

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

An applicant for the M.S.E. degree must present the equivalent of an undergraduate civil engineering program as preparation. If the applicant's undergraduate degree is not in civil engineering, then some undergraduate prerequisite courses may be required. See the CEE Department Guidelines for additional information.

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 at least three out of the following four core courses to constitute the transportation systems engineering core (*all CCE55? course numbers are to be finalized):
 - CEE551: Traffic Science
 - CEE552: Infrastructure Systems Optimization
 - CEE553: Travel Behavior Analysis and Forecasting
 - CEE554: Data Mining in Transportation
- 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:
 - CEE556: Economics of Transportation Systems
 - CEE557: Large-scale Transportation Systems Optimization
 - CEE558: Urban Traffic Operations
 - CEE559: Transportation Network Modeling
 - URP560: Transportation and Land Use Planning
- The student is required to elect two more courses from the following recommended electives to broaden their knowledge on systems engineering/theory:
 - CEE571: Linear System Theory

- CEE572: Dynamics of Infrastructure Systems
 - CEE575: Sensing for Civil Infrastructure Systems
 - CEE576: Stochastic Systems
 - EECS460: Control Systems Analysis and Design
- At least 18 of the credit hours must be in Civil and Environmental Engineering (CEE) courses.
 - A student must satisfactorily complete at least one course (cognate course) with a minimum of 4 credit hours in a department other than Civil and Environmental Engineering. Courses cross-listed with CEE courses do not qualify as cognates. A core plus course is suitable for use to satisfy this 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 listed in the bulletin of the Rackham School of Graduate Studies are acceptable. 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 (CCE970) may be applied towards the degree.
 - 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.
 - Table 1 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 web site (<http://www.rackham.umich.edu/>).

Additional Information:

For additional information on M.S.E. degree requirements, see the *Graduate Student Handbook* (prepared by the Horace H. Rackham School of Graduate Studies) and the CEE Department Guidelines. The *Graduate Student Handbook* is available on the World Wide Web at <http://www.rackham.umich.edu/>.

Concentration in Transportation Systems Engineering: WORKSHEET

STEP 1: Core NGTS Courses:

Please select courses taken or to be taken (select 3).

Core Course	Term Taken	CEE Credits	Non-CEE Credits*
CEE551: Traffic Science			
CEE552: Infrastructure Systems Optimization			
CEE552: Travel Behavior Analysis and Forecasting			
CEE554: Data Mining in Transportation			
TOTAL			

STEP 2: Core Plus NGTS Courses:

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

Core Course	Term Taken	CEE Credits	Non-CEE Credits*
CEE556: Economics of Transportation Systems			
CEE557: Large-scale Transportation Systems Optimization			
CEE558: Urban Traffic Operations			
CEE559: Transportation Network Modeling			
UP572: Transportation and Land Use Planning			
TOTAL			

STEP 3: Recommended Elective Courses:

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

Core 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			
TOTAL			

STEP 4: Other Courses:

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

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

STEP 6: Cognate Requirements:

Check to ensure you met the cognate requirement:

Cognate Course	

STEP 7: 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