The University of Cincinnati

Masters of Engineering Degree
Program Schedule 2017-18

Curriculum

The curriculum in the Master of Engineering Program is structured to provide a foundation of advanced engineering topics while allowing students flexibility to meet their specific educational objectives. The Master of Engineering requires a minimum of 30 semester hours including:

- **Program core courses** taken by all Master of Engineering students
- **Track required courses** from the discipline of interest (number of credit hours required depends upon the discipline)
- **Elective courses** depth or interdisciplinary focus depending on student educational objectives (number of credit hours available depends upon the discipline)
- **Capstone project** demonstrates applications of skills and synthesis of knowledge

Each individual program has flexibility on setting appropriate track requirements. The following pages describe the course requirements for each of the program options provided.

MEng Program Options

Aerospace Engineering	Biomedical Engineering	Chemical Engineering
Civil Engineering	Computer Engineering	Computer Science
Electrical Engineering	Environmental Engineering	
Material Science Engineering	Mechanical Engineering	

Advisors

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Electrical and Computer			
Environmental Eng	Dominic Boccelli	ERC 742	dominic.boccelli@uc.edu
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Core Curriculum

The core curriculum is required of all Master of Engineering students, regardless of which track they pursue. The core provides skills in the effective practice of engineering recognizing that for experienced practitioners, effectiveness includes technical skills, project and task management skills, and interpersonal skills. Students are required to take 1 course from the Project / Task Management set and 1 course from the Interpersonal set. Additional courses from these areas can be taken as elective courses.

Project / Task Management Development (1 required)

MECH6074	Quality Control	Fall & Spring	***On Line***
ENGR6014	Eng Project Management	Fall & Spring	
AEEM6067	Entrepreneurship and Tech Law	Spring	
AEEM6099	System Eng & Analysis	Spring	
CVE 6044	Construction Law	Fall	
EECE 6032	Software Test and QA (CS majors)	Fall	**On-line**
ENGR 6012	Innov. & Design Thinking	Fall	
ENGR 7025	Product & Process QC	Fall	

Interpersonal Skill Development (1 required)

ENGR6003	Org Behavior for Tech Prof.	Fall & Spring	
ENGR6050	Fundamentals of Leadership	Fall & Spring	
ENGR6010	Effectiveness in Tech Orgs	Fall & Spring	***On Line***
OLHR8029	Individual Behavior in the Workplace	Fall	
OLHR6050	Teams	Spring	
OLHR 8090	Strategic Leadership		
MGMT7014	Leadership & Organizations	Fall & Spring	with permission
ENGR 6012	Innov. & Design Thinking	Fall	

Other courses that fit the core requirements may be available. Check with the MEng advisor in your program to verify if another course fulfills the core course requirements.

Capstone

Each master's degree student is required to undergo an individual evaluation process at the end of his or her program. For the Master of Engineering program we refer to this as a capstone experience. For the Master of Engineering program this experience is expected to be around the general topic of application of engineering principles since the MEng is focused on the practice of engineering rather than research or the generation of new knowledge. The capstone experience provides a mechanism to demonstrate a synthesis of knowledge and the application of advanced concepts learned in the program.

Each program (track) decides which options to offer students. All programs do not offer the same options. Depending on the program, students can choose: 1) to complete a project, 2) an MEng capstone evaluation, 3) to perform an internship or 4) to prepare a written paper under the supervision of the advisor. If students choose the capstone evaluation, this is a 0 credit hour option and students will need an additional course in order to meet the credit hour requirements for the degree. This MEng capstone evaluation can be written or oral, as deemed appropriate by each Program.

MEng Graduate Program Curriculum
Aerospace Engineering

The Aerospace Engineering and Engineering Mechanics Masters of Engineering degree is meant to be extremely flexible so as to meet the needs of prospective students. The coursework requirements are:

MEng Core Courses – 2 courses

Fundamental AEEM Courses - at least 4 courses selected from available graduate courses in the track. The following are typically available:

FALL

AEEM 6001	Adv Strength of Materials
AEEM 6003	Analytical Dynamics
AEEM 6011	Combustion
AEEM6041	Comp Flow and Thermodynamics
AEEM6076	Modeling Complex Systems
AEEM 7027	Non-Destructive Test
AEEM 7035	Physics of Gases
AEEM 7050	Turbomachinery Flow
AEEM 7074	Adv Finite Elem Method
AEEM8030	Advanced Propulsion
EGFD 7041	Viscous Flow and Heat Transfer
EGFD 7051	Nu Meth Aero Fluid Mech

SPRING

AEEM6012	TURBINE COMBUSTIION
AEEM6093	ADV. FLIGHT MECH.
AEEM6095	ASTRODYNAMICS
AEEM6096	FUZZY CONTROL SYS
AEEM6099	SYS ENG ANALYSIS
AEEM7028	ULTRASONIC NDE
AEEM7050	TURBOMACHINERY FLOW

Capstone Project – 1 course

With permission of their advisor, students may select some of their elective credit hours in areas outside of Aerospace Engineering. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Biomedical Engineering

DRAFT

MEng Core Courses – 2 courses

BME Tracks (12 credits required from either track).
Tissue Engineering and Biomechanics Track Courses:
Joint Biomechanics and Measurement Methods (BME 6024) 3 S
Functional Tissue Engineering (BME 6030) 3 S
Tissue Biomechanics (BME 7021) 3 F
Independent Study in Biomechanics (BME 8020) 3 F,S,U
Independent Study in Tissue Engineering (BME 8030) 3 F,S,U
Molecular and Cellular Biology (GNTD 7001) 3 F
Biomechanical and Physiological Aspects 2 F
of Muscular Activity (OSE 7044C)

Medical Imaging Track Courses:
MR Imaging and Spectroscopy (BME 6011) 3 F
Biomedical Signal and Image Processing (BME 6012) 3 F
Biomedical Ultrasound (BME 6050) 3 S
Advanced Topics in Magnetic Resonance Imaging (BME 7012) 3
Independent Study in Medical Imaging (20 BME 8010) 3 F,S,U
Diagnostic Radiological Imaging Physics (MP 9050) 3 F

BME MEng Electives (Need at least 6 cr total from the following)
General Medical Sciences Courses:
Human Gross Anatomy (ANAT 8071C) 4-10 U
Scientific Integrity & Research Ethics (BE 7067) 1 U
Biology of Cancer (CB 8080) 3 S
Molecular and Cellular Biology (GNTD 7001) 3 F
Biochemistry and Cellular Signaling (GNTD 7002) 3 F
Human Physiology (MCP 6000) 4 F
Brain and Behavior I (NS 8041) 4-10 S
Brain and Behavior II (NS 8061) 4-10 F

Mathematics Courses
Biostatistics in Research (BME 7061) 3 F,S
Advanced Statistical Methods in Biomedical Res. (BME 8064) 3
Introduction to Biostatistics (BE 7022) 3 F
Computational Fluid Dynamics (EGFD 6037C) 4 S
Numerical Analysis (MATH 6006) 3 F
Partial Differential Equations and Fourier Analysis (MATH 6007) 3 S
Applied Probability and Stochastic Processes (MATH 6008) 3 F
Mathematical Programming (MATH 6015) 3 S
Applied Ordinary Differential Equations (MATH 6051) 3 S
Scientific Computation (MATH 8011) 3
Mathematical Physics (PHYS 7001) 4 F

In addition to the above courses, these can come from any graduate level engineering, science, medicine, business, or law course that is relevant to the student's career goals as determined via discussion with the Graduate Program MEng advisor, and approved accordingly by the advisor. All elective choices need approval of the MEng Program Director.

Note: Not all courses are taught every year. Students should use this curriculum sheet as a guide, and check Onestop prior to enrollment every semester to ensure that the course being considered is actually offered in that semester. This requires careful planning and students should start early to develop their program of study with the MEng program advisor.

Capstone – 1 course

MEng Graduate Program Curriculum
Civil Engineering

A total of at least 30 semester credit hours are required for an MEng degree in Civil Engineering. Of these, 3 credit hours can be counted for the Capstone Project, if available. Students in the Civil Engineering program can choose between a targeted program that provides significant depth and a program that adds breadth within the practice of Civil Engineering. Students seeking to strengthen their area of expertise can choose either a focus on Infrastructure Design (with emphasis on Structures or Geotechnical) or on Infrastructure Systems (with emphasis on Building Systems, Construction Engineering and Management, Pavement Engineering, or Transportation). *Note that some courses are only offered in even years or in odd years, thus in some cases a minimum of three semesters will be necessary to fulfill all requirements.*

Students who have taken any of the 6000 level courses listed herein as part of their undergraduate degree at the University of Cincinnati will identify suitable substitutes in consultation with their academic advisor.

The total number of credit hours taken as independent study courses may not exceed six.

MEng Core Courses – 2 courses

Final Comprehensive Examination OR Capstone Project – 1 course

Take a final comprehensive examination (0 semester credit hours) OR, if an advisor is available, work on a Capstone Project (3 semester credit hours) that represents the synthesis of what was learned during the formal classwork. An internship alone is NOT considered a valid Capstone Project, however a Capstone Project that contains a summative analysis of some or all aspects of the internship work, with explicit reflections on the ties to the coursework taken and on how the data and/or information collected could have been used more efficiently or how codes and specification used hindered or contributed to the success of the internship work and how this codes could be improved or changed can be considered a valid Capstone Project. The Capstone Project consists of a written report and an oral presentation to the MEng committee.

An internship does not count for an MEng project. However, students can carefully work with the capstone advisor to develop a project based on the data and observations made during the internship, and prepare a report reflecting on the material learned during your MEng and analyzing and discussing data, methods, codes, and approaches based on work you have done during your internship. **A mere internship report will NOT be acceptable as an MEng project**

Civil Engineering Depth Options – Required Classes

Option 1 – Structural Engineering

CVE 7011	Structural Mechanics	**Fall**
CVE 7012	Finite Element Analysis	**Spring**
CVE 7081	Theory and Design of Concrete Structures I	**Fall 2017**
CVE 7085	Metal Structures Theory and Design I	**Fall 2018**
CVE 7088	Structural Dynamics	**Fall**

Option 2 – Geotechnical Engineering

CVE 7011	Structural Mechanics	**Fall**
CVE 7061	Consolidation and Settlement	**TBA**
CVE 7062	Soil Shear Strength and Slope Stability	**TBA**

Take **two** of the following courses:

CVE 6081	Foundation Engineering	**Fall**
CVE 7081	Theory and Design of Concrete Structures I	**Fall 2017**
CVE 7085	Metal Structures Theory	**Fall 2018**

In addition students must complete **three** of the following

CVE 6082	Reinforced Concrete Design of Shallow Foundations	**Spring**
CVE 6063	Principles of Pavement Engineering	**TBA**
GEOL 7001C	Geomorphic Processes	**TBD**
GEOL 6004	Glacial Geology	**TBD**

Option 3. – Building Systems

CVE 6042	Sustainable Construction and LEED	**Fall**
CVE 6047	Energy Efficiency in Buildings and Energy Modeling	**Spring**
CVE 60xx	Advanced Lighting and Daylighting	**TBA**

Select elective courses in consultation with area advisor: suggested courses are MECH 6097 – HVAC Design I, MECH 6098 – HVAC Design II, MECH 6013 – Intro to Smart Structures, MECH 6034 – Distributed Sensing and Control, MECH 6066 – Acoustics, MECH 6094 – Fundamentals and Applications of Solar Energy, ARCH 7081 – Environmental Technologies I, ARCH 7082 – Environmental Technologies II.

Option 4 – Construction Engineering and Management

CVE 6044	Construction Law	**Fall**
CVE 6042	Sustainable Construction and LEED	**Fall**
CVE 6036	Value Engineering and Constructability	**Spring**

Option 5 – Transportation Engineering

CVE 6022C	Traffic Control and Signal System Design	**Fall 2017**
CVE 6010C	Advanced Traffic Engineering, or	**Fall 2018**
CVE 6024	Highway Engineering and Traffic Safety	**Fall 2018**
CVE 6012	Travel Demand Forecasting and Environmental Analysis	**Spring 2018**
CVE 6008	Transportation Planning and System Evaluation	**Fall 2018**

<u>Civil Engineering Breadth Option – Required Classes</u>

CVE 7010	Risk and Reliability	**TBA**

Two courses from structures and/or geotechnical areas
Two courses from building systems, construction, and/or transportation area

Elective Courses:

With permission of their advisor and of the college, students may select some of their elective credit hours in areas outside of Civil Engineering and/or outside of the College of Engineering and Applied Science. Independent studies may also be arranged, for a maximum of 6 semester credit hours total. Note that some of the courses listed below have prerequisite courses.

CVE6008	Transportation Planning and System Evaluation
CVE6010C	Advanced Traffic Engineering
CVE6011	Advanced Strength of Materials
CVE6012	Travel Demand Forecasting and Environmental Analysis
CVE6021	Bridge Engineering
CVE6022C	Traffic Control and Signal System Design
CVE6024	Highway Engineering and Traffic Safety
CVE6036	Value Engineering and Constructability
CVE6037	Construction Financing & Strategy Planning
CVE6038	Leadership/Decision Making
CVE6041	Project Management Functions
CVE6042	Sustainable Construction and LEED
CVE6043	Structural Systems for Constructors
CVE6044	Construction Law
CVE6045	Heavy Highway Estimating
CVE6046	MEP systems for Constructors
CVE6058	Design of Wood and Masonry Structures
CVE6063	Principles of Pavement Engineering
CVE6067	Advanced Pavement Engineering
CVE6079	Data Management and Analysis
CVE6081	Foundation Engineering
CVE6082	Reinforced Concrete Design of Shallow Foundations
CVE6085	Advanced Structural Analysis
CVE6088	Finite Element Modeling of Civil and Architectural Engineering Structures
CVE7010	Risk and Reliability
CVE7011	Structural Mechanics
CVE7012	Finite Element Analysis
CVE7013	Advanced Topics in Finite Element Analysis
CVE7061	Consolidation and Settlement
CVE7062	Soil Shear Strength and Slope Stability
CVE7074	Traffic Flow Theory and Network Modeling
CVE7076	Intelligent Transportation Systems: Integrated Planning and Technologies
CVE7081	Theory and Design of Concrete Structures I
CVE7082	Design of Concrete Structures II (CVE7081 prerequisite)
CVE7085	Metal Structures Theory and Design I
CVE7086	Metal Structures Theory and Design II (CVE 7085 prerequisite)
CVE7088	Structural Dynamics
CVE7089	Earthquake Engineering

MEng Graduate Program Curriculum
Chemical Engineering

The Chemical Engineering Masters of Engineering degree is meant to be extremely flexible so as to meet the needs of prospective students. The coursework requirements are:

MEng Core Courses – 2 courses

Track Required Courses – 4 courses

CHE 6040	Advanced Thermodynamics	Fall
CHE 6043	Adv Transport Phenomenon I	Fall
CHE 6044	Transport Phenomenon II	Spring
CHE 7077	Chemical Reactor Design	Spring

Capstone Project – 1 course

Elective Courses – courses

CHE 6045C	Transp. Phenom Modelling & Anal	Spring
CHE 6057	Fuel Cells	Spring
CHE 6059	Inorganic Membranes	Fall
CHE 6076	Colloid Science	Spring
CHE 6080	NanoColloids and their Application	Fall
CHE6096	Env. Catalysis & Reaction Eng	Fall

With permission of their advisor, students may select some of their elective credit hours in areas outside of Chemical Engineering. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Computer Engineering

The Computer Engineering Masters of Engineering is focused around several distinct tracks. The coursework requirements for the tracks are:

MEng Core Courses – 2 courses

Capstone Project – Students may complete 6 credits of capstone toward the 30 credit hour requirement. Students are **required to take 3 credits of capstone in the fall** and may choose to take another 3 credits in the spring semester.

General Computer Engineering
The General Computer Engineering track is focused on development of foundational competencies in the computer engineering field. Courses in the general computer engineering track are designed to provide a strong foundation in both hardware and software development.

Required Courses (choose 4 of the 5 courses):
1. CS 6051 Database Theory 3 Credits (Fall or Spring)
2. EECE 6029 Introduction to Operating systems 3 Credits (Fall or Spring)
3. EECE 6080 Intro to VLSI Design 4 Credits (Fall)
4. EECE 7095 Introduction to Computer Architecture 3 Credits (Fall)

Elective Courses (Choose 2 from the following List):
1. CS 6043 Computer Networking 3 Credits (Fall or Spring)
2. EECE 6083 Compiler Theory and Practice 3 Credits (Spring)
3. EECE 6038C Adv. Microsystems 4 credits (Spring)
4. CS 6033 Artificial Intelligence (Fall)
5. CS 7081 Adv Algorithms 3 credits
6. CS 6026 Formal Methods 3 credits

Embedded Systems
An embedded system combines customized hardware and software to carry out a specific set of tasks. Every day we benefit from many embedded systems in our cars, in medical devices, in consumer electronics, and in smart home appliances. New applications for embedded systems are constantly being developed. Embedded systems developers must pay particular attention to safety, reliability, and security in the products they design. The Embedded Systems track prepares students to work in this exciting and constantly evolving sub discipline of Computer Engineering

Required Courses (choose 4 of the 5 courses):
1. EECE 6017C, Embedded Systems 4 Credits (Fall)
2. EECE 6029, Operating Systems 3 Credits (Fall and Spring)
3. EECE 6038C, Advanced Microsystem Design 4 Credits (Spring)
4. EECE 7095, Introduction to Computer Architecture 3 Credits (Fall)
5. CS 7092 Sensor Embedded Systems 3 credits (Spring)

Elective Courses (Choose 2 from the following List):
1. EECE 6007, Biomedical Microsystems 3 Credits (Fall)
2. EECE 6015C, Instrumentation & Industrial Control 3 Credits (Spring)
3. EECE 6032, Software Testing and Quality Assurance 3 Credits (Fall)
4. EECE 7017C, Trustworthy Embedded Systems 4 Credits (Spring)
5. CS 6027, Requirements Engineering 3 Credits (Fall)
6. CS 6097, Intro to Wireless and Mobile Networking 3 Credits (Fall)
7. EECE 6080 VLSI Design 4 credits (Fall)
8. EECE 7019 Bio-Inspired Robotics 3 credits (fall)
9. MECH 6031 Intro to Robotics 3 credits (Fall)
10. EECE 702 Sensor Embedded Systems 3 credits (Spring)
11. EECE 7017C Trustworthy Embedded Systems 4 credits (Spring)
12. EECE 7075 Principles of Modern Networking 3 credits (Spring)
13. EECE 8115 Humans, Machines, Robots 3 credits (Spring)

Computer Engineering - VLSI Design
The VLSI Design track is focused on preparing students for jobs in the integrated circuit design industry. Students take a core set of courses to learn skills associated VLSI chip design, layout and testing. Student can then supplement this core knowledge with electrics in areas related to computer architecture, wireless systems, embedded systems design, signal processing or software development. NOTE: This track requires significant background in computer programming. Students must have a demonstrated strength in computer programing using an object oriented programming language such as C++ in order to be accepted into this track.

Required Courses (Choose 3 of 4):
1. EECE 6080C Introduction to VLSI Design 4 credits (Fall)
2. EECE 6082C VLSI Design for Test and Power 4 credits (Spring)
3. EECE 6086C VLSI Design Automation 4 credits (Spring)
4. EECE 6088 Principles of VLSI Devices 3 credits (Fall)

Elective Courses (Choose 2-3 from the following List):
1. EECE 6017C Embedded Systems 4 credits (Fall)
2. EECE 6024 Introduction to Digital Signal Processing 3 credits (Fall)
3. EECE 6038C Advanced Microsystems 4 credits (Spring)
4. EECE 7095 Introduction to Computer Architecture 3 credits (Fall)
5. CS 7081 Adv Algorithms 3 credits (Fall and Spring)
6. EECE 6083 Compilers 3 credits (Spring)
7. EECE 6078 Biomicrofluidic Systems 3 credits (Spring)
8. EECE 7017C Trustworthy Embedded Systems 4 credits (Spring)
9. CS 6043 Computer Networks 3 credits (Spring)

Computer Engineering - Cyber Security
The Cyber Security track focuses on the development of technical skills necessary to address challenges of securing cyberspace and digital life. This track is designed to address the growing needs of companies, governments and organizations of professionals to manage the challenges of security in the cyberspace.

Required Courses (take all 4):
1. CS-6055 Cyber Defense Overview 3 credits (Fall)

2. CS-6021 Mathematical Logic 3 credits (Spring)
3. CS-6056 Security Vulnerability Assessment 3 credits (Spring)
4. EECE 6032 Software Testing 3 credits (Fall)

Elective Courses (Choose 2 from the following List):
1. CS-6097 Wireless and Mobile Networking 3 credits (Fall)
2. EECE-7095 Introduction to Computer Architecture 3 credits (Fall)
3. EECE-6017C Embedded Systems 4 credits (Fall)
4. CS 6043Computer Networks 3 credits (Fall and Spring)
5. CS 6053 Network Security 3 credits (Spring)
6. CS 60XX Data Security & Privacy 3 credits (Spring)
7. CS 7038 Malware Analysis 3 credits (Spring)
8. CS 7092 Sensor Embed Sys 3 credits (Spring)
9. EECE 6029 Operating Systems 3 credits (Fall & Spring)
10. EECE 6083 Compilers 3 credits (Spring)
11. EECE 7017C Trustworthy Embedded Sys 4 credits (Spring)
12. EECE 6038C Adv Microsystems 3 credits (Spring)

Computer Engineering - Data Science
The data science track focuses on analytical techniques and algorithms, including data mining, to extract meaningful insights by processing large data sets efficiently. Students acquire hands-on experience with relevant software tools, languages, data models, and environments.

Required Courses Choose 3 of 5):
1. CS 6052 Intelligent Data Analysis 3 credits (Fall and Spring)
2. CS 6054 Information Retrieval 3 credits (Fall)
3. CS 6034 Natural Lang Processing 3 credits (Fall)
4. CS 6035 Learning Probl. Models 3 credits (Fall)
5. CS 6073 Deep Learning 3 credits (Spring)

Elective Courses (Choose 2 from the following List):
CS 6033 Artificial Intelligence 3 credits (Fall)
EECE 6036 Intelligent Systems 3 credits (Fall)
CS 6037 Machine Learning 3 credits (Fall)
CS 6051 Database Theory 3 credits (Fall & Spring)
CS 6068 Parallel Computing 3 credits (Fall)
CS 6072 Network Science 3 credits (Fall)
CS 7054 Readings: Autonomous Agents& Distr. AI 3 credits (Fall)
CS 7081 Adv Algorithms 3 credits (Fall & Spring)
EECE 6017C Embedded Systems 4 credits (Fall)
EECE 6029 Op Systems 3 credits (Fall & Spring)
EECE 7095 Comp Architecture 3 credits (Fall)
CS 6025 Data Encoding (Spring)
CS 6055 Cloud Computing 3 credits (Spring)
CS 60XX Data Security & Privacy 3 credits (Spring)
CS 7051 Adv. Topic: Spatial Temp Data Mining 3 credits (Spring)
CS 7052 Adv Topic: Natural Language Process 3 credits (Spring)
EECE 6038C Adv Microsystems 3 credits (Spring)
EECE 6083 Compilers 3 credits (Spring)

With permission of their advisor, students may select some of their elective credit hours in areas

outside of Computer Engineering. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Computer Science

The Computer Science Masters of Engineering degree is focused around several distinct tracks. The coursework requirements for the tracks are:

MEng Core Courses – 2 courses

Capstone Project – Students may complete 6 credits of capstone toward the 30 credit hour requirement. Students are **required to take 3 credits of capstone in the fall** and may choose to take another 3 credits in the spring semester.

General Computer Science
The General Computer Science track is focused on development of foundational competencies in the computer science field. Courses in the general computer science track are designed to provide a strong foundation in software development and computer system analysis.

Required Courses (Choose 3 of 5):
1. CS 6037 Machine Learning 3 credits (Fall)
2. CS 6051 Database Theory 3 credits (Fall & Spring)
3. CS 6072 Network Science 3 credits (Fall)
4. CS 7081 Adv Algorithms 3 credits (Fall & Spring)
5. EECE 6029 Op Systems 3 credits (Fall & Spring)

Elective Courses (Choose 3 from the following List):
CS 6027 Requirement Eng 3 credits (Fall)
CS 6033 Artificial Intelligence 3 credits (Fall)
CS 6034 Natural Language Processing 3 credits (Fall)
CS 6035 Learning Probabilistic Models 3 credits (Fall)
CS 6043 Computer Networks 3 credits (Fall)
CS 6052 Intelligent Data Analysis 3 credits (Fall & Spring)
CS 6060 Computer Graphic 3 credits (Fall)
CS 6068 Parallel Computing 3 credits (Fall)
CS 6097 Wireless & Mobile Networks 3 credits (Fall)
CS 7054 Readings: Autonomous Agents& Distr. AI 3 credits (Fall)
EECE 6036 Intelligent Systems 3 credits (Fall)
CS 6021 Math Logic 3 credits (Spring)
CS 6028 Lg Scale SW Eng 3 credits (Spring)
CS 6043 Computer Networks 3 credits (Spring)
CS 6053 Network Security 3 credits (Spring)
CS 6073 Deep Learning 3 credits (Spring)
CS 60XX Data Security & Privacy 3 credits (Spring
CS 7092 Sensor Embed Sys 3 credits (Spring)
EECE 6031 Interconnection Networks 3 credits (Spring)

Computer Science - Cyber Security
The Cyber Security track focuses on the development of technical skills necessary to address challenges of securing cyberspace and digital life. This track is designed to address the growing

needs of companies, governments and organizations of professionals to manage the challenges of security in the cyberspace.

Required Courses (take all 4):
1. CS-6055 Cyber Defense Overview 3 credits (Fall)
2. CS-6021 Mathematical Logic 3 credits (Spring)
3. CS-6056 Security Vulnerability Assessment 3 credits (Spring)
4. EECE 6032 Software Testing 3 credits (Fall)

Elective Courses (Choose 2 from the following List):
CS-6097 Wireless and Mobile Networking 3 credits (Fall)
EECE-7095 Introduction to Computer Architecture 3 credits (Fall)
CS 6043Computer Networks 3 credits (Fall and Spring)
CS 6053 Network Security 3 credits (Spring)
CS 60XX Data Security & Privacy 3 credits (Spring)
CS 7038 Malware Analysis 3 credits (Spring)
CS 7092 Sensor Embed Sys 3 credits (Spring)
EECE 6029 Operating Systems 3 credits (Fall & Spring)
EECE 6083 Compilers 3 credits (Spring)
EECE 7017C Trustworthy Embedded Sys 4 credits (Spring)
CS 7035 Cryptography 3 credits (Fall)
CS 6055 Cloud Computing 3 credits (Spring)

Computer Science - Data Science
The data science track focuses on analytical techniques and algorithms, including data mining, to extract meaningful insights by processing large data sets efficiently. Students acquire hands-on experience with relevant software tools, languages, data models, and environments.

Required Courses Choose 3 of 5):
1. CS 6052 Intelligent Data Analysis 3 credits (Fall and Spring)
2. CS 6054 Information Retrieval 3 credits (Fall)
3. CS 6034 Natural Lang Processing 3 credits (Fall)
4. CS 6035 Learning Probl. Models 3 credits (Fall)
5. CS 6073 Deep Learning 3 credits (Spring)

Elective Courses (Choose 2 from the following List):
CS 6033 Artificial Intelligence 3 credits (Fall)
CS 6037 Machine Learning 3 credits (Fall)
CS 6051 Database Theory 3 credits (Fall & Spring)
CS 6068 Parallel Computing 3 credits (Fall)
CS 6072 Network Science 3 credits (Fall)
CS 7054 Readings: Autonomous Agents& Distr. AI 3 credits (Fall)
CS 7081 Adv Algorithms 3 credits (Fall & Spring)
CS 6025 Data Encoding (Spring)
CS 6055 Cloud Computing 3 credits (Spring)
CS 60XX Data Security & Privacy 3 credits (Spring)
CS 7051 Adv. Topic: Spatial Temp Data Mining 3 credits (Spring)
CS 7052 Adv Topic: Natural Language Process 3 credits (Spring)
With permission of their advisor, students may select some of their elective credit hours in areas outside of Electrical Engineering. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Electrical Engineering

The Electrical Engineering Masters of Engineering degree is focused around several distinct tracks. The coursework requirements for the tracks are:

MEng Core Courses – 2 courses

Capstone Project – Students may complete 6 credits of capstone toward the 30 credit hour requirement. Students are **required to take 3 credits of capstone in the fall** and may choose to take another 3 credits in the spring semester.

Advanced Materials, Devices and Microsystems
The Advanced Materials, Devices and Microsystems track aims to prepare students for jobs in industries focused on the advanced materials, nanoelectronic devices, and microelectromechanical systems (MEMS) for health. Students take a core set of courses to learn skills associated semiconductor fabrication, MEMS, and advanced devices. Students can then supplement this core knowledge with electives in areas related to microfabrication, quantum systems, thermoelectric systems, optical systems, or electromagnetic systems.

Required Courses (Choose 4 of 5)
1. EECE6007 Biomedical Microsystems 3 credits (Fall)
2. EECE6008 Fundamentals of MEMS 3 credits (Fall)
3. EECE6018 Microfab of Semiconductor Devices 3 credits (Fall)
4. EECE6041C Microfabrication Lab 3 credits (Spring)
5. EECE 6078 Biomicrofluidic Systems 3 credits (Spring)

Elective Courses (Choose 2 from the following List):
EECE6048C Optics for Engineers 3 credits (Fall)
EECE6088 Principles of VLSI Devices 3 credits
EECE7023 Thermoelectric Energy Conversion Devices 3 credits (Spring)
EECE7011 Electromagnetic Systems 3 credits (Spring)
MTEN 6013 Intro Smart Structures 3 credits (Fall)
EECE 7022 Wireless Communication

Systems Engineering
The Systems Engineering track is focused on preparing students for jobs in modeling, designing, analyzing and optimizing electrical or physical systems with a broad array of applications. Students take a core set of courses to learn skills associated with systems theory, systems design and modeling. Student can then supplement this core knowledge with expertise in areas related to communications, signal and image processing, instrumentations, control, simulations and electric machines and drives etc. NOTE: This track requires students have the necessary breadth and depth of knowledge in mathematics including differential equations, linear algebra, probability and statistics in order to be accepted into this track. Students are also expected to have completed the undergraduate courses in in signal and systems.

Required Courses (Choose 4 of 6):
1. EECE6019 Probability and Random Processes 3 credits (Fall)
2. EECE7033 Linear Systems Theory 3 credits (Spring)
3. EECE6036 Intelligent Systems 3 credits (Spring)

4. EECE 6024 Dig Signal Processing 3 credits (Fall)
5. EECE 6042 Digital Image Processing 3 credits (Fall)
6. AEEM 6099 System Eng Analysis 3 credit (Spring)

Elective Courses (Choose 2 from the following List):
EECE 6011 RF & Microwave Wireless Comm 3 credits (Fall)
EECE 6016C Electric Machines & Drives 3 credits (Fall)
EECE 6017C Embedded Systems 4 credits (Fall)
CS 7054 Readings: Autonomous Agents & Distr. AI 3 credits (Fall)
EECE 6015C Instrumentation & Controls 3 credits (Spring)
EECE 6025 Power Electronic 3 credits (Spring)
EECE 6026 Communication Sys 3 credits (Spring)
EECE 6027 Digital Communication 3 credits (Spring)
EECE 6058 GPS System & Receivers 3 credits (Spring)
EECE 7022 Wireless Communications 3 credits (Spring)
EECE 7065 Complex Systems 3 credits (Spring)
AEEM 6003 Analytical Dynamics 3 credits (Spring)
AEEM 6015 Modern Control 3 credits (Spring)
AEEM 6098 Unmanned Aircraft Systems 3 credits (Spring)

Electrical Engineering - VLSI Design
The VLSI Design track is focused on preparing students for jobs in the integrated circuit design industry. Students take a core set of courses to learn skills associated VLSI chip design, layout and testing. Student can then supplement this core knowledge with electrics in areas related to computer architecture, wireless systems, embedded systems design, signal processing or software development. NOTE: This track requires significant background in computer programming. Students must have a demonstrated strength in computer programing using an object oriented programming language such as C++ in order to be accepted into this track.

Required Courses (Choose 3 of 4):
1. EECE 6080C Introduction to VLSI Design 4 credits (Fall)
2. EECE 6082C VLSI Design for Test and Power 4 credits (Spring)
3. EECE 6086C VLSI Design Automation 4 credits (Spring)
4. EECE 6088 Principles of VLSI Devices 3 credits (Fall)

Elective Courses (Choose 2-3 from the following List):
1. EECE 6017C Embedded Systems 4 credits (Fall)
2. EECE 6024 Introduction to Digital Signal Processing 3 credits (Fall)
3. EECE 6038C Advanced Microsystems 4 credits (Spring)
4. EECE 7095 Introduction to Computer Architecture 3 credits (Fall)
5. CS 7081 Adv Algorithms 3 credits (Fall and Spring)
6. EECE 6083 Compilers 3 credits (Spring)
7. EECE 6078 Biomicrofluidic Systems 3 credits (Spring)
8. EECE 7017C Trustworthy Embedded Systems 4 credits (Spring)
9. CS 6043 Computer Networks 3 credits (Spring)

Robotics & Automation
The *Robotics and Automation* track focuses on developing new sensors and controls to achieve a higher level of performance from electro-mechanical, pneumatic, hydraulic and hybrid robotics

devices. Advanced hybrid hardware-software systems now make it possible to design elegant and sophisticated devices whose capabilities far surpass purely mechanical systems.

Required Courses (Choose 4of 6):
1. MECH 6031 Intro to Robotics 3 credits (Fall)
2, AEEM 6098 Unmanned Aircraft Systems 3 credits (Fall)
3. EECE 7019 Bio-Inspired Robotics 3 credits (Fall)
4. MECH 6032 Robot Control & Design 3 credits (Spring)
5. EECE 6015C Instrumentation & Controls 3 credits (Spring)
6. EECE 8115C Humans, Machines, Robots 3 credits (Spring)

Elective Courses (Choose 2 from the following List):
EECE 6011 RF & Microwave Wireless Comm 3 credits (Fall)
EECE 6016 Electrics Machines & Drives 3 credits (Fall)
EECE 6017C Embedded Systems 4 credits (Fall)
EECE 6019 Probability & Random Process 3 credits (Fall)
EECE 6036 Intelligent Systems 3 credits (Fall)
EECE 6042 Digital Image Process 3 credits (Fall)
AEEM 6003 Analytical Dynamic 3 credits (Fall)
MECH 6035 Intelligent Systems 3 credits (Fall)
ENGR 7025 Concurrent Product & Process Design 3 credits (Fall)
EECE 6025 Power Electronics 3 credits (Spring)
EECE 6038C Adv Microsystems 34 credits (Spring)
EECE 7017C Trustworthy Embedded Sys 4 credits (Spring)
MECH 6036 Robot Vision 3 credits (Spring)
AEEM 6015 Modern Controls 3 credits (Spring)
AEEM 7063 Flight Engineering 3 credits (Spring)

With permission of their advisor, students may select some of their elective credit hours in areas outside of Computer Engineering. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Environmental Engineering or Environmental Science

In order to graduate with a Master of Engineering degree with specialization in Environmental Engineering, the student has to successfully complete 30 cr hr of courses including at least 2 **Fundamental** courses and 1 **Design** course.

MEng Core Courses – two courses

Track Required Courses (10 – 15 cr hr)
Minimum of Two Fundamental courses and
Minimum of One Design course

Capstone Project (1 – 4 cr hr)

Elective Courses (2 – 9 cr hr)

Fundamental Courses - at least 2 courses to be selected from the following

Fall Semester
ENVE 6000/6001 Applied Biology for Engineered Systems (3/2 cr hr)
ENVE 6047 Chemical Principles of Environmental Systems (4 cr hr)
ENVE 6053 Physical Principles of Environmental Systems (3 cr hr)

Spring Semester
ENVE 6046 Biological/Microbiological Principles of Environmental Systems (4 cr hr)

Design Courses - at least 1 course to be selected from the following

Fall Semester
ENVE 6026 Environmental/Hydrologic System Analysis (3 cr hr)

Spring Semester
CVE 6090 Engineering Hydrology (3 cr hr)
ENVE 6054 Physical/Chemical Processes for Water Quality Control (4 cr hr)
ENVE 6055 Biological Processes for Water Quality Control (3 cr hr)
ENVE 6064 Air Resources Management (3 cr hr)

Elective Courses

Fall Semester
ENVE 6014 Solid Waste Management (3 cr hr)
ENVE 6022C Atmospheric Chemistry and Monitoring (3 cr hr)
ENVE 6094 Probability and Estimation Methods for Engineering Systems (3 cr hr)
GEOG 6071C Introduction to Geographic Information Systems (3 cr hr)

Spring Semester
ENVE 6044 Environmentally Conscious Engineering (3 cr hr)

ENVE 6058 Environmental Instrumentation (3 cr hr)
ENVE 6068C Bioprocess Engineering and Renewable Energy (3 cr hr)

With permission of their advisor, students may select some of their elective credit hours in areas outside of Environmental Engineering; typical courses come from Arts & Science and DAAP. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Materials Science or Metallurgical Engineering

The Master of Engineering consists of two tracks: Materials Science or Metallurgical Engineering. For either track the following general requirements apply:

MEng Core Courses – 2 courses

Fundamental Materials Science Courses - at least 4 courses selected from available graduate courses in the track. The following are typically available:

MTEN6012C	Nano Materials Eng	Spring
MECH6013	Smart Structures	Fall
MTEN6025C	POLYMER PROCESSING	Spring
MTEN6042	COMPOSITE MATERIALS	Spring
MTEN6047	ELEC OPT PROP CER	
MTEN6049	Mag, Diel and Sensor Properties	Spring
MTEN6052	Physical Metallurgy	Fall
MTEN 6053	Ceramic Matls Chem & Synthesis	Fall
MTEN6060	Corrosion	Spring
MTEN6070	Phase Transitions	Spring
MTEN6085	Coatings	Spring
MTEN6090	MOLECULAR MODELING	Spring
MTEN6097	Mechanical Behavior of Mater.	Fall
MTEN 7010C	Adv Materials Tech	Fall
MTEN7032	Polymer Analysis & Char	Fall
MTEN7035	Advanced Thermodynamics	Fall
MTEN7048	DIFFRACTION THEORY	Spring
MTEN7079	DEFECT IN SOLID	
MTEN7094	Fund of Polymer Science	Fall

Capstone Project – 1 course

With permission of their advisor, students may select some of their elective credit hours in areas outside of Materials Science / Metallurgical Engineering. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Mechanical Engineering

The Mechanical Engineering Master of Engineering curriculum allows the flexibility for students to choose from a combination of courses to complete the Track & Elective credit hours requirement. For students who wish to specialize in a particular area, suggested courses oriented toward the available areas of specialization are given below. However, students do not need to specialize.

MEng Core Courses – 2 courses

Capstone Project – Students may complete 6 credits of capstone toward the 30 credit hour requirement. Students are **required to take 3 credits of capstone in the fall** and may choose to take another 3 credits in the spring semester.

Track / Elective Courses – 6 courses

Primary areas of specialization within Mechanical Engineering are:

- Structural Dynamics and Vibro-Acoustics
- System Dynamics and Controls
- Design and Manufacturing
- Solid Mechanics
- Thermal-Fluids Engineering

The following are typically available:

FALL

AEEM6001	Advanced Strength of Materials
MECH6013	Smart Structures
MECH6020	Itro Adv manufacturing Processes
MECH6031	Intro to Robotics
MECH6035	Intelligent Systems
MECH 6043	Momentum & Energy Trnsfr with CFD Appl in Biosystems
MECH6050	Occupational Safety Engineering
MECH6060	Applied Fast Fourier Transforms
MECH6066	Acoustics
MECH6071	Advanced DFM
MECH6074	Quality Control
MECH6075	Production Planning & Control
MECH6077	Micro & Nano Manufacturing
MECH6081	Modeling Materials
MECH6097	HVAC Design I
MECH7002	Reliability Eng and Design
MECH7005	Materials Prop and Selection for Mechanical Eng
MECH7010	Parallel Computing
MECH7011	Math Meth for Decision making in Eng Systems
MECH7012	Elasticity I
MECH7023	Thermoelectric energy Conv
MECH7062	System Dynamic analysis
MECH7067	Roterdynamics
MECH7090	Conduction Heat Transfer
MECH8092	Adv Convection Heat Transfer

EGFD7041	Viscous Flow and Heat Transfer

SPRING (subject to change)

MECH6004	Monte Carlo Methods
MECH6011	Computational Design
MECH6023	CAD for Manufacturing
MECH6032	Robot Control and Design
MECH6035	Intelligent Systems Theory
MECH6036	Robot Vision
MECH6051	Safety Eng & Product Liability
MECH6052	System Safety
MECH6062	Experimental Vibrations
MECH6063	Experimental Analysis of Rotating Systems
MECH6073	Intro to E-Manufacturing
MECH6074	Quality Control
MECH6076	Supply Chain Modeling and Optimization
MECH6094	Fundamentals & Applications of Solar Energy
MECH6095	Thermal Energy Storage
MECH6096	Internal Combustion Engines
MECH7052	Finite Element Method
MECH7055	Fracture Mechanics
MECH7064	Advanced System Dynamics
MECH7070	Advanced Manufacturing Processes
MECH7072	Precision engineering and Computational metrology
MECH7091	Convection Heat Transfer
MECH7094	Boiling Heat Transfer and Two-Phase Flow

With permission of their advisor, students may select some of their elective credit hours in areas outside of Mechanical Engineering or EGFD. Independent studies or projects in advanced topics may also be arranged.

MEng Graduate Program Curriculum
Aero systems and Operations (AESOP)

Collaborative program between the University of Cincinnati and the University of Bordeaux

MEng Core Courses – 2 courses taken in Fall Semester

Track Courses – 6 courses

1st Semester – University of Cincinnati
AEEM 6101 Introduction to Aero Systems & Operations – Required
Choose Technical Specialty:

- Aeronautical Engineering – two courses (6 credits)
- Mechanical Engineering – two courses (6 credits)
- Electrical / Computer Engineering – two courses (6 credits)
- Computer Science - – two courses (6 credits)

2nd Semester – University of Bordeaux
Airworthiness – required
Maintenance Program Planning – required
Chose one from the following list:

- Maintenance, Repair and Overhaul
- Continuous Airworthiness
- Reliability

Chose one of the three modules and take the courses from that module:

1. Structural Maintenance Module

Regulations, documentation and maintenance of work site organization
Maintenance and repair structure
Non-destructive test (NDT)

2. Avionics Maintenance Module

Regulations, documentation and maintenance of work site organization
Avionics maintenance and repair systems
Avionics Test Bench

3. Propulsion Systems Maintenance

Regulations, documentation and maintenance of work site organization
Maintenance of turbomachinery
Aerofan engine test bench

Capstone Project – Independent research funded at UBx/IMA or summer internship et one of IMA's industrial partner. 3 credits in the summer semester.