

Information for Graduate Students in

**STRUCTURAL ENGINEERING AND STRUCTURAL MECHANICS
(SESM)**

March 2017

1. Introduction

Welcome to the graduate program in Structural Engineering and Structural Mechanics (SESM) at the University of Colorado at Boulder. The following introductory information should be useful to familiarize yourself with our graduate program. In particular this advice will enable you to pre-register for classes in your first semester and will acquaint you with some of the graduate degree requirements in Civil, Environmental, and Architectural Engineering (CEAE). When pre-registering for departmental courses, sign up for the 5000-level section of courses if they are cross listed. This is important since 4000-level departmental courses will be considered deficiencies, and graduate credit will not be awarded for them.

Usually graduate students admitted to the SESM-program will have completed a B.S. degree in either Civil or Architectural Engineering from a program accredited by the Accreditation Board for Engineering and Technology (ABET) in the United States, or will hold an equivalent degree from a foreign institution. Students should consult with their SESM Academic Advisor before initial registration. Advanced courses at the 6000 and 7000 levels are usually offered only in alternate years.

All entering graduate students are assigned a temporary Academic Advisor by the SESM-member on the departmental Graduate Committee. When a student selects a research topic, the research advisor, who will supervise his/her work towards a thesis/report, will take over the responsibilities of the Academic Advisor. Such a change is routine, but it does require formal action consisting of filling out a form signed by the original and proposed advisors and approved by the Departmental Chair. All graduate students are expected to develop a Degree Plan during the first semester of their graduate work with the advice of the Academic Advisor. This Degree Plan requires Departmental approval.

2. Masters Program

There are two degree plans for the M.S. Degree in SESM:

Plan I consists of 30 semester hours, which include 6 thesis hours for writing a Master Thesis. The SESM faculty members require Plan I for those students who anticipate receiving financial support in the form of Teaching or Research Assistantships. This plan is recommended for all M.S. students as it entails a significant research experience.

Plan II consists of 30 semester hours and has two versions:

Plan II/A includes 3 master report hours for writing a Master Report based on research conducted under the supervision of the student's advisor.

Plan II/B consists of 30 hours of coursework only.

The graduate curriculum may vary according to the student's needs, and it is very important that the curriculum be discussed and agreed upon together with the Academic Advisor. MS students are required to take at least two courses in each of the two groups (Structural Mechanics and Structural Engineering) indicated under the Table of Graduate Courses. All students are required to take CVEN 5111, CVEN 5161 and either CVEN 5525 or 5511, or provide documentation of a similar course taken elsewhere.

Students should consult with their Academic Advisor before selecting courses. A course plan for the duration of your M.S. degree is due to your Academic Advisor 1 week before the start of Thanksgiving break (for students starting in the Fall semester) and 1 week before the start of spring break (for students starting in the spring semester). This course plan will be reviewed by 3 faculty. Changes can be made with Advisor approval. Please see the graduate program advisor for the appropriate form. With advisor prior approval, one or two courses may be taken outside of the courses in the Table of Graduate Courses as part of a coherent program.

Transfer credit of up to 9 hours for graduate work outside CU-Boulder may be given after successful completion of three graduate courses in the CEAE Department (GPA \geq 3.25) (subject to advisor approval).

Final Comprehensive Examination

M.S. students in Plan I and Plan II/A present their research in what is termed an oral final defense. The final version of the report or thesis must be submitted to the committee members (a minimum of three) at least one week prior to the oral defense.

There is no final examination for students in MS Plan II/B. However, course grades must be reviewed by a group of three faculty.

3. Doctoral Program

There is no core curriculum for the doctoral program, though all students are required to take CVEN 5111, CVEN 5161 and either CVEN 5525 or 5511, or provide documentation of a similar course taken elsewhere. Each such program is customized to the background and experience of each individual doctoral student. Therefore it is extremely important that the Academic Advisor be called upon to develop the Degree Plan very early in the student's work, so that it can be used as a guide in sequencing the selection of courses. Moreover, the rules of the Departmental and the Graduate School require appointment of an Advisory Committee for every Ph.D. Student, in order to assist the Academic Advisor in developing the degree plan.

The doctoral student is expected to sit for a Preliminary Examination within one academic year of the beginning of his/her doctoral program (unless his/her advisor suggests a delay until the second year), and a Comprehensive Examination after all course work has been essentially completed. The Preliminary Examination is an assembled written examination offered to SESM doctoral students once a semester. The Comprehensive Examination is tailored to each student's program by his/her Advisory/Examining Committee. The goals of the Comprehensive Examination are for the student to demonstrate that the student: is able to perform research at the doctoral level, has a good idea of the plans for the proposed research, and has sound understanding of the fundamentals for the proposed research. The Comprehensive Exam involves an oral presentation to a committee of faculty, which includes a summary of the proposed research. In addition, students should prepare a written document consisting of introduction/background, objectives, a critical literature review, and a sketch of the methodology to be carried out. It is expected that this document be limited to 40 pages. The Comprehensive Exam may be accompanied by written questions about fundamental concepts at the discretion of the committee. It is expected that the Comprehensive Exam be completed approximately 1 year after the prelim exam. In addition, the doctoral candidate must defend his/her dissertation successfully and publicly in the "Thesis Defense" at the final stage of his/her doctoral program. Students are welcome and encouraged to meet with their doctoral committee (individually or in groups) regularly throughout this process.

The Rules of the Graduate School do not require a doctoral student to hold the M.S. degree, but the quality of the M.S. thesis is very often an important consideration in selecting doctoral students. The minimum

requirements for the doctorate are 30 semester hours of graduate level coursework, of which as many as 21 hours may be transferred from M.S. work upon consultation with and approval by the advisor (if this prior work was outside of CU-Boulder it may be transferred only after successful completion of at least three graduate courses in the CEAE-Department with a GPA ≥ 3.25). Remaining required course requirements for the degree are determined by the advisor. Proficiency in engineering mathematics is not a formal "Minor" requirement, but it is expected that Ph.D. students will have a satisfactory mathematical background. For this reason it is strongly recommended to add two courses in Engineering Mathematics beyond the standard course requirement of 30 semester hours. In addition to the coursework, the doctoral program requires completion of 30 thesis hours of research towards the doctoral degree.

4. First Semester Registration

After having been admitted to the Graduate School and paying the deposit, registration for the First Semester can be completed through the MyCUInfo portal. In order to complete registration, the temporary Academic Advisor will need to confer with you before granting permission to remove the registration advising hold. Once permission has been given, the temporary advisor will send an email to the Department Graduate Program Coordinator, who will remove the "advising" hold. You will then be able to pre-register for classes on the MyCUInfo portal.

5. Ph.D. Preliminary Exam

This Exam is offered twice a year, the week after Spring Break in the Spring Semester, the week after Thanksgiving in the Fall Semester. Students have eight hours (four in the morning, four in the afternoon) to solve a total of eight problems on the following two general topics:

*Structural Engineering
Structural Mechanics*

No books or notes are allowed in the exam, and only non-programmable calculators may be used.

The comprehensive passing grade for **Ph.D. students** is 70%. Ph.D. students who fail the Ph.D. Preliminary Exam may petition to take it again the following semester. Failure in two exams results in exclusion from the Ph.D. program. Students in the Ph.D. program are expected to take the Preliminary Exam during the first year of enrollment in the program.

These are the topics in each of the two areas.

Structural Engineering

- Fundamentals of structural design
- Flexibility/stiffness methods
- Stability theory
- Dynamic analysis

Suggested References

- Hibbeler, R.C. *Structural Analysis*. Prentice-Hall.
- W. McGuire, R.H. Gallagher, R.D. Ziemian. *Matrix Structural Analysis*. Wiley.
- Clough, R.W. and Penzien, J. *Dynamics of Structures*. McGraw-Hill.

Structural Mechanics

- 3D stress analysis
- Elastic/inelastic bending and torsion
- Failure theories
- Mathematics

Suggested References

- A.P. Boresi, R.J., Schmidt, O.M. *Sidebottom*. Advanced Mechanics of Materials. Wiley.
- Crandall, S.H., Dahl, N.C., Lardner, T.J. An Introduction to the Mechanics of Solids, McGraw-Hill.

6. Summary of Requirements

M.S. Requirements:

Plan I	Coursework + Thesis	24+ 6 hrs
Plan II/A	Coursework + Report	27 + 3 hrs
Plan II/B	Coursework	30 hrs

Up to 9 graduate hours may be transferred from other institutions after successful completion of 3 CEAE-graduate courses ($GPA \geq 3.25$). MS students are required to take at least two courses (from those listed in the Table of Graduate Courses) in each of the two groups (Structural Mechanics and Structural Engineering). Students should consult with their Academic Advisor before selecting these courses. The program plan form must be signed by at least three program faculty members.

Thesis Defense:

Public defense of dissertation

Report Defense

Public discussion of report with oral exam

Ph.D. Requirements:

Coursework:

30 hours of coursework (up to 21 hours may be transferred from the MS-degree at CU-Boulder, or from other institutions after successful completion of 3 CEAE-graduate courses, $GPA \geq 3.25$).

Thesis work:

30 thesis hours of research

Preliminary Exam:

Written exam within the first academic year in the CEAE-Department

Comprehensive Exam:

Written and/or oral exam at the end of course work

Thesis Defense:

Public defense of dissertation

7. Table of Graduate Courses

Graduate Courses in Structural Engineering & Structural Mechanics fall into two groups

<i>STRUCTURAL MECHANICS</i>			
CVEN 5111	3	Fall (A)	Structural Dynamics
CVEN 5131	3	Spring (A)	Continuum Mechanics & Elasticity
CVEN 5161	3	Fall (A)	Advanced Mechanics of Materials
CVEN 5511	3	Fall (A)	Introduction to Finite Element Analysis
CVEN 5831	3	Fall (B)	Special Topics in Construction Materials
CVEN 6161	3	Spring (B)	Advanced Mechanics of Materials II
<i>STRUCTURAL ENGINEERING</i>			
CVEN 5835	3	Fall (B)	Experimental Methods in Structural Engineering
CVEN 5525	3	Fall (A)	Analysis of Framed Structures
CVEN 5565	3	Spring (A)	Life-Cycle Engineering of Civil Infrastructure Systems
CVEN 5575	3	Fall (A)	Advanced Topics in Steel Design
CVEN 5585	3	Spring (A)	Advanced Topics in Reinforced Concrete Design
CVEN 5835	3	Spring (B)	Special Topics in Cable Structures
CVEN 6525	3	Spring (A)	Nonlinear Analysis of Framed Structures
CVEN 6595	3	Spring (A)	Earthquake Engineering

Note:

A = Annual Offering

B = Biennial Offering

MS students are required to take at least two courses (from those listed above) in each of the two areas (Structural Mechanics and Structural Engineering). CVEN 5111, 5161, and 5525 or 5511 are required. Students should consult with their Academic Advisor before selecting courses. Note that since the graduate

program is continually evolving, the actual list of offered courses may differ somewhat from those in this table.

During the student's first semester in residence, he/she must complete the *Graduate Student Academic Advising Sheet*, having it signed by the advisor and co-signed by two other SESM faculty members.