MASTER OF SCIENCE IN COMPUTER ENGINEERING AND ELECTRICAL ENGINEERING

The purpose of the Master of Science in Computer Engineering and Electrical Engineering dual degree (M.S.CP.E/E.E.) is to prepare students for advanced study and/or research, or for industry in the fields of both computer and electrical engineering. The M.S.CP.E./E.E. program provides for a strong foundation in all aspects of the design and development of computer systems, and also offers several areas of study within electrical engineering. There is also an option to pursue thesis research under the guidance of a faculty adviser.

There is a growing need for engineers with a strong educational background in both computer engineering and electrical engineering. In the M.S.CP.E./E.E. program, students will be introduced to topics important to the computer engineering field, such as computer hardware design, computer networks, and software engineering, as well as topics in electrical engineering, such as communications and signal processing, electronics and electromagnetics, and power and control systems. The program of study includes a minimum of 45 credit hours of acceptable graduate coursework in both computer engineering and electrical engineering. M.S.CP.E./E.E. degree requirements are described in the section below. Requirements for the M.S.CP.E./E.E. fully satisfy the existing requirements for an M.S. in Computer Engineering and an M.S. in Electrical Engineering. The program is usually completed in four semesters of full-time study.

Admission requirements for the M.S.CP.E./E.E. are the same as those for admission to the Master of Science in Computer Engineering or Electrical Engineering. Students whose accredited B.S. degree is not in computer and/or electrical engineering may pursue the CP.E./E.E. degree provided that they demonstrate proficiency in the material contained in the following undergraduate courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ECE 211</td>
<td>Circuit Analysis I</td>
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<td>ECE 213</td>
<td>Circuit Analysis II</td>
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<td>ECE 218</td>
<td>Digital Systems</td>
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<td>ECE 242</td>
<td>Digital Computers and Computing</td>
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<td>or CS 350</td>
<td>Computer Organization and Assembly Language Programming</td>
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<td>ECE 307</td>
<td>Electrodynamics</td>
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<td>ECE 308</td>
<td>Signals and Systems</td>
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<td>ECE 311</td>
<td>Engineering Electronics</td>
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<td>CS 201</td>
<td>Accelerated Introduction to Computer Science</td>
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<td>CS 401</td>
<td>Introduction to Advanced Studies I</td>
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<tr>
<td>MATH 251</td>
<td>Multivariate and Vector Calculus</td>
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<tr>
<td>MATH 252</td>
<td>Introduction to Differential Equations</td>
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1. i.e. CS 115 and CS 116 combined

A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department.

In addition to all university requirements for a master of science degree, the M.S.CP.E./E.E. degree has the following requirements:

1. A minimum of 45 credit hours of graduate-level coursework including the following:
   a. Two core courses and two elective courses in a CPE major area, chosen from among the CPE areas of concentration.
   b. One core course from each of the two remaining areas of CPE concentration.
   c. Four (or more) courses within an EE major area, chosen from among the EE areas of concentration.
   d. A minimum of two courses chosen from either or both of the remaining EE areas of concentration.
   e. Additional coursework approved by the academic adviser.

2. A GPA of at least 3.0/4.0 (excluding prerequisites and proficiencies).

The CPE/EE program is subject to the following restrictions: a minimum of 30 credit hours coursework at the 500-level or higher; at least 30 credit hours of ECE courses, excluding short courses; no more than six credit hours of ECE short courses; six to eight credit hours of research work (ECE 591) leading to an M.S. dissertation may be included with the approval of a thesis adviser.

Each regular (matriculated) graduate student is assigned an academic adviser, indicated in his/her formal letter of admission to the master’s program.

Students should consult with their academic adviser to file a program of study meeting these requirements within three months after initial registration for full-time students, and prior to enrolling beyond 12 credit hours for part-time students.
Master of Science in Computer Engineering and Electrical Engineering (Coursework Only Option)

Minimum Credits Required 45
Minimum 500-Level Credit 30
Minimum ECE Credit 30
Maximum 700-Level Credit 6

Computer Engineering Major Courses (12-15)
Select two core courses from the chosen CPE area of concentration from the lists below 6-7
Select two elective courses from the chosen CPE area of concentration from the lists below 6-8

Computer Engineering Elective Courses (6-8)
Select one course from each of the two remaining CPE areas of concentration from the lists below 6-8

Electrical Engineering Major Courses (12-16)
Select four courses from the chosen EE area of concentration from the lists below 12-16

Electrical Engineering Minor Electives (6-8)
Select two courses from either or both of the remaining EE areas of concentration 6-8

General Electives (0-9)
Select zero to nine credit hours of general ECE electives 0-9

Master of Science in Computer Engineering and Electrical Engineering (Thesis Option)

Minimum Credits Required 45
Minimum 500-Level Credit 30
Minimum ECE Credit 30
Maximum 700-Level Credit 6

Computer Engineering Major Courses (12-15)
Select two core courses from the chosen CPE area of concentration from the lists below 6-7
Select two elective courses from the chosen CPE area of concentration from the lists below 6-8

Computer Engineering Elective Courses (6-8)
Select one course from each of the two remaining CPE areas of concentration from the lists below 6-8

Electrical Engineering Major Courses (12-16)
Select four courses from the chosen EE area of concentration from the lists below 12-16

Electrical Engineering Minor Electives (6-8)
Select two courses from either or both of the remaining EE areas of concentration 6-8

General Electives (0-3)
Select zero to three credit hours of general ECE electives 0-3

Thesis Research (6-8)
ECE 591 Research and Thesis for Masters Degree 6-8

1 Students pursuing the thesis option must complete six to eight credit hours of research work (ECE 591) leading to an M.S. dissertation with the approval of a thesis adviser.

CPE Areas of Concentration

Computer Hardware Design
Core Courses (6-7)
ECE 529 Advanced VLSI Systems Design 3-4
or ECE 429 Introduction to VLSI Design
ECE 585 Advanced Computer Architecture 3

Elective Courses (48)
ECE 425 Analysis and Design of Integrated Circuits 3
ECE 429 Introduction to VLSI Design 4
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<td>Fundamentals of Semiconductor Devices</td>
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<td>Microcomputers</td>
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<td>High Speed Computer Arithmetic</td>
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<td>VLSI Architecture for Signal Processing and Communication Systems</td>
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<td>ECE 585</td>
<td>Advanced Computer Architecture</td>
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<td>Fault Detection in Digital Circuits</td>
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<td>Hardware/Software Codesign</td>
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<td>ECE 588</td>
<td>CAD Techniques for VLSI Design</td>
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<td>ECE 589</td>
<td>Computer-Aided Design of Analog IC</td>
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**Computer Systems Software**

**Core Courses**

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<td>Advanced Operating Systems</td>
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<td>CS 551</td>
<td>Operating System Design and Implementation</td>
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**Elective Courses**

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<td>Object-Oriented Programming and Computer Simulation</td>
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<td>ECE 587</td>
<td>Hardware/Software Codesign</td>
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<td>CS 487</td>
<td>Software Engineering I</td>
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<td>CS 545</td>
<td>Distributed Computing Landscape</td>
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<td>CS 546</td>
<td>Parallel and Distributed Processing</td>
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<td>CS 550</td>
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<td>CS 551</td>
<td>Operating System Design and Implementation</td>
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<tr>
<td>CS 555</td>
<td>Analytic Models and Simulation of Computer Systems</td>
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<td>CS 586</td>
<td>Software Systems Architectures</td>
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<td>CS 587</td>
<td>Software Project Management</td>
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<td>CS 588</td>
<td>Advanced Software Engineering Development</td>
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<td>CS 589</td>
<td>Software Testing and Analysis</td>
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**Networks and Telecommunications**

**Core Courses**

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<td>ECE 408</td>
<td>Introduction to Computer Networks</td>
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<tr>
<td>ECE 541</td>
<td>Performance Evaluation of Computer Networks</td>
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<tr>
<td>or ECE 545</td>
<td>Advanced Computer Networks</td>
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**Elective Courses**

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<td>ECE 408</td>
<td>Introduction to Computer Networks</td>
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<td>ECE 443</td>
<td>Introduction to Computer Security</td>
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<tr>
<td>ECE 504</td>
<td>Wireless Communication System Design</td>
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<tr>
<td>ECE 508</td>
<td>Video Communications</td>
<td>3</td>
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<tr>
<td>ECE 511</td>
<td>Analysis of Random Signals</td>
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<td>ECE 513</td>
<td>Communication Engineering Fundamentals</td>
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<td>ECE 514</td>
<td>Digital Communication Principles</td>
<td>3</td>
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<td>ECE 515</td>
<td>Modern Digital Communications</td>
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<td>ECE 516</td>
<td>Coding for Distributed Storage Systems</td>
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<td>ECE 517</td>
<td>Modern Wireless Network Protocols and Standards</td>
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<td>ECE 519</td>
<td>Coding for Reliable Communications</td>
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<tr>
<td>ECE 520</td>
<td>Information Theory and Applications</td>
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<td>ECE 541</td>
<td>Performance Evaluation of Computer Networks</td>
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</table>
### ECE 542  
Design and Optimization of Computer Networks  
3

### ECE 543  
Computer Network Security  
3

### ECE 544  
Wireless and Mobile Networks  
3

### ECE 545  
Advanced Computer Networks  
3

### ECE 546  
Wireless Network Security  
3

### ECE 547  
Wireless Networks Performance Analysis  
3

### ECE 570  
Fiber-Optic Communication Systems  
3

### ECE 584  
VLSI Architecture for Signal Processing and Communication Systems  
3

### CS 455  
Data Communications  
3

### CS 544  
Computer Networks II: Network Services  
3

## EE Areas of Concentration
### Communications and Signal Processing

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<td>ECE 403</td>
<td>Digital and Data Communication Systems</td>
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<td>ECE 405</td>
<td>Digital and Data Communication Systems with Laboratory</td>
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<td>ECE 406</td>
<td>Introduction to Wireless Communication Systems</td>
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<td>ECE 421</td>
<td>Microwave Circuits and Systems</td>
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<td>ECE 423</td>
<td>Microwave Circuits and Systems with Laboratory</td>
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<td>ECE 436</td>
<td>Digital Signal Processing I with Laboratory</td>
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<td>ECE 437</td>
<td>Digital Signal Processing I</td>
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<td>ECE 481</td>
<td>Image Processing</td>
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<td>ECE 504</td>
<td>Wireless Communication System Design</td>
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<tr>
<td>ECE 507</td>
<td>Imaging Theory &amp; Applications</td>
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<td>ECE 508</td>
<td>Video Communications</td>
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<td>Electromagnetic Field Theory</td>
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<td>ECE 511</td>
<td>Analysis of Random Signals</td>
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<td>ECE 513</td>
<td>Communication Engineering Fundamentals</td>
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<td>ECE 514</td>
<td>Digital Communication Principles</td>
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<td>Modern Digital Communications</td>
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<td>Coding for Distributed Storage Systems</td>
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<td>ECE 519</td>
<td>Coding for Reliable Communications</td>
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<td>ECE 520</td>
<td>Information Theory and Applications</td>
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<td>ECE 522</td>
<td>Electromagnetic Compatibility</td>
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<td>ECE 555</td>
<td>Computer Vision and Image Processing</td>
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<td>ECE 556</td>
<td>Statistical Pattern Recognition</td>
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<td>Digital Signal Processing II</td>
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<td>Antenna Theory</td>
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<td>ECE 578</td>
<td>Microwave Theory</td>
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## Computers and Microelectronics

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<td>ECE 407</td>
<td>Introduction to Computer Networks with Laboratory</td>
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<td>Introduction to Computer Networks</td>
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<td>ECE 425</td>
<td>Analysis and Design of Integrated Circuits</td>
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<td>ECE 429</td>
<td>Introduction to VLSI Design</td>
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<td>ECE 430</td>
<td>Fundamentals of Semiconductor Devices</td>
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<td>Microcomputers</td>
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<td>ECE 443</td>
<td>Introduction to Computer Security</td>
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<td>Object-Oriented Programming and Computer Simulation</td>
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<td>Computer Organization and Design</td>
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<td>Basic Network Theory</td>
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<td>Modern Wireless Network Protocols and Standards</td>
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<td>Quantum Electronics</td>
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<td>RF Integrated Circuit Design</td>
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<td>Active Filter Design</td>
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<td>Performance Analysis of RF Integrated Circuits</td>
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<td>Computer-Aided Design of Analog IC</td>
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**Power and Control**

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<td>Power System Analysis</td>
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<td>Power Systems Analysis with Laboratory</td>
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<td>Control Systems</td>
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<td>Applied Optimization for Engineers</td>
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<td>Analysis of Nonlinear Systems</td>
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