental research and methods.

Eric Jacques, Assistant Professor, Ph.D., P.Eng., University of Ottawa. Blast resistant design, reinforced concrete structures, infrastructure resilience, detonation science.

Ioannis Koutromanos, Associate Professor, Ph.D. University of California. San Diego. Reinforced concrete and masonry design. Advanced constitutive models. Seismic loads and response. Retrofitting for improved seismic behavior.

Roberto Leon, Burrows Professor, P.E., Ph.D., University of Texas. Behavior and design of steel and composite connections and structures, serviceability of composite floors, high performance materials, progressive collapse of bridges, community resilience.

Adam Phillips, Associate Professor, P.E., Ph.D., Virginia Tech, hybrid steel-timber structures, mass timber, life-cycle analysis & sustainable design, earthquake engineering, and experimental testing.

Carin Roberts-Wollmann, Professor, P.E., Ph.D., University of Texas. Reinforced and prestressed concrete, concrete time dependent behavior, field testing of bridges, bridge behavior and design.

Rodrigo Sarlo, Assistant Professor, Ph.D., Virginia Tech. Structural Health Monitoring, infrastructure instrumentation and testing, sensing and data fusion, vibrations and structural dynamics

Emeritus Faculty

Finley A. Charney, Professor Emeritus, P.E., Ph.D., University of California-Berkeley. Structural analysis, structural dynamics, earthquake engineering, wind engineering, behavior of structures

W. Samuel Easterling, Professor Emeritus, P.E., Ph.D., Iowa State University. Steel-concrete composite structures, steel structures, cold-formed steel structures, partially-restrained connections, experimental research.

Thomas M. Murray, Professor Emeritus; P.E., Ph.D., Kansas. Steel structures; serviceability aspects of design; pre-engineered building design; testing of full-scale structural components.

Raymond H. Plaut, Professor Emeritus; Ph.D., California-Berkeley. Stability of structures; inflatable structures; structural dynamics; adhesion; blast loading; cable dynamics; vibration isolation; geomembranes; railway joints.

Kamal B. Rojiani, Professor Emeritus, P.E., Ph.D., University of Illinois at Urbana-Champaign. Structural safety and reliability; code calibration; risk analysis; computer applications; programming methodologies.

Richard E. Weyers, Professor Emeritus; P.E., Ph.D., Penn State. Concrete durability; concrete bridges, steel corrosion.

Appendix A

Rules governing the final exam for coursework-only M.S.

- MS coursework-only students should notify the SEM coordinator by December 15 of the previous year if they desire to graduate at the end of the Spring semester or Summer term and by May 15 if they expect to graduate at the end of the Fall semester.
- The SEM coordinator will assign committee chairs and committee members for all MS course-work only students.
- The written exams must be turned into the SEM coordinator to distribute to the committee members no later than the Friday of the fourth week of the semester of graduation.
    - For Fall 2023 graduates, written exams are due Friday September 15, 2023.
    - For Spring 2024 graduates, written exams are due Friday February 9, 2024.
- The format for the written exam is presented below.
- The committee will evaluate the written exams and grade as pass or fail. If two of the three committee members give a failing grade, an oral exam must be scheduled. The procedure for the oral exam is described below.
- If the oral exam is also deemed a failing effort, the student must schedule a second exam during the last two weeks of the semester.

Format for written exit exam

The exit exam for the coursework only option consists of a collection of "summaries" from each course that is on the student's plan of study that has been completed at the time of the exam. Students need not complete more than seven summaries, and no summary is required for seminar. The general protocols for preparing the summaries are as follows:

(1) The summary must be your original work, and a statement to that effect must be clearly written on each summary. You are not to copy or paraphrase from lecture notes or to reuse examples from class notes or homework.

(2) The summaries must be typed (including equations) and all figures redrawn if originals are not clear.

(3) The summary must be neat and well organized. Use sketches where needed. Where appropriate show all computational units (kip, inch) and signs (positive, negative, tension, compression).

(4) Each summary shall have the following parts:

a. Your name, the date the summary is turned in, the course number, the course title, the name of the instructor, and the semester completed

b. A statement of course objectives, *written in your own words (not copied or paraphrased from the course syllabus;* suggested length 100-200 words)

c. A statement indicating, in your view, the relevance of the course to the field of Structural Engineering and/or Structural Materials (suggested length 100-200 words).

d. A statement indicating, in your view, which was the most interesting topic in the course, and why (suggested length 100-150 words).

e. A statement indicating, in your view, which was the least interesting topic in the course, and why (suggested length 100-150 words)

f. A summary of one important topic in the course (your choice) suitable for presentation in a classroom. This summary is in effect, a set of “lecture notes” that you would present using a chalkboard in a time frame of about 15 minutes. Examples include "Loss of Prestress”, “Analyzing Continuous Beams”, “Creep in Concrete”, “The ASCE 7 Seismic Response

Spectrum". You are welcome to choose a topic that extends beyond what was covered in the course.

g. The write up should illustrate your ***deep*** understanding of this one topic. Preferably this should be kept to under 1500 words, excluding equations, figures and references.

h. When assembling this summary, please think of it as needing to include an introduction, a discussion of fundamental principles involved, important assumptions and limitations of the approach used, a clear description of the topic along with example(s) (as needed), and a conclusion. Please include a list of references.

i. The use of numerical examples is encouraged; those examples must be sufficiently different from those done in class to show your mastery of the topic. The examples must be a complete problem, not part of one. A discussion of the reasonableness of the results should be included.

j. Although some topics may benefit from the extensive use of figures, it is best if that number is kept at a reasonable level. One of the criteria being judges (see below) is written communication, so you should avoid assuming that the reader can interpret a figure or photo by themselves. Note that it is best if you write each of the summaries immediately after you complete the course.

k. To assist in the development of your summaries, after you complete your first summary, you may submit this to your committee chair. The chair will review the summary and provide comments. Then you can proceed with your other summaries.

The summaries are intended to be used by faculty to assess whether the student demonstrates;

1. technical competence in chosen area of study within CEE
2. effective written communication skills
3. ability to articulate design elements of CEE infrastructure
4. ability to articulate the breadth of discipline chosen with CEE

Please keep these criteria in mind when submitting your summaries.

<u>Rules governing oral exam if required</u>

- Each student will prepare a 7-to-10-minute presentation based on each completed course (except for seminar) that is part of his or her plan of study. You will only be required to prepare a presentation on courses that you have completed and not the courses that you are currently taking. However, if you take the oral exam for a second time, you will be required to prepare a presentation on courses taken during your last semester.
- The focus of your presentations should be on 2 or 3 of the most important things that you learned in each course. You should provide technical details to demonstrate your knowledge.
- In the oral exam, you will be asked to make two of the presentations you have prepared. You won't know which two until you get into the exam. This way, you will be motivated to perform a comprehensive review of all the courses you have taken.
- The only visual aid you will be able to use is the chalkboard. The purpose of this requirement is to limit your preparation time, which could otherwise get out of hand if students were allowed to prepare fancy overheads or slides.
- You may refer to notes while making your presentation. We encourage you to practice your presentations in advance so that reliance on your notes is kept to a minimum, but the point is that you do not have to memorize all the presentations that you prepare.
- You must stick to the 7-to-10-minute time frame for each presentation. We won't interrupt you during your presentations. This will give you the opportunity to get relatively comfortable in the exam setting by being able to deliver a prepared presentation before we begin asking you questions.

- After each presentation, we will ask you questions about that presentation. It is possible that the questions will stray into material covered by other courses, but the focus will be on the courses you present. You will not be permitted to look at your notes during the question and answer portion of the exam.

Based on the exams that have been held using this format, the following suggestions are offered:

- The presentations that have been most successful have used the following pattern: To begin, give a very short introduction stating what the course covered and what particular topics you are going to address in your presentation. It is impossible to completely cover an entire semester course in 10 minutes, so you should choose 2 or 3 topics from the course that are especially interesting or significant to you. The remainder of your time should be spent on the 2 or 3 topics you chose. It is important that you show us technical details. Don't just recite lists.
- Don't write everything you say on the chalkboard. A principal use of the chalkboard should be to draw graphs. Remember to label axes on graphs. For some topics, it may also be appropriate to use the chalkboard for writing equations or illustrating procedures.
- It is very important to stick to the time frame. A presentation length under 7 minutes creates an impression that you didn't understand the material in the course. We will stop you if you go over the 10-minute limit.
- Practice your presentations beforehand. Get comfortable speaking and working at the chalkboard. Start at the upper left and work to the lower right.
- If you don't know the answer to a question, it's certainly all right to try to reason your way through it (we will help you), but do not try to fake your way through it. It's better to admit you don't know than it is to guess.
- If you do not pass the oral exam on your first attempt, you may take the exam again before the end of the semester. You may be required to do some remedial work before your second attempt. Also, if you take the oral exam for a second time, you will be required to prepare a presentation on courses taken during your last semester.

Appendix B

Sample Qualifying Exam Instructions

Structural Engineering Ph.D. Qualifying Examination

Written Component

This Exam consists of six problems in fundamental areas, as shown below:

1. Structural Dynamics
2. Mechanics of Materials
3. Structural Analysis (classical or matrix)
4. Steel Design
5. Reinforced or Prestressed Concrete Design
6. Mathematics

The exam is closed book, closed notes. In some cases, the exam administrator will provide references documents, such as ACI 318.

You are expected to solve all problems.

After you have completed the exam, place your solution sheets for each problem immediately after the problem statement the exam notebook.

The determination of your pass/fail status on the Ph.D. Qualifying Exam will be based on your combined performance on the written and oral portions of the exam.

Good luck!

Honor Code Pledge: I have not given or received unauthorized assistance on this exam. Further, in the future, I will not discuss this exam with anyone other than the problem authors.

Name _____

Signature _____