# ELECTRICAL AND COMPUTER ENGINEERING: MACHINE LEARNING AND SIGNAL PROCESSING, MS

## REQUIREMENTS

## MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum degree requirements (https://guide.wisc.edu/graduate/#requirementstext) and policies (https://guide.wisc.edu/graduate/#policiestext), in addition to the program requirements listed below.

## NAMED OPTION REQUIREMENTS
### MODE OF INSTRUCTION

| Face to Face | Evening/ Weekend | Online | Hybrid | Accelerated |
|---|---|---|---|---|
| Yes | No | No | No | Yes |

### Mode of Instruction Definitions

**Accelerated:** Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

**Evening/Weekend:** Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules.  Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

**Face-to-Face:** Courses typically meet during weekdays on the UW-Madison Campus.

**Hybrid:** These programs combine face-to-face and online learning formats.  Contact the program for more specific information.

**Online:** These programs are offered 100% online.  Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

## CURRICULAR REQUIREMENTS

| Requirement | Detail |
|---|---|
| Minimum Credit Requirement | 30 credits |
| Minimum Residence Credit Requirement | 23 credits |

| Minimum Graduate Coursework Requirement | 15 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework (50%) Requirement policy: https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/). |
|---|---|
| Overall Graduate GPA Requirement | 3.00 GPA required. Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/). |
| Other Grade Requirements | 1. A grade of B or better in any graduate course is acceptable. <br> 2. A grade of BC in an E C E course is acceptable, provided the total cumulative GPA for graduate E C E courses is greater than or equal to 3.00. <br> 3. A grade of BC or C in a non-E C E course is acceptable only if approved by the Graduate Committee. |
| Assessments and Examinations | A specified course sequence must be completed. |
| Language Requirements | Non-native speakers of English who enroll in the MS program must take the ESLAT test on arrival at the university and then take any recommended courses based on the exam results. In addition, if a student's advisor believes that his or her technical writing ability needs improvement, the student may be required to undertake remedial work. |

## REQUIRED COURSES

The same course may not satisfy more than one requirement. For example, if E C E 431 is taken as a "Signal Processing" course, it cannot be used to satisfy an "Elective" course.

| Code | Title | Credits |
|---|---|---|
| **Required Seminar** | | |
| All on-campus E C E graduate students must register for 1 credit during their first semester of graduate studies. | | |
| E C E 610 | Seminar in Electrical and Computer Engineering | 1 |
| **Machine Learning** | | |
| Complete at least one course from the following: | | 3 |
| E C E/COMP SCI/ M E 532 | Matrix Methods in Machine Learning | |
| E C E/COMP SCI/ M E 539 | Introduction to Artificial Neural Networks | |
| E C E/ COMP SCI 561 | Probability and Information Theory in Machine Learning | |
| E C E/ COMP SCI 760 | Machine Learning | |
| E C E/ COMP SCI 761 | Mathematical Foundations of Machine Learning | |
| E C E/COMP SCI/ STAT 861 | Theoretical Foundations of Machine Learning | |
| **Signal Processing** | | |
| Complete at least one course from the following: | | 3 |
| E C E 431 | Digital Signal Processing | |
| E C E/ COMP SCI 533 | Image Processing | |

| E C E 734 | VLSI Array Structures for Digital Signal Processing | |
|---|---|---|
| E C E 735 | Signal Synthesis and Recovery Techniques | |
| E C E 738 | Advanced Digital Image Processing | |

**Electives**

| Complete at least 12 credits from the following: | | 12 |
|---|---|---|
| E C E 431 | Digital Signal Processing | |
| E C E 436 | Communication Systems I | |
| E C E 437 | Communication Systems II | |
| E C E/COMP SCI/ I SY E  524 | Introduction to Optimization | |
| E C E/COMP SCI/ M E  532 | Matrix Methods in Machine Learning | |
| E C E/ COMP SCI  533 | Image Processing | |
| E C E/COMP SCI/ M E  539 | Introduction to Artificial Neural Networks | |
| E C E/ COMP SCI  561 | Probability and Information Theory in Machine Learning | |
| E C E/I SY E  570 | Ethics of Data for Engineers | |
| E C E 601 | Special Topics in Electrical and Computer Engineering (as approved by faculty advisor) | |
| E C E 717 | Linear Systems | |
| E C E 729 | Information Theory | |
| E C E 730 | Probability and Random Processes | |
| E C E 734 | VLSI Array Structures for Digital Signal Processing | |
| E C E 735 | Signal Synthesis and Recovery Techniques | |
| E C E 736 | Wireless Communications | |
| E C E 738 | Advanced Digital Image Processing | |
| E C E/ COMP SCI  760 | Machine Learning | |
| E C E/ COMP SCI  761 | Mathematical Foundations of Machine Learning | |
| E C E/ COMP SCI  766 | Computer Vision | |
| E C E/B M E/ MED PHYS  778 | Machine Learning in Ultrasound Imaging | |
| E C E 817 | Nonlinear Systems | |
| E C E 830 | Estimation and Decision Theory | |
| E C E/COMP SCI/ STAT  861 | Theoretical Foundations of Machine Learning | |
| E C E 901 | Special Topics in Electrical and Computer Engineering (as approved by faculty advisor, max of 3 credits) | |

**Other Course Requirements**

| Chosen in consultation with advisor, complete some combination of the following: [1] | | 11 |
|---|---|---|
| *Hands-On Project and/or Internship* [2] | | |
| Complete up to 3 credits of independent study by enrolling in the following or equivalent in another department with advisor approval: | | |

| E C E 699 | Advanced Independent Study | |
|---|---|---|
| Complete up to 3 credits of the following: | | |
| E C E 702 | Graduate Cooperative Education Program | |
| *Additional Coursework* | | |
| Complete additional courses from the Electives list above | | |
| Complete other E C E coursework numbered 400 or above, with advisor approval | | |
| Complete up to 9 credits of relevant coursework numbered 300 or above in other departments with advisor approval, typically in COMP SCI, MATH, STAT, or E P D (Engineering Professional Development) | | |
| **Total Credits** | | **30** |

[1]  Please keep written communication (emails are acceptable) of approvals from your faculty advisor. Note the following courses are not allowed to satisfy requirements: E C E 611 Introduction to Doctoral Research in Electrical & Computer Engineering or E C E 790 Master's Research, E C E 890 Pre-Dissertator's Research, E C E 990 Dissertator's Research.

[2]  Students are strongly encouraged to seek out and engage in these development opportunities. Availability is not guaranteed.

## Other Policy

Students in this program may not take courses outside the prescribed curriculum without faculty advisor and program director approval. Students in this program cannot enroll concurrently in other undergraduate or graduate degree programs.