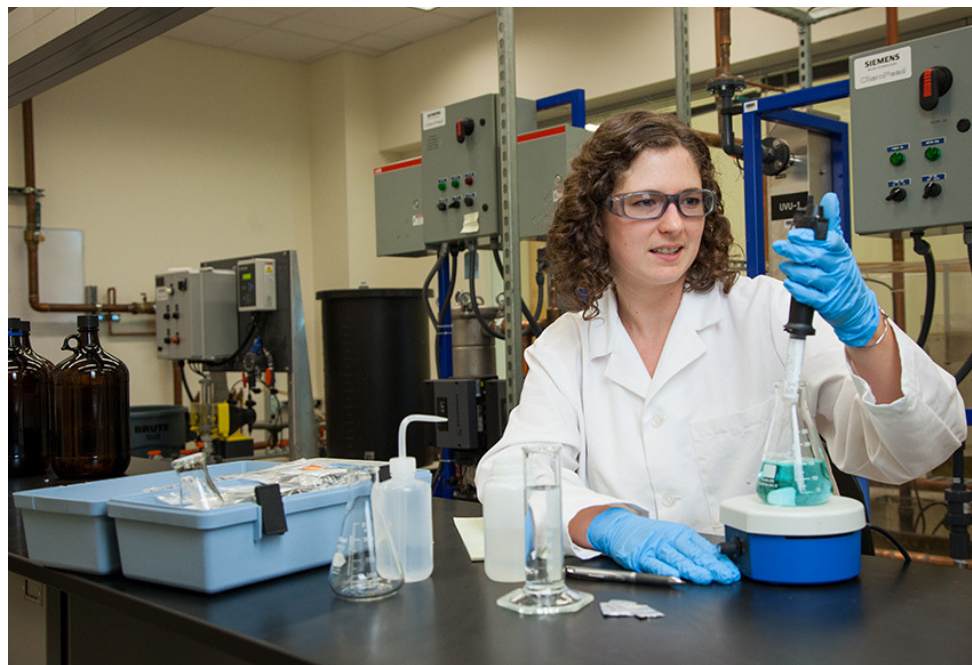


PROGRAM OF STUDY GUIDE

MASTERS OF SCIENCE

MASTERS OF ENGINEERING

CIVIL AND ENVIRONMENTAL ENGINEERING



Graduate programs with research options in:

- Environmental and Water Resources Engineering
- Transportation Engineering
- Geotechnical Engineering
- Structural Engineering



Portland State
UNIVERSITY

PROGRAM OF STUDY GUIDE FOR MASTER'S STUDENTS

Maseeh College of Engineering and Computer Science
Department of Civil and Environmental Engineering

Developing a program of study is key step in your graduate education and should be developed in consultation with your adviser to meet your personal education and career objectives. Students must complete the *Program of Study* form (posted on the CEE web site under "[Graduate Advising](#)"), obtain adviser approval, and submit to the CEE Academic Program Administrator. The *Program of Study* should ideally be submitted after the first 9 credits but is required once 18 credits have been completed in the program.

All students in the CEE Master's program must specialize in one of four areas:

- Environmental and Water Resources Engineering,
- Transportation Engineering,
- Geotechnical Engineering, or
- Structural Engineering.

This document provides the required core courses and a list of approved electives for each specialization. In all cases, a minimum of 30 credits must be taken in the Department of Civil and Environmental Engineering unless otherwise approved by the Graduate Program Chair. The adviser may require courses that are not listed in this document as required by research or project topic. Electives not listed in this document for each specialization can still be part of the program of study with adviser approval. Students are encouraged to seek useful and relevant courses outside the civil and environmental engineering to develop a robust program of study.

Note that any courses taken without adviser approval may not be accepted towards degree requirements. If a course listed on the approved *Program of Study* is not available due to changed course offerings, scheduling conflicts, or other reasons, another course can be substituted with adviser approval. Documentation of adviser approval is needed but a new *Program of Study* form is not required.

MASTER OF SCIENCE PROGRAM

A coursework and independent research degree. The Master of Science program consists of two options, each with a total of 45 credits.

- *Thesis*: The thesis option consists of a total of 45 credit hours including 6-9 hours of CE 503 Thesis credits plus successful completion of a final oral examination covering the thesis. Coursework may include up to 6 hours of CE 501 Research, CE 504 Internship, CE 505 Reading and Conference or CE 506 Projects.
- *Project*: The project option requires completion of 45 credit hours including 4 credits of CE 501 Research on a research project that produces a report and technical presentation. The presentation must be announced and given in a public forum. Project credits may be taken in one term or over multiple terms. Coursework may include up to 8 credit hours of CE 504 Internship, CE 505 Reading and Conference or CE 506 Projects.

A student who has been employed as a graduate research assistantship (GRA) is expected to complete the thesis option unless permission is granted by his/her adviser.

MASTER OF ENGINEERING PROGRAM

A coursework only degree. A total of 48 graduate credits are required for the MEng program. Coursework may include up to 8 hours of CE 501 Research, CE 504 Internship, CE 505 Reading and Conference or CE 506 Projects.

ENVIRONMENTAL AND WATER RESOURCES ENGINEERING

REQUIRED CORE COURSES (20 CREDITS)

Water & Wastewater, Chemistry, Mitigation, Treatment (a minimum of 2 courses - 8 credits)

- CE 574 Unit Operations of Environmental Engineering (4)
- CE 579 Fate and Transport of Toxics in the Environment (4)
- CE 580 Chemistry of Environmental Toxins (4)
- CE 587 Aquatic Chemistry (4)

Modeling of Surface Water and Air Systems (a minimum of 2 courses - 8 credits)

- CE 568 Advanced Methods in Hydrologic System Analysis (4)
- CE 572 Environmental Fluid Mechanical Transport (4)
- CE 573 Numerical Methods in Environmental and Water Resources Engineering (4)
- CE 578 Water Quality Modeling (4)
- CE 582 Introduction to Sediment Transport (4)
- CE 583 Estuarine Circulation (4)
- CE 588 Air Quality (4)
- CE 589 Introduction to Advanced Environmental Fluid Mechanics (4)

Hydrology and Groundwater (a minimum of 1 course - 4 credits)

- CE 565 Watershed Hydrology (4)
- CE 569 Subsurface Hydrology (4)
- CE 571 Subsurface Contaminant Transport (4)
- CE 590 Soil and Groundwater Restoration (4)

APPROVED ELECTIVE COURSES

The courses listed below are approved electives that can be used to satisfy degree requirements. Other elective courses not included in this list must be approved in advance by a student's adviser. Any of the listed required core courses not used to satisfy the core requirements can also be used to satisfy degree requirements.

- CE 510 Selected Topics (any CE 510 class with an environmental or water resources focus)
- CE 512 Sustainability in Civil and Environmental Engineering Seminar (1)
- CE 561 Water Resource Systems Analysis (4)
- CE 566 Environmental Data Analysis (4)
- CE 576 Environmental Fluid Mechanics (4)
- CE 581 The Columbia River as a System (2)
- CE 585 Environmental Cleanup and Restoration (4)
- CE 586 Environmental Chemistry (4)

TRANSPORTATION ENGINEERING

REQUIRED CORE COURSES (34 CREDITS, any combination)

Fundamentals of Operations, Safety and Travel

CE 550 Transportation Safety Analysis (4)
CE 559 Transportation Operations (4)
CE 596 Theories & Methods of Travel Behavior (4)
CE 597 Transportation & Health (4)

Urban Transportation Engineering

CE 553 Freight Transportation & Logistics (4)
CE 558 Public Transportation Systems (4)
CE 562 Traffic Engineering Applications & Signal Timing (4)
CE 593 Design and Operation of Bicycle and Pedestrian Infrastructure (4)
CE 595 Netherlands Study Abroad (*up to 3 credits may be applied to degree requirements*)

Multimodal Network Concepts and Data Analysis

CE 551 Computer Applications in Civil and Environmental Engineering (4)¹
CE 552 Transportation Network Analysis (4)¹
CE 554 Introduction to Multimodal Transportation Engineering Data Analysis (4)
CE 563 Transportation & Logistics Modeling & Optimization (4)
CE 598 Travel Survey Data & Analysis (4)

¹ Course will be offered as CE 510 until approval by University Curriculum Committee

Special Topics

CE 510 Selected Topics (any CE 510 class with Transportation Engineering focus)
CE 507 Transportation Research & Communication Seminar (1)
CE 514 Transportation Seminar (1) (*up to 2 credits may be applied to degree requirements*)

APPROVED ELECTIVE COURSES

The courses listed below are approved electives that can be used to satisfy degree requirements. Other elective courses not included in this list must be approved in advance by a student's adviser. Any of the listed required core courses not used to satisfy the core requirements can also be used to satisfy degree requirements.

Computer Science

CS 541 Artificial Intelligence (3)
CS 542 Advanced AI: Combinatorial Games (3)
CS 543 Advanced AI: Combinatorial Search (3)
CS 545 Machine Learning (3)
CS 582 Theory of Computation
CS 584 Algorithm Design (3)

Geography

GEOG 588 Geographic Information systems (4)
GEOG 592 GIS applications (4)
GEOG 596 Intro.to Spatial Quantitative Analysis (4)
GEOG 597 Advanced Spatial Quantitative Analysis (4)

Math

MTH 510 Numerical Optimization I, II (3)
MTH 510 Introduction to Convex Optimization (3)
MTH 561,562 Graph Theory (3)
MTH 577,578 Mathematical Control Theory (3)

Psychology

PSY 522/622 Mult. Reg. & Multivariate Quant. Methods (5)

System Science

SySc 527 Discrete System Simulation (4)
SySc 551 Discrete Multivariate Modeling (4)
Sycs 575 AI: Neural Networks I/II (4)

Updated 4/2021

Statistics

STAT 561/562/563 Mathematical Statistics I/II/III (3)*
STAT 565 Exp. Design: Theory and Methodology I (3)
STAT 564 Applied Regression Analysis (3)
STAT 566 Exp. Design: Theory and Methodology II (3)

Urban Studies and Planning

USP 511 Pedestrian & Bicycle Planning Lab (2)
USP 583 Transportation Finance (3)
USP 537 Economics of Urban Transportation (3)
USP 587 Travel Demand Modeling (3)
USP 544 Urban Transportation Planning (3)
USP 655 Adv. Data Analysis: Structural Eq. Modeling (3)
USP 556 Urban Transportation: Prob. & Policies (3)
USP 656 Advanced Data Analysis: Multilevel Regression (3)
USP 565 Pedestrian & Bicycle Planning (3)
USP 657 Adv. Data Analysis: Discrete Choice Modeling (3)
USP 570 Transportation & Land Use (3)

GEOTECHNICAL ENGINEERING

REQUIRED CORE COURSES (24 CREDITS)

Geotechnical Engineering Fundamentals (16 credits)

- CE 541 Advanced Soil Mechanics (4)
- CE 584/684 Theoretical and Computational Geomechanics (4)¹
- CE 543 Introduction to Geotechnical Earthquake Engineering (4)
- CE 594/694 Advanced Geotechnical Earthquake Engineering (4)¹

¹ Course will be offered as CE 510 until approval by University Curriculum Committee

Advanced Topics (a minimum of 2 courses - 8 credits)

- CE 542 In Situ Behavior and Testing of Soils (4)
- CE 546 Numerical Methods in Soil-Structure Interaction (4)
- CE 549 Deep Foundation Design and Analysis (4)
- CE 544 Advanced Shallow Foundation Design (4)
- CE 547 Slope Stability (4)
- CE 548 Geotechnical Case Histories (4)
- CE 540 Geosynthetics in Infrastructure Engineering (2)
- CE 545 Geo-environmental Engineering with Geosynthetics (2)

APPROVED ELECTIVE COURSES

The courses listed below are approved electives that can be used to satisfy degree requirements. Other elective courses not included in this list must be approved in advance by a student's adviser. Any of the listed required core courses not used to satisfy the core requirements can also be used to satisfy degree requirements.

CEE Courses – Geotechnical

- CE 510 Selected Topics (any CE 510 class with a geotechnical engineering focus)

Geology

- G 510 Selected Topics (any G 510 class with a geotechnical engineering application)
- G 570 Engineering Geology (4)

Civil Engineering - Structural Engineering

- CE 519 Bridge Engineering (4)
- CE 523 Vibration Analysis in Structural Engineering (4)
- CE 524 Matrix and Computer Methods in Structural Analysis (4)
- CE 529 Structural Dynamics (4)
- CE 532 Structural Steel Design (4)
- CE 534 Advanced Reinforced Concrete Design (3)
- CE 537 Earthquake Engineering (4)
- CE 539 Advanced Steel Design (4)

Mechanical and Materials Engineering

- ME 555 Finite Element Modeling and Analysis (4)
- ME 565 Advanced Finite Element Applications (4)
- ME 576 Material Failure Analysis (4)

STRUCTURAL ENGINEERING

REQUIRED CORE COURSES (15 CREDITS)

Structural Engineering Analysis (a minimum of 2 courses - 8 credits)

- CE 523 Vibration Analysis in Structural Engineering (4)
- CE 524 Matrix and Computer Methods in Structural Analysis (4)
- CE 529 Structural Dynamics (4)

Structural Engineering Design (7 credits)

- CE 534 Advanced Reinforced Concrete Design (3)
- CE 539 Advanced Steel Design (4)

APPROVED ELECTIVE COURSES

The courses listed below are approved electives that can be used to satisfy degree requirements. Other elective courses not included in this list must be approved in advance by a student's adviser. Any of the listed required core courses not used to satisfy the core requirements can also be used as satisfy degree requirements.

CEE Courses - Structural Engineering

- CE 510 Selected Topics (any CE 510 class with a structural engineering focus)
- CE 516 Forensic Structural Engineering
- CE 517 Timber Design (4)
- CE 518 Prestressed Concrete Design (4)
- CE 519 Bridge Engineering (4)
- CE 532 Structural Steel Design (4)
- CE 535 Design of Reinforced Concrete Structures (4)
- CE 536 Masonry Design (3)
- CE 537 Earthquake Engineering (4)

CEE Courses – Geotechnical

- CE 510 Selected Topics (any CE 510 class with a geotechnical engineering focus)
- CE 540 Geosynthetics in Infrastructure Engineering (2)
- CE 544 Advanced Shallow Foundation Design (4)
- CE 546 Numerical Methods in Soil Structure Interaction (4)
- CE 549 Deep Foundation Design and Analysis (4)

CEE Courses – Other

- CE 551 Computer Applications in Civil and Environmental Engineering (4)¹
- CE 513 Reliability and Risk Based Civil and Environmental Engineering Design (4)¹

¹ Course will be offered as CE 510 until approval by University Curriculum Committee

Mechanical and Materials Engineering

- ME 530/630 Solid Mechanics (4)
- ME 525 Advanced Topics in Building Science (4)
- ME 555 Finite Element Modeling and Analysis (4)
- ME 565 Advanced Finite Element Applications (4)
- ME 576 Material Failure Analysis (4)



Portland State
Civil & Environmental
Engineering



Funded graduate research and teaching positions are available for qualified applicants.

Department of Civil & Environmental Engineering

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