Request for Graduate Addition, Deletion, or Change of a Major or Degree

NOTE: Before you submit a request for a new Major or Degree, you must submit an INTENT TO PLAN form. Only after the INTENT TO PLAN goes through the approval process are you ready to submit this request for a new Major or Degree. For detailed information on new programs please see: http://wvhepcdoc.wvnet.edu/resources/133-11.pdf.

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one PDF copy without signatures to the Graduate Council Chair.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE

Dept/Division: Engineering

Contact Person: Dr. Eldon R. Larsen

Phone: 6-2047

Degree Program: M.S.E. (Master of Science in Engineering

Check action requested: ☐ Addition ☐ Deletion ☒ Change

Effective Term/Year: Fall 20 15 Spring 20 ☐ Summer 20 ☐

Information on the following pages must be completed before signatures are obtained.

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head	Date
College Curriculum Chair	Date
College Dean	Date
Graduate Council Chair	Date
Provost/VP Academic Affairs	Date
Presidential Approval	Date
Board of Governors Approval	Date

Request for Graduate Addition, Deletion, or Change of a Major or Degree-Page 2

Please provide a rationale for addition, deletion, change: (May attach separate page if needed)

We have several purposes in these revisions:
(1) To allow three options for each of the majors (Engineering Management; Environmental Engineering; and Transportation and Infrastructure Engineering): (a) Coursework-only option; (b) Coursework-plus-comprehensive-project option; and (c) Thesis option.
(2) To allow more flexibility to meet the needs of the graduate engineering students, which also aids in recruiting and retention.
(3) To strengthen the curriculum as needed for the majors.
(4) To revise and clarify admissions language to be more consistent with practice.

Please describe any changes in curriculum:
List course number, title, credit hours. Note whether each course is required or optional. Enter NONE if no change. (May attach separate page if needed)

1. The following changes are made for all three M.S.E. majors: Comprehensive Project option--remains at 30 credit hours; new Thesis option--30 credit hours; and new Coursework-only option--33 credit hours. See attached documents for details.

2. The curriculum is slightly changed for the Environmental Engineering major: (a) dividing the curriculum into six categories to be covered by each student; (b) adding courses ENVE 671 and ENVE 672; (c) change ENVE 616 to "Wastewater Treatment Facility Design," and (d) change ENVE 617 to "Water Treatment Facility Design." Required foundation courses or their equivalents have also been added.

3. For the Transportation Engineering major: Required foundation courses or their equivalents have been added.

1. ADDITIONAL RESOURCE REQUIREMENTS: If your program requires additional faculty, equipment or specialized materials to ADD or CHANGE this major or degree, attach an estimate of the time and money required to secure these items.
NOTE: Approval of this form does not imply approval for additional resources. Enter NONE if not applicable.

No new resources are required at this time. If the enrollment in the majors grows significantly over the coming years, then more resources could be needed in the future.

2. NON-DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the request and any response received from them. Enter NONE if not applicable.

No duplication.

For catalog changes as a result of the above actions, please fill in the following pages.

Request for Graduate Addition, Deletion, or Change of a Major or Degree-Page 3

3. *Current* Catalog Description

Insert the *Current* Catalog Description and page number from the latest catalog for entries you would like to change. (May attach separate page if needed)

See attached document.

4. *Edits* to the Current Description

Attach a PDF copy of the current catalog description prepared in MS WORD with strikethroughs to mark proposed deletions and use the highlight function to indicate proposed new text.

Request for Graduate Addition, Deletion, or Change of a Major or Degree-Page 4

5. *New* Catalog Description

Insert a 'clean' copy of your proposed description, i.e., no strikethroughs or highlighting included. This should be what you are proposing for the new description. (May attach separate page if needed)

See attached document.

Request for Graduate Addition, Deletion, or Change of a Major or Degree-Page 5

Please insert in the text box below your change summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Major or Degree:
Type of Change: *(addition, deletion, change)*
Rationale:

College: CITE

Department: Engineering

Major or Degree: M.S.E. Degree Program, with majors in (1) Engineering Management, (2) Environmental Engineering, and (3) Transportation and Infrastructure Engineering

Type of Change: Change

Rationale: We have several purposes in these revisions:
(1) To allow three options for each of the majors (Engineering Management; Environmental Engineering; and Transportation and Infrastructure Engineering): (a) Coursework-only option; (b) Coursework-plus-comprehensive-project option; and (c) Thesis option.
(2) To allow more flexibility to meet the needs of the graduate engineering students, which also aids in recruiting and retention.
(3) To strengthen the curriculum as needed for the majors.
(4) To revise and clarify admissions language to be more consistent with practice.

ENGINEERING, M.S.

Majors:

Engineering Management
Environmental Engineering
Transportation and Infrastructure Engineering.

Program Description

The M.S. in Engineering (M.S.E.) program is an interdisciplinary engineering program designed to meet the specific needs of engineers employed in industry, government, and consulting, as well as those desiring a traditional research-based graduate degree. The program offers a broad core curriculum with opportunities for concentrated study in three majors: Engineering Management, Environmental Engineering, and Transportation and Infrastructure Engineering.

Admission Requirements

Applicants should follow the admissions process described in this catalog or at the Graduate Admissions website: http://www.marshall.edu/graduate/admissionsrequirements.asp. Each applicant for admission to the M.S. in Engineering degree program must have an undergraduate engineering degree from either an accredited ABET curriculum or an internationally recognized program and meet *one* of the following (A, B, or C) admission requirement options:

Deleted: an ABET-accredited college or university

A. Pass the PE exam, or

B. Have an undergraduate cumulative GPA of 3.00 or greater, or

C. Have an undergraduate cumulative GPA of 2.50 or greater, and satisfy at least two of the following:
(1) Pass the FE exam,
(2) verbal GRE score at least 145,
(3) quantitative GRE score at least 150, and/or
(4) analytical writing GRE score at least 3.0.

Additionally, to be considered for admission, international students must have an iBT TOEFL score of at least 85, or a Paper-Based TOEFL score of at least 527.

Students who do not meet admission requirement options A, B, or C are welcome to apply, and their applications will be considered for admission on a case by case basis. The program admission recommendation will be decided by the M.S.E. degree program coordinator based on a combination of GRE scores and level of performance in undergraduate engineering coursework.

Applicants who do not meet the above criteria but have an undergraduate engineering degree are welcome to apply as non-degree seeking students and take courses toward their M.S.E. degree. If the student has a minimum cumulative graduate GPA of 3.30 in his or her first 9 credit hours of

Deleted: up to 2.99, and have at least two of the following: (1) Pass the FE, (2) verbal GRE score at least 151, (3) quantitative GRE score at least 150, and (4) analytical writing GRE score at least 4.0. Alternatively, an applicant who has an undergraduate engineering degree from an ABET-accredited college or university and has an undergraduate GPA less than 3.00 may be considered for Provisional Admission without taking the GRE. To be removed from Provisional Admission, the student must have a minimum cumulative graduate GPA of at least 3.30 at the end of his or her first 9 credit hours of CITE M.S.E. degree courses—if this provisional requirement is not met, the student will be dropped from the program.¶

CITE M.S.E. courses, that student may re-apply to the university to be considered for admission to the M.S.E. degree program.

Eligibility to take the PE exam is based primarily on completion of an ABET accredited undergraduate engineering degree in most states. Completion of a M.S.E. graduate degree at an institution with an ABET-accredited undergraduate degree does not fulfill that requirement to take the PE exam.

Degree Requirements

Each degree candidate is required to complete at least 30-33 graduate credit hours, depending on the "option" chosen below (project, thesis, or coursework only), with a cumulative Grade Point Average of 3.0 for the courses included in the student's Plan of Study. At least one-half of the minimum required hours for the degree must be earned in classes numbered 600 or above.

Each degree-seeking student must file an approved "Plan of Study," developed with a faculty advisor, before the student registers for the 12th credit hour. The Academic Regulations portion of the Graduate Catalog may be consulted for additional information.

A student may only earn the M.S.E. degree once. Therefore, students wishing to complete two of three M.S.E. majors (i.e., double major) must complete all requirements for both majors before the degree is awarded. A maximum of 12 credit hours may be counted toward both majors, as approved by the student's academic advisor in each major. An option must be selected for each major and the two options are permitted to be different. However, each major must have its own comprehensive assessment (e.g., comprehensive project, thesis, comprehensive examination). For example, a single thesis and defense cannot satisfy the requirements for both majors.

Students may choose to complete either the "project option," the "thesis option," or the "coursework only option" after consultation with their academic advisor.

Project Option. The comprehensive project involves the application of coursework completed as part of the degree to a practical problem. Students will work with their advisor to identify an appropriate project and scope. Students must prepare a formal written report and deliver an oral presentation to a committee. Students register for ENGR 699 Comprehensive Project (3 HR) during the semester in which their project will be completed and presented, but preliminary work on the project may commence before that semester.

Thesis Option. The thesis option involves the completion of 6 HR of research (ENGR 681) under the direction of an advisor on an approved project. Students must summarize their work in the form of a formal, written document and successfully defend the thesis before a committee. Thesis work is typically conducted over two semesters.

Coursework Only Option. Students can complete 33 hours of coursework and then complete a comprehensive examination within the last two semesters of graduation to fulfill the requirements of their degree. Examinations will be administered once per semester for all students.

MAJOR: Engineering Management

Deleted: Applicants who do not meet the above criteria but who do have an undergraduate engineering degree are welcome to apply as non-degree seeking students and take CITE M.S.E. degree classes. If a non-degree seeking student has at least a minimum cumulative graduate GPA of 3.30 in his or her first 9 credit hours of CITE M.S.E. courses, and has an undergraduate engineering degree, that student may re-apply to the university to be considered for admission to the M.S.E. degree program. ¶
Foreign students who have an undergraduate engineering degree, but not from an ABET-accredited college or university, and who have an undergraduate GPA equivalent to at least a 2.75, can be considered for admission only on a case by case basis, and the program admission recommendation will be up to the judgment and decision of the program coordinator for the M.S.E. degree program, while taking into consideration the other requirements stated above as well as individual high achievement of the applicant. ¶
Also, all international students must have an iBT TOEFL score of at least 85, or a Paper-Based TOEFL score of at least 527, prior to registering for the first semester of courses.¶
All students, foreign or domestic, who are admitted without an engineering degree from an ABET-accredited engineering degree program must realize that they will likely not qualify to take the FE exam or the PE exam, even if they earn the M.S.E. degree.¶

Deleted: Each degree candidate is required to complete at least 30 graduate credit hours, consisting of 24 credit hours of required courses and 6 credit hours of electives approved by the student's advisor, with a cumulative Grade Point Average of 3.0 for the courses included in the student's Plan of Study. Each degree-seeking student must have an approved "Plan of Study," developed with a faculty advisor, that must be filed before the student registers for the 12th credit hour. Please consult the Academic Regulations portion of the Graduate Catalog for other information. The Master of Science in Engineering program culminates with the comprehensive graduate project. This project is not the traditional graduate thesis with a research orientation, but rather a real-life, industry-type project in which the student undertakes an assignment that requires synthesis of all of the coursework and its application to a typical problem from a relevant subject area.¶
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Page Break
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Project Option. (30 hours)

Required courses

EM	620	Management of Technical Human Resources and Organizations	3 hrs
EM	660	Project Management	3 hrs
EM	668	Operations Management	3 hrs
EM	670	Seminar in Engineering Management	3 hrs
EM	675	Engineering Economics (or TM equivalent)	3 hrs
EM	694	Engineering Law	3 hrs
ENGR	610	Applied Statistics	3 hrs
TE	699	Comprehensive Project	3 hrs

Elective courses (see approved Engineering Management electives below) 6 hrs

Thesis Option. (30 hours)

Required courses

EM	620	Management of Technical Human Resources and Organizations	3 hrs
EM	660	Project Management	3 hrs
EM	668	Operations Management	3 hrs
EM	670	Seminar in Engineering Management	3 hrs
EM	675	Engineering Economics (or TM equivalent)	3 hrs
EM	694	Engineering Law	3 hrs
ENGR	610	Applied Statistics	3 hrs
ENGR	681	Engineering Research	6 hrs

Elective course (see approved Engineering Management electives below) 3 hrs

Coursework Only Option. (33 hours)

Required courses

EM	620	Management of Technical Human Resources and Organizations	3 hrs
EM	660	Project Management	3 hrs
EM	668	Operations Management	3 hrs
EM	670	Seminar in Engineering Management	3 hrs
EM	675	Engineering Economics (or TM equivalent)	3 hrs
EM	694	Engineering Law	3 hrs
ENGR	610	Applied Statistics	3 hrs

Elective courses (see approved Engineering Management electives below) 12 hrs

Approved Elective Courses for the Engineering Management Major

Any EM (Engineering Management) course.

Any TM (Technology Management) course.

Any College of Business course approved in advance by the advisor.
Any engineering course approved in advance by the advisor.

MAJOR: Environmental Engineering

All Environmental Engineering majors must have completed the Foundation Courses listed below (and their associated prerequisites), or their equivalents as approved by their advisor before being fully admitted. Until this requirement is satisfied, the student can only receive Provisional admission to the program. All other admission requirements must still be satisfied.

Foundation Courses:

ENGR 318 Fluid Mechanics
CE 331 Hydraulic Engineering
CE 432 Water/Wastewater Treatment

Project Option. (30 hours)

Required courses
- One of: ENGR 610, ENGR 620, or ME 601 ..... 3 hrs
- ENVE 615 Environmental Chemistry ..... 3 hrs
- ENGR 699 Comprehensive Project ..... 3 hrs

Three courses – one per category – from among the following six categories ..... 9 hrs
- (1) Engineering Management: EM 660
- (2) Water/Wastewater: ENVE 616 or ENVE 617
- (3) Solid/Hazardous Waste: ENVE 620 or ENVE 625
- (4) Air Pollution: ENVE 611, ENVE 612, ENVE 680, or ES 604
- (5) Hydraulics/Hydrology: ENVE 670, ENVE 671, or ENVE 672
- (6) Env. Remediation/Risk/Mgmt: ENVE 682, ES 514, ES 620

Elective courses (see approved Environmental Engineering electives below) ..... 12 hrs

Thesis Option. (30 hours)

Required courses
- One of: ENGR 610, ENGR 620, or ME 601 ..... 3 hrs
- ENVE 615 Environmental Chemistry ..... 3 hrs
- ENGR 681 Engineering Research ..... 6 hrs

Three courses – one per category – from among the following six categories ..... 9 hrs
- (1) Engineering Management: EM 660
- (2) Water/Wastewater: ENVE 616 or ENVE 617
- (3) Solid/Hazardous Waste: ENVE 620 or ENVE 625
- (4) Air Pollution: ENVE 611, ENVE 612, ENVE 680, or ES 604
- (5) Hydraulics/Hydrology: ENVE 670, ENVE 671, or ENVE 672
- (6) Env. Remediation/Risk/Mgmt: ENVE 682, ES 514, ES 620

Elective courses (see approved Environmental Engineering electives below)

Coursework Only Option. (33 hours)

Required courses
- One of: ENGR 610, ENGR 620, or ME 601 ..... 3 hrs
- ENVE 615 Environmental Chemistry ..... 3 hrs

Three courses – one per category – from among the following six categories ..... 9 hrs
- (1) Engineering Management: EM 660
- (2) Water/Wastewater: ENVE 616 or ENVE 617
- (3) Solid/Hazardous Waste: ENVE 620 or ENVE 625
- (4) Air Pollution: ENVE 611, ENVE 612, ENVE 680, or ES 604
- (5) Hydraulics/Hydrology: ENVE 670, ENVE 671, or ENVE 672
- (6) Env. Remediation/Risk/Mgmt: ENVE 682, ES 514, ES 620

Elective courses (see approved Environmental Engineering electives below) ..... 18 hrs

Approved Elective Courses for the Environmental Engineering Major
- Any ENVE course.
- Any course listed above not already taken.
- ES 550 Environmental Law
- ES 630 Environmental Site Assessment
- ES 640 Groundwater Principles and Monitoring
- Other courses approved in advance by the student's advisor.

MAJOR: Transportation and Infrastructure Engineering

All Transportation and Infrastructure Engineering majors must have completed the Foundation Courses listed below (and their associated prerequisites), or their equivalents as approved by their advisor before being fully admitted. Until this requirement is satisfied, the student can only receive Provisional admission. All other admission requirements must still be satisfied.

Foundation Courses:

CE 312 Structural Analysis
CE 342 Transportation Engineering
CE 413 Reinforced Concrete or CE 414 Steel Design

Students pursuing the Project Option and the Thesis Option must choose either Transportation Engineering or Structural Engineering as their primary focus. The other discipline will be the secondary focus. Three courses must be completed in the primary focus and two courses in the secondary focus for the Project and Thesis Option. The Coursework Only Option requires three courses in both disciplines.

Project Option. (30 hours)

ENGR 610 Applied Statistics or other Advisor Approved MTH course ..... 3 hrs

Three (3) Courses in Primary Focus (Structural Engr or Transportation Engr) ..... 9 hrs
Two (2) Courses in Secondary Focus (Structural Engr or Transportation Engr) ..... 6 hrs
Three (3) Elective Courses ..... 9 hrs
ENGR 699 Comprehensive Project ..... 3 hrs

Thesis Option. (30 hours)

ENGR 610 Applied Statistics or other Advisor Approved MTH course ..... 3 hrs
Three (3) Courses in Primary Focus (Structural Engr or Transportation Engr) ..... 9 hrs
Two (2) Courses in Secondary Focus (Structural Engr or Transportation Engr) ..... 6 hrs
Two (2) Elective Courses ..... 6 hrs
ENGR 681 Engineering Research ..... 6 hrs

Coursework Only Option. (33 hours)

ENGR 610 Applied Statistics or other Advisor Approved MTH course ..... 3 hrs
EM 660 Engineering Management ..... 3 hrs
Three (3) Courses in Structural Engineering ..... 9 hrs
Three (3) Courses in Transportation Engineering ..... 9 hrs
Three (3) Elective Courses ..... 9 hrs

Structural Engineering Courses

CE 612 – Structural Steel Design and Behavior (3 hrs)
CE 614 – Advanced Reinforced Concrete Structure Design and Behavior (3 hrs)
CE 615 – Finite Element Applications in Civil Engineering (3 hrs)
CE 616 – Pre-stressed Concrete Design (3 hrs)
CE 618 – Bridge Engineering (3 hrs)

Transportation Engineering Courses

CE 534 – Geometric Design of Highways (3 hrs)
CE 538 – Pavement Design (3 hrs)
CE 634 – Traffic Engineering (3 hrs)
CE 635 – Evaluation of Transportation Systems (3 hrs)
CE 636 – Transportation Planning (3 hrs)
CE 637 – Highway Safety Engineering (3 hrs)

Approved Elective Courses for the Transportation and Infrastructure Engineering Major

Any Transportation Engineering or Structural Engineering course not already taken.
Any ENVE (Environmental Engineering) course approved in advance by the student's advisor.
Any EM (Engineering Management) course approved in advance by the student's advisor.
Other courses approved in advance by the student's advisor.

Deleted: MAJOR: Engineering Management¶
Required courses¶
EM 620 Management of Technical Human Resources and Organizations 3 hrs¶
EM 660 Project Management 3 hrs¶
EM 668 Operations Management 3 hrs¶
EM 670 Seminar in Engineering Management 3 hrs¶
EM 675 Engineering Economics (or TM equivalent) 3 hrs¶
EM 694 Engineering Law 3 hrs¶
ENGR 610 Applied Statistics 3 hrs¶
TE 699 Comprehensive Project 3 hrs¶
¶
Elective courses¶
Two (2) elective courses approved in advance by the student's advisor 6 hrs¶
¶
MAJOR: Environmental Engineering¶
Required courses¶
EM 660 Project Management 3 hrs¶
ENVE 615 Environmental Chemistry 3 hrs¶
ENVE 681 Environmental Engineering Design 3 hrs¶
ES 514 Environmental Risk Assessment 3 hrs¶
ES 550 Environmental Law 3 hrs¶
TE 699 Comprehensive Project 3 hrs¶
ENGR 610 Applied Statistics 3 hrs¶
One of the following three courses:¶
ES 620 Environmental Management Systems 3 hrs¶
ES 640 Groundwater Principles 3 hrs¶
ES 646 Dynamics of Ecosystems 3 hrs¶
¶
Elective courses¶
Two elective courses approved in advance by the student's advisor 6hrs¶
¶
MAJOR: Transportation and Infrastructure Engineering¶
Required courses¶
ENGR 610 Applied Statistics 3 hrs¶
EM 660 Project Management 3 hrs¶
TE 699 Comprehensive Project 3 hrs¶
Three (3) Courses in Primary Field (Either Transportation or Infrastructure Engineering) 9 hrs¶
Two (2) Courses in Secondary Field (Either Transportation or Infrastructure Engineering) 6 hrs¶
¶
Elective courses¶
Two (2) elective courses approved in advance by the student's advisor 6 hrs

ENGINEERING, M.S.

Majors:

Engineering Management
Environmental Engineering
Transportation and Infrastructure Engineering.

Program Description

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A. Pass the PE exam, or

B. Have an undergraduate cumulative GPA of 3.00 or greater, or

C. Have an undergraduate cumulative GPA of 2.50 or greater, and satisfy at least two of the following:
   (1) Pass the FE exam,
   (2) verbal GRE score at least 145,
   (3) quantitative GRE score at least 150, and/or
   (4) analytical writing GRE score at least 3.0.

Additionally, to be considered for admission, international students must have an iBT TOEFL score of at least 85, or a Paper-Based TOEFL score of at least 527.

Students who do not meet admission requirement options A, B, or C are welcome to apply, and their applications will be considered for admission on a case by case basis. The program admission recommendation will be decided by the M.S.E. degree program coordinator based on a combination of GRE scores and level of performance in undergraduate engineering coursework.

Applicants who do not meet the above criteria but have an undergraduate engineering degree are welcome to apply as non-degree seeking students and take classes toward their M.S.E. degree. If the student has a minimum cumulative graduate GPA of 3.30 in his or her first 9 credit hours of

CITE M.S.E. courses, that student may re-apply to the university to be considered for admission to the M.S.E. degree program.

Eligibility to take the PE exam is based primarily on completion of an ABET accredited undergraduate engineering degree in most states. Completion of a M.S.E. graduate degree at an institution with an ABET-accredited undergraduate degree does not fulfill that requirement to take the PE exam.

Degree Requirements

Each degree candidate is required to complete at least 30-33 graduate credit hours, depending on the "option" chosen below (project, thesis, or coursework only), with a cumulative Grade Point Average of 3.0 for the courses included in the student's Plan of Study. At least one-half of the minimum required hours for the degree must be earned in classes numbered 600 or above.

Each degree-seeking student must file an approved "Plan of Study," developed with a faculty advisor, before the student registers for the 12th credit hour. The Academic Regulations portion of the Graduate Catalog may be consulted for additional information.

A student may only earn the M.S.E. degree once. Therefore, students wishing to complete two of three M.S.E. majors (i.e., double major) must complete all requirements for both majors before the degree is awarded. A maximum of 12 credit hours may be counted toward both majors, as approved by the student's academic advisor in each major. An option must be selected for each major and the two options are permitted to be different. However, each major must have its own comprehensive assessment (e.g., comprehensive project, thesis, comprehensive examination). For example, a single thesis and defense cannot satisfy the requirements for both majors.

Students may choose to complete either the "project option," the "thesis option," or the "coursework only option" after consultation with their academic advisor.

Project Option. The comprehensive project involves the application of coursework completed as part of the degree to a practical problem. Students will work with their advisor to identify an appropriate project and scope. Students must prepare a formal written report and deliver an oral presentation to a committee. Students register for ENGR 699 Comprehensive Project (3 HR) during the semester in which their project will be completed and presented, but preliminary work on the project may commence before that semester.

Thesis Option. The thesis option involves the completion of 6 HR of research (ENGR 681) under the direction of an advisor on an approved project. Students must summarize their work in the form of a formal, written document and successfully defend the thesis before a committee. Thesis work is typically conducted over two semesters.

Coursework Only Option. Students can complete 33 hours of coursework and then complete a comprehensive examination within the last two semesters of graduation to fulfill the requirements of their degree. Examinations will be administered once per semester for all students.

MAJOR: Engineering Management

Project Option. (30 hours)

Required courses

EM	620	Management of Technical Human Resources and Organizations	3 hrs
EM	660	Project Management	3 hrs
EM	668	Operations Management	3 hrs
EM	670	Seminar in Engineering Management	3 hrs
EM	675	Engineering Economics (or TM equivalent)	3 hrs
EM	694	Engineering Law	3 hrs
ENGR	610	Applied Statistics	3 hrs
TE	699	Comprehensive Project	3 hrs

Elective courses (see approved Engineering Management electives below) ..... 6 hrs

Thesis Option. (30 hours)

Required courses

EM	620	Management of Technical Human Resources and Organizations	3 hrs
EM	660	Project Management	3 hrs
EM	668	Operations Management	3 hrs
EM	670	Seminar in Engineering Management	3 hrs
EM	675	Engineering Economics (or TM equivalent)	3 hrs
EM	694	Engineering Law	3 hrs
ENGR	610	Applied Statistics	3 hrs
ENGR	681	Engineering Research	6 hrs

Elective course (see approved Engineering Management electives below) ..... 3 hrs

Coursework Only Option. (33 hours)

Required courses

EM	620	Management of Technical Human Resources and Organizations	3 hrs
EM	660	Project Management	3 hrs
EM	668	Operations Management	3 hrs
EM	670	Seminar in Engineering Management	3 hrs
EM	675	Engineering Economics (or TM equivalent)	3 hrs
EM	694	Engineering Law	3 hrs
ENGR	610	Applied Statistics	3 hrs

Elective courses (see approved Engineering Management electives below) ..... 12 hrs

Approved Elective Courses for the Engineering Management Major

Any EM (Engineering Management) course.
Any TM (Technology Management) course.
Any College of Business course approved in advance by the advisor.
Any engineering course approved in advance by the advisor.

MAJOR: Environmental Engineering

All Environmental Engineering majors must have completed the Foundation Courses listed below (and their associated prerequisites), or their equivalents as approved by their advisor before being fully admitted. Until this requirement is satisfied, the student can only receive Provisional admission to the program. All other admission requirements must still be satisfied.

Foundation Courses:

ENGR 318 Fluid Mechanics
CE 331 Hydraulic Engineering
CE 432 Water/Wastewater Treatment

Project Option. (30 hours)

Required courses
- One of: ENGR 610, ENGR 620, or ME 601 ..... 3 hrs
- ENVE 615 Environmental Chemistry ..... 3 hrs
- ENGR 699 Comprehensive Project ..... 3 hrs

Three courses – one per category – from among the following six categories ..... 9 hrs
- (1) Engineering Management: EM 660
- (2) Water/Wastewater: ENVE 616 or ENVE 617
- (3) Solid/Hazardous Waste: ENVE 620 or ENVE 625
- (4) Air Pollution: ENVE 611, ENVE 612, ENVE 680, or ES 604
- (5) Hydraulics/Hydrology: ENVE 670, ENVE 671, or ENVE 672
- (6) Env. Remediation/Risk/Mgmt: ENVE 682, ES 514, ES 620

Elective courses (see approved Environmental Engineering electives below) ..... 12 hrs

Thesis Option. (30 hours)

Required courses
- One of: ENGR 610, ENGR 620, or ME 601 ..... 3 hrs
- ENVE 615 Environmental Chemistry ..... 3 hrs
- ENGR 681 Engineering Research ..... 6 hrs

Three courses – one per category – from among the following six categories ..... 9 hrs
- (1) Engineering Management: EM 660
- (2) Water/Wastewater: ENVE 616 or ENVE 617
- (3) Solid/Hazardous Waste: ENVE 620 or ENVE 625
- (4) Air Pollution: ENVE 611, ENVE 612, ENVE 680, or ES 604

(5) Hydraulics/Hydrology: ENVE 670, ENVE 671, or ENVE 672
(6) Env. Remediation/Risk/Mgmt: ENVE 682, ES 514, ES 620

Elective courses (see approved Environmental Engineering electives below)

Coursework Only Option. (33 hours)

Required courses
One of: ENGR 610, ENGR 620, or ME 601 ..... 3 hrs
ENVE 615 Environmental Chemistry ..... 3 hrs

Three courses – one per category – from among the following six categories ..... 9 hrs
(1) Engineering Management: EM 660
(2) Water/Wastewater: ENVE 616 or ENVE 617
(3) Solid/Hazardous Waste: ENVE 620 or ENVE 625
(4) Air Pollution: ENVE 611, ENVE 612, ENVE 680, or ES 604
(5) Hydraulics/Hydrology: ENVE 670, ENVE 671, or ENVE 672
(6) Env. Remediation/Risk/Mgmt: ENVE 682, ES 514, ES 620

Elective courses (see approved Environmental Engineering electives below) ..... 18 hrs

Approved Elective Courses for the Environmental Engineering Major
Any ENVE course.
Any course listed above not already taken.
ES 550 Environmental Law
ES 630 Environmental Site Assessment
ES 640 Groundwater Principles and Monitoring
Other courses approved in advance by the student's advisor.

MAJOR: Transportation and Infrastructure Engineering

All Transportation and Infrastructure Engineering majors must have completed the Foundation Courses listed below (and their associated prerequisites), or their equivalents as approved by their advisor before being fully admitted. Until this requirement is satisfied, the student can only receive Provisional admission. All other admission requirements must still be satisfied.

Foundation Courses:
CE 312 Structural Analysis
CE 342 Transportation Engineering
CE 413 Reinforced Concrete or CE 414 Steel Design

Students pursuing the Project Option and the Thesis Option must choose either Transportation Engineering or Structural Engineering as their primary focus. The other discipline will be the secondary focus. Three courses must be completed in the primary focus and two courses in the secondary focus for the Project and Thesis Option. The Coursework Only Option requires three courses in both disciplines.

Project Option. (30 hours)

ENGR 610 Applied Statistics or other Advisor Approved MTH course ..... 3 hrs
Three (3) Courses in Primary Focus (Structural Engr or Transportation Engr) ..... 9 hrs
Two (2) Courses in Secondary Focus (Structural Engr or Transportation Engr) ..... 6 hrs
Three (3) Elective Courses ..... 9 hrs
ENGR 699 Comprehensive Project ..... 3 hrs

Thesis Option. (30 hours)

ENGR 610 Applied Statistics or other Advisor Approved MTH course ..... 3 hrs
Three (3) Courses in Primary Focus (Structural Engr or Transportation Engr) ..... 9 hrs
Two (2) Courses in Secondary Focus (Structural Engr or Transportation Engr) ..... 6 hrs
Two (2) Elective Courses ..... 6 hrs
ENGR 681 Engineering Research ..... 6 hrs

Coursework Only Option. (33 hours)

ENGR 610 Applied Statistics or other Advisor Approved MTH course ..... 3 hrs
EM 660 Engineering Management ..... 3 hrs
Three (3) Courses in Structural Engineering ..... 9 hrs
Three (3) Courses in Transportation Engineering ..... 9 hrs
Three (3) Elective Courses ..... 9 hrs

Structural Engineering Courses

CE 612 – Structural Steel Design and Behavior (3 hrs)
CE 614 – Advanced Reinforced Concrete Structure Design and Behavior (3 hrs)
CE 615 – Finite Element Applications in Civil Engineering (3 hrs)
CE 616 – Pre-stressed Concrete Design (3 hrs)
CE 618 – Bridge Engineering (3 hrs)

Transportation Engineering Courses

CE 534 – Geometric Design of Highways (3 hrs)
CE 538 – Pavement Design (3 hrs)
CE 634 – Traffic Engineering (3 hrs)
CE 635 – Evaluation of Transportation Systems (3 hrs)
CE 636 – Transportation Planning (3 hrs)
CE 637 – Highway Safety Engineering (3 hrs)

Approved Elective Courses for the Transportation and Infrastructure Engineering Major

Any Transportation Engineering or Structural Engineering course not already taken.
Any ENVE (Environmental Engineering) course approved in advance by the student's advisor.
Any EM (Engineering Management) course approved in advance by the student's advisor.
Other courses approved in advance by the student's advisor.