GUIDELINES FOR M.S.E. DEGREE IN CIVIL ENGINEERING: CONCENTRATION IN STRUCTURAL ENGINEERING[1]

Introduction

The ever-increasing world population and growth of urban environments has resulted in an unprecedented number of structures and infrastructure systems being built in regions that are exposed to natural hazards such as earthquakes, hurricanes, wind storms, flooding and fire. The increased risk associated with building in these areas, coupled with society's demand for an enhanced level of performance of the built environment, calls for the development of new multi-disciplinary analysis, design and fabrication approaches for a wide spectrum of structural systems and materials.

Meanwhile, the building revolution of the last century has resulted in a huge inventory of deteriorating structures and infrastructure systems, the continued usability of which must be guaranteed for an economically and environmentally sustainable future. Investment in innovative sensing systems for structural health monitoring and new technologies for the effective retrofitting of existing structures is therefore crucial. The greater awareness of the world's limited resources and the desire for state-of-the-art systems requires new materials to be adopted in the design and construction of structures. This realization is spearheading efforts towards the development of new higher-performing structural systems and materials.

This program has been designed for students planning to pursue careers in structural with a strong background in analysis and design concepts, as well as opportunities for independent research with faculty and interaction with professionals in related disciplines.

General

An applicant for the M.S.E. degree must present the equivalent of an undergraduate in a Civil Engineering program as preparation. Students with undergraduate degrees from other disciplines will be accepted into the M.S.E. degree program, but may need to complete prerequisite courses that supplement their undergraduate course work and provide the necessary foundation for this program (see Appendix A). Students will be informed of these requirements when they are accepted into the degree program.

Coursework

A student pursuing a M.S.E. degree in Structural Engineering must complete at least 30 credit hours of acceptable graduate work. (This usually corresponds to 10 courses.) A thesis is not required. In satisfying the credit hour requirement, the following requirements must be satisfied:

- At least 15 of the credit hours must be in Civil and Environmental Engineering (CEE) courses.
- At least 12 credit hours must correspond to courses within the Structures concentration area. Acceptable courses are listed below. However, no more than 21 credit hours from the courses listed below can be counted toward the M.S.E. degree. Among the 12 credit hours required, at least 3 should be at the 600 level.

CEE 510	Finite Element Methods	CEE 611	Performance –Based Earthquake Engineering
CEE 511	Dynamics of Structures	CEE 616	Passive Control of Structural Systems
CEE 512	Nonlinear Analysis of Structures	CEE 6xx	Structural Fire Engineering
CEE 513	Plastic Analysis and Design of Frames	CEE 6xx	Deployable and Reconfigurable Structures
CEE 514	Prestressed Concrete	CEE 650	Adv. Fiber R/C for Sustainable Infrastructure
CEE 515	Advanced Design of R/C Structures		
CEE 516	Bridge Structures		
CEE 517	Reliability of Structures	CEE 910	Structural Engineering Research
CEE 574	Materials Selection for Sustainable Design		

- In addition to the minimum 12 credit hours of Structures courses, a student must enroll for 1 credit hour of the CEE 812 Structural Engineering Graduate Seminar. Attendance of all structural engineering seminars scheduled during the period of study is mandatory and strict attendance records will be kept.
- A student must satisfactorily complete at least 3 credit hours of cognate courses related to the field of specialization, but offered outside the Civil and Environmental Engineering Department, to increase the intellectual breadth of the graduate education. Courses cross-listed with the Civil and Environmental Engineering Department may satisfy the cognate requirement provided that the course is in a subfield different from the student's own. Cognate courses must be passed with a B- or better (see Rackham's website at: https://rackham.umich.edu/academic-policies/section5/#5-3 for more information). The list of courses on page 3 can be used as a guide to satisfy the cognate course requirement. Courses other than those listed should be approved by the student's academic advisor in advance.
- The student must complete at least one course (minimum of 3 credit hours) in mathematics or math intensive studies, probability, statistics, or mathematical programming, beyond the minimum undergraduate requirements of the Civil and Environmental Engineering Department of The University of Michigan. A course used to satisfy this math requirement also can be used toward the 3 credit hour cognate requirement provided that it is taken outside the Civil and Environmental Engineering Department or is cross-listed with another department and is outside the student's subfield of study. Approved courses within the department (see dept. guidelines) can be used to satisfy the math requirement.
- No more than 6 credit hours of directed studies, seminars or research can be counted toward the 30-credit requirement. This covers credit hours received for CEE 910 and CEE 950.

[1] For additional information on M.S.E. degree requirements, see the Rackham Graduate School's website for current students at: https://rackham.umich.edu/current-students/ and the CEE Department Guidelines found on the CEE website at: https://cee.engin.umich.edu/academics/graduate/masters/.

- No more than 12 credit hours at the 400 level are acceptable. Of these 12 hours, a maximum of 9 hours can be in CEE courses. CEE 412, 413 and 415 may be approved for graduate credit in advance by the M.S.E. graduate advisor in structural engineering provided a similar course was not taken during the student's undergraduate degree. Students receiving graduate credit for any of these courses must take at least 3 structural engineering courses at the 500 or 600 level.
- A student who has not taken Matrix Structural Analysis (CEE 412) or an equivalent course during their undergraduate studies, is required to take the class as part of their M.S.E. degree.
- SUGS students are permitted to double count up to 6 credit hours, including CEE 413 and 415. However, students who double count 413 and 415 must take at least 3 structural engineering courses at the 500 or 600 level.
- A maximum of 6 graduate level semester hours (with a grade of B or better) can be transferred from other institutions approved by Rackham.

Grades

The grading system used for graduate studies is based on the following 4-point scale:

A+ = 4.3; A = 4; A- = 3.7; B+ = 3.3; B = 3.0; B- = 2.7; C+ = 2.3; C = 2; C-=1.7

A minimum cumulative graduate grade point average (GPA) of 3 on this 4-point scale is required for all graduate courses taken for credit and applied toward the Master's Degree.

Diploma

To be considered for a master's degree diploma, a student must submit a formal application to the Office of Graduate Academic Records of the Graduate School. The deadline for the Graduate School to receive the degree application form is four weeks after the first day of classes in a full term and one week after the first day of classes in a half term. These dates can usually be found on the Rackham Graduate School web site (http://www.rackham.umich.edu/).

Acceptable Cognate Courses for M.S.E. in Structural Engineering

Shown below is a partial list of courses that can be used to satisfy the advanced math course requirement for the CEE Department's M.S.E. degrees. In general, the math course should have a prerequisite of Math 215 or equivalent.

Math 404	Intermediate Differential Equations
Math 412	Introduction to Modern Algebra
Math 416	Theory of Algorithms
Math 417	Matrix Algebra I
Math 419	Linear Spaces and Matrix Theory
Math 433	Intro. to Differential Geometry
Math 450	Adv. Math for Engineers I
Math 451	Adv. Calculus I
Math 454	Boundary Value Prob. for PDE
Math 462	Mathematical Models
Math 471	Intro. to Numerical Methods
Math 5XX	Any 500 level math course

BioStat 553	Applied Biostatistics
IOE 510	Linear Programming
CEE 517	Reliability of Structures
CEE 553	Infrastructure Systems Optimization
CEE 571	Linear System Theory
CEE 572	Dynamic Infrastructure Systems
CEE 573	Data Analysis in CEE

Shown below is a partial list of courses that may be used to satisfy the cognate course requirement for the CEE Department's M.S.E. degrees.

ME 400	Mechanical Engineering Analysis
ME 401	Statistical Quality Control and Design
ME 412	Advanced Strength of Materials
ME 515	Contact Mechanics
ME 501	Analytical Methods in Mechanics
ME 502	Methods of Diff. Eqns. In Mechanics
ME 511	Theory of Solid Continua
ME 519	Theory of Plasticity I
ME 543	Analytical and Comp. Dynamics I
ME 555	Design Optimization
ME 558	Discrete Design Optimization
ME 563	Time Series Modeling
ME 564	Linear Systems Theory
ME 605	Adv. Finite Element Methods in Mech.
ME 619	Theory of Plasticity II

Aero 416	Plates and Shells
Aero 513	Solid and Structural Mechanics I
Aero 514	Solid and Structural Mechanics II
Aero 516	Mechanics of Composites
Aero 518	Theory of Elastic Stability I
Aero 565	Optimal Structural Design
Aero 611	Advanced Finite Elements
MSE 514	Composite Materials
ARCH 524	Surface Structures
ARCH 544	Wood Structures
ARCH 571	Digital Fabrication

There are many other courses in engineering, math, science, and architecture/urban planning that may satisfy the requirements for the cognate course. (A cognate course must be at the 400 level or higher, must be related to the field of specialization, and must be listed in the Rackham Program of Study website at: https://rackham.umich.edu/programs-of-study. Cognate courses must be passed with a B- or better to count towards the degree.) Such courses must be approved for cognate credit in advance by the student's academic advisor. Courses outside of engineering, math, science, and architecture/urban planning are generally not acceptable as cognate courses. Except as listed above, generally 400 level courses are not acceptable.

Examples of courses accepted in the past: UP 538, UP 594, UP 565

Checklist

The checklist below can be used to monitor your progress toward your M.S.E. degree.

Student Name:_____

	Requirement Description	Course Number	Adv. Math √	Course Description	Credits	Transfer √
1	Cognate					
2	CEE (Concentration Area)					
3	CEE (Concentration Area)					
4	CEE (Concentration Area)					
5	CEE (Concentration Area) 600 level					
6	CEE					
7	Open Choice*					
8	Open Choice*					
9	Open Choice*					
10	Open Choice*					
11	CEE 812 (Graduate seminar)					
	Extra					
	Extra					

*No more than 21 credits can be taken from the Structures concentration area (see list on page 1)

Advisor Approval: _____ Date:_____

Appendix A: Undergraduate Requirements for the M.S.E. (Structural Engineering) Degree Program

Students entering the M.S.E. degree program in Structural Engineering with an undergraduate degree in Civil Engineering, or Civil and Environmental Engineering, will be accepted directly into the degree program. For students entering this program with some other undergraduate degree, there may be some prerequisite courses that need to be completed before formal admission into the program. Students must have completed three semesters of calculus and two semesters of physics. They should also have completed courses in statics, dynamics and solid mechanics. In addition, three core civil engineering courses are required but can be taken after the student enrolls in the M.S.E. degree program. Those courses are:

- Structural Engineering: CEE 312[1]
- Civil Engineering Breadth[1]: Either CEE 331 (Construction Management) or CEE 351 (Civil Engineering Materials) or CEE 345 (Geotechnical Engineering)
- Structural Design [2] : Either CEE 413 (Design of Metal Structures) or CEE 415 (Design of Concrete Structures)

[1] These courses may not be used for credit towards the M.S.E. degree, and students should consider their minor area of emphasis when selecting between breadth courses.

[2] Students should consider taking both of these courses, although only one course is required to meet this prerequisite requirement.