

GUIDELINES FOR M.S.E. DEGREE IN CIVIL ENGINEERING: CONCENTRATION IN TRANSPORTATION SYSTEMS ENGINEERING

Introduction

Transportation is integral to the prosperity of our society. However, there are ongoing issues with the existing transportation system: high fatality and injury rates, growing levels of congestion and pollution, rising transportation costs, and inefficient use of resources. Driven by the rapid development of information and vehicular technologies, we are on the cusp of a revolution in transportation on a scale not seen since the introduction of automobiles. For instance, smart mobile devices retrieve users' geolocations, enable ubiquitous communications, and allow instant peer-to-peer interactions, giving rise to various on-demand mobility services for goods and people such as ridesourcing and ridesharing, as well as crowd-sourced urban delivery. Connected and automated vehicle (CAV) technologies will further revolutionize urban and rural mobility and support a range of uses, from sole vehicle ownership to shared ownership, ridership, and subscription services. These technologies hold the potential to substantially improve traffic safety, facilitate mobility, and reduce traffic congestion, fuel consumption, and emissions.

These emerging technologies present both opportunities and challenges. On-demand mobility services enrich mobility options for people and goods and play an increasingly important role in meeting urban and rural mobility needs. At the same time, these new services come with important security and political challenges that must be addressed through innovative policy strategies at Local, State, and Federal levels. While CAV technologies will continue to advance towards incorporation into our transportation systems, policy, planning, and operations strategies are key to successfully bringing these technologies to market.

The Next Generation Transportation Systems (NGTS) program at the University of Michigan (UM) aims to address research questions related to the implication of emerging technologies on the planning, design, operations and management of transportation systems. In addition to developing and pioneering technical research related to the next generation of transportation systems, NGTS seeks to educate and train the next generation of transportation leaders.

General

Students holding B.S. degrees in an engineering discipline, or a physical or social science, may be admitted if they have achieved the technical background necessary to pursue advanced work in the NGTS program.

This background includes one year of college-level calculus, one year of college-level physical science, one semester engineering-level probability and statistics and one semester computer programming. More specifically, it is expected that applicants will have successfully completed the following courses in their undergraduate preparation prior to applying:

- Physics 140 (mechanics) and 240 (electricity and magnetism) or equivalents
- Mathematics 215 (multivariable calculus) and 216 (differential equations) or equivalents
- CEE 373 (probability and statistical methods) or equivalent
- CEE 303 (computational methods) or equivalent

If an admitted applicant has not completed these courses, then some additional undergraduate coursework may be required to be completed (without credit) to complete the M.S.E. degree in Civil Engineering with a concentration in NGTS. In such situations, the specific additional courses to be completed will be determined by the Masters Advisor for the NGTS specialization

Coursework

A student pursuing an M.S.E. degree in Civil Engineering with a concentration in transportation systems engineering must complete at least 30 credit hours of acceptable graduate work. A thesis is not required for the M.S.E. degree. In satisfying the credit hour requirement, the following requirements must be satisfied:

- To be defined as proficient in the transportation systems engineering, a student must elect the following three core courses to constitute the transportation systems engineering core:
 - CEE551: Traffic Science (Fall every year)
 - CEE553: Infrastructure Systems Optimization (Fall every year)
 - CEE554: Data Mining in Transportation (Winter every year)

- The student is required to elect two more courses from the following “core plus” set of courses to further their foundation in the planning and operations of transportation systems:
 - CEE552: Travel Behavior Analysis and Forecasting (Winter every other year)
 - CEE556: Economics of Transportation Systems (Winter every other year)
 - CEE557: Large-scale Transportation Systems Optimization (Fall every other year)
 - CEE558: Urban Traffic Operations (Winter every other year)
 - CEE559: Transportation Network Modeling (Winter every other year)
 - CEE547: Soil Engineering and Pavement Systems (Winter every other year)
 - CEE577: Dynamics and Control of Connected Vehicles (Winter every year)
 - URP560: Transportation and Land Use Planning (Winter every year)
 - URP561: Public Policy and Transportation (Fall every year)
- The student is required to elect two more courses from the following recommended electives to broaden their knowledge on systems engineering/theory. A (third) “core plus” course can be used to satisfy this elective course requirement.
 - CEE571: Linear System Theory
 - CEE572: Dynamics of Infrastructure Systems
 - CEE575: Sensing for Civil Infrastructure Systems
 - CEE576: Stochastic Systems
 - EECS460: Control Systems Analysis and Design
 - AEROSP740: Air Transportation Systems
- The student is required to discuss the plan of study with his or her advisor.
- At least 18 of the credit hours must be in Civil and Environmental Engineering (CEE) courses.
- In congruence with the CEE Department Cognate Course Requirement, the 30 hours of graduate work must include at least 3 credit hours of cognate courses related to the field of specialization to increase the intellectual breadth of the graduate education. Courses in 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. At least one course used to fulfill the cognate requirement must be at minimum 2 credit hours and, at most, 1 credit hour of a seminar course offered in a different subfield can be used toward meeting the cognate requirement. Courses from other departments in the College of Engineering, Taubman College of Architecture and Urban Planning, Departments of Economics, Mathematics and Statistics are acceptable for filling the cognate requirement. Courses from departments other than the above need to be approved by the student’s graduate advisor.
- No more than 12 credit hours at the 400 level are acceptable. Refer to Rackham’s policy at: <https://rackham.umich.edu/policy/section3/>. These courses can be found by the graduate program name on Rackham’s Programs of Study website at: <https://rackham.umich.edu/programs-of-study>. Of these 12 hours, a maximum of 9 hours can be in CEE courses.
- Up to 6 credit hours of independent study in transportation systems (CEE970) may be applied towards the degree.
- Up to 2 credit hours of NGTS seminar class (CEE510-850) may be applied towards the degree.
- No more than six credit hours of independent study, seminar and research will be accepted for graduate credit
- SUGS students with undergraduate specialization in any area of CEE may pursue an M.S.E. degree in Civil Engineering with a concentration in NGTS. SUGS students are permitted to double count up to 6 credit hours.
- A maximum of 6 graduate level semester hours (with a grade of B or better) can be transferred from other institutions approved by Rackham.
- The following worksheet provides students with guidance on courses pertinent to the concentration in transportation systems engineering

Grades

The grading system used for graduate studies is based on the following 9.0 grade point system to a 4.3 system, with a maximum term and cumulative GPA of 4.0.

A+ = 4.3; A = 4.0; A- = 3.7; B+ = 3.3; B = 3; B- = 2.7; C+ = 2.3; C = 2; C- = 1.7; D+ = 1.3; D = 1; D- = 0.7

A minimum cumulative graduate grade point average (GPA) of 3 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 website (<http://www.rackham.umich.edu/>).

Additional Information:

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](https://cee.engin.umich.edu/academics/graduate/masters/) at: <https://cee.engin.umich.edu/academics/graduate/masters/>.

Concentration in Transportation Systems Engineering WORKSHEET

STUDENT'S FULL NAME: _____

STEP 1: Core Courses:

Course	Term Taken	CEE Credits	Non-CEE Credits*
CEE551: Traffic Science			
CEE553: Infrastructure Systems Optimization			
CEE554: Data Mining in Transportation			
TOTAL			

STEP 2: Core Plus Courses:

Please select courses taken or to be taken (select 2).

Course	Term Taken	CEE Credits	Non-CEE Credits*
CEE552: Travel Behavior Analysis and Forecasting			
CEE556: Economics of Transportation Systems			
CEE557: Large-scale Transportation Systems Optimization			
CEE558: Urban Traffic Operations			
CEE559: Transportation Network Modeling			
CEE547 Soil Engineering and Pavement Systems			
CEE577: Dynamics and Control of Connected Vehicles			
URP560: Transportation and Land Use Planning			
URP561: Public Policy and Transportation			
TOTAL			

STEP 3: Recommended Elective Courses:

Please select courses taken or to be taken (select 2).

Course	Term Taken	CEE Credits	Non-CEE Credits*
CEE571: Linear System Theory			
CEE572: Dynamic Infrastructure Systems			
CEE575: Sensing for Civil Infrastructure Systems			
CEE576: Stochastic Systems			
EECS460: Control Systems Analysis and Design			
AEROSP740: Air Transportation Systems			
TOTAL			

STEP 4: Other Courses:

Please identify other courses taken. Directed studies, seminar or independent research credits are not acceptable to satisfy course requirements.

Course	400-Level (Yes/No)	Term Taken	CEE Credits	Non-CEE Credits*

TOTAL

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STEP 5: Cognate Requirements:

Check to ensure you met the cognate requirement:

Course	

STEP 6: Program Requirements:

Check to ensure all other program requirements have been met.

Requirement	Credits	Limit
Total Number of Credits Taken		≥ 30
Number of CEE Credits Taken		≥ 18
Total Number of 400-Level Credits		≤ 12
Total Number of 400-Level Credits in CEE		≤ 9
Total Number of Independent Study Credits		≤ 6

ADVISOR'S SIGNATURE: _____ **DATE:** _____