Department of Electrical and Computer Engineering

231 Kaufman Hall
757-683-3741

http://www.odu.edu/ece/

Khan M. Iftekharuddin, Chair
Oscar González, Associate Chair
Dimitrie C. Popescu, Graduate Program Director

Department Description

The Department of Electrical and Computer Engineering strives to provide the highest quality engineering education at the undergraduate and graduate levels, to engage in scholarly research at the forefront of electrical and computer engineering, and to serve the profession of electrical and computer engineering. The department has strong graduate and research programs providing a high quality and broad-based education that prepares graduates for successful professional careers and a lifetime of learning.

Electrical and Computer Engineering graduate studies encompass four broad areas:

1. systems
2. signal and image processing
3. physical electronics
4. computer engineering

Special Facilities

The research laboratories and institutes directly associated with the department include the Advanced Signal Processing in Engineering and Neuroscience Laboratory (ASPE), the Applied Plasma Technology Laboratory (APTL), the Plasma Engineering and Medicine Institute (PEMI), the Cybersecurity, Communications & Networking Innovation (CCNI) Laboratory, the Medical Imaging, Diagnosis & Analysis (MIDA) Laboratory, the Systems Research Laboratory, the Virginia Institute for Photovoltaics (VIPV), the Vision Lab, and the Virginia Institute for Vision Analysis (VIVA). In addition, the department has strong ties to the Applied Research Center at the Jefferson National Laboratory and to the Frank Reidy Research Center for Bioelectronics. These research facilities position the department for national leadership in several areas and as a leading institution of research and higher education in the southeastern United States.

List of Degrees

The department offers the following graduate degrees:

- Master of Engineering, Electrical and Computer Engineering
- Master of Science, Engineering - Electrical and Computer Engineering
- Doctor of Philosophy, Engineering - Electrical and Computer Engineering
- Doctor of Engineering, Electrical and Computer Engineering

Master's Degrees

Degree Description

The Department of Electrical and Computer Engineering offers two master's degree programs: Master of Engineering (M.E.) and Master of Science (M.S.). Both Master degrees require a minimum of 30 credit hours of graduate study. For the M.E. degree the credit hours are obtained through graduate coursework, while for the M.S. degree the credit hours are obtained through a combination of graduate coursework and thesis research. Full-time and part-time students may complete coursework through a combination of on-campus and distance learning courses. The distance learning courses are available synchronously at the higher education centers and can be broadcast to any computer with a high speed Internet connection. These distance learning courses can also accommodate asynchronous students. Full details on all requirements for graduating with a Master's degree are outlined in a separate section that follows the admission information.

Admission Information

Applicants are expected to hold a B.S. degree in electrical engineering (EE) or computer engineering (CpE) from an accredited institution. Applicants are also expected to have a minimum grade point average of 3.0 (on a 4.0 scale) in both the baccalaureate major area (EE or CpE) and overall. Applicants with a GPA below a 3.0 may be considered for provisional admission, which may require additional prerequisite courses in addition to the graduate degree requirements. The applications are submitted through the Office of Admissions of Old Dominion University. Together with the completed application form, two letters of recommendation from former instructors or employment supervisors, transcripts from all colleges and universities attended, GRE scores, a resume, and a personal statement of objectives are required. Applicants to the M.S. degree should express their interest in research and desire to complete a research-based M.S. thesis in their personal statement. TOEFL scores are also required for international applicants. Applicants with academic degrees in areas other than electrical and computer engineering will be considered. Those with degrees in math, physics, computer science, or other engineering fields are encouraged to apply. The linked Bachelor's/Master's degree program in the Frank Batten College of Engineering and Technology at Old Dominion University is designed to provide an opportunity for exceptionally qualified engineering undergraduate students to obtain both a bachelors and a master's degree in Electrical and Computer Engineering. Typically undergraduate students apply at the end of their junior year for admission to the linked programs.

Accepted students from disciplines other than EE or CpE are required to complete a number of leveling courses to meet prerequisites for graduate studies. All students are required to have one year of college chemistry and one year of calculus-based college physics in addition to Calculus III and Differential Equations courses. Students at Old Dominion University may complete the leveling requirement by earning a minor in electrical or computer engineering with a GPA of 3.0 or greater. Students that have not earned a minor need to meet with the graduate program director to prepare a course plan and determine which pre-requisite courses are needed. In general, three to four leveling courses are needed and they are chosen from the following lists.

List of Possible Courses to Meet the Leveling Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Requirement</th>
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</thead>
<tbody>
<tr>
<td>ECE 202</td>
<td>Circuit Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>ECE 241</td>
<td>Fundamentals of Computer Engineering</td>
<td>4</td>
</tr>
<tr>
<td>ECE 302</td>
<td>Linear System Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECE 303</td>
<td>Introduction to Electrical Power</td>
<td>3</td>
</tr>
<tr>
<td>ECE 304</td>
<td>Probability, Statistics, and Reliability</td>
<td>3</td>
</tr>
<tr>
<td>ECE 313</td>
<td>Electronic Circuits</td>
<td>4</td>
</tr>
<tr>
<td>ECE 323</td>
<td>Electromagnetics</td>
<td>3</td>
</tr>
<tr>
<td>ECE 332</td>
<td>Microelectronic Materials and Processes</td>
<td>3</td>
</tr>
<tr>
<td>ECE 340</td>
<td>Digital Circuits</td>
<td>4</td>
</tr>
<tr>
<td>ECE 341</td>
<td>Digital System Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 346</td>
<td>Microcontrollers</td>
<td>3</td>
</tr>
<tr>
<td>ECE 381</td>
<td>Introduction to Discrete-time Signal</td>
<td>3</td>
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<tr>
<td></td>
<td>Processing</td>
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Students interested in taking computer engineering graduate courses may need to take additional leveling computer science courses as indicated below.

List of Possible Computer Science Courses to Meet the Leveling Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Requirement</th>
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</thead>
<tbody>
<tr>
<td>CS 333</td>
<td>Programming and Problem Solving in C++</td>
<td>4</td>
</tr>
<tr>
<td>CS 350</td>
<td>Introduction to Software Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>
Degree Requirements

Both M.S. and M.E. degrees require a minimum of 30 credit hours of graduate study.

The M.S. degree requires a minimum of 24 credit hours of courses (not including the Graduate Seminar), at least 1 credit hour of Graduate Seminar (ECE 731), and 6 credit hours of thesis along with the oral thesis defense examination. Continuation in the M.S. program is contingent upon identifying a Ph.D. advisor after completing 18 credit hours of coursework (which coincides approximately with the end of the second semester of study for full-time students). Students who have difficulty identifying a Ph.D. advisor have the option to transfer to the M.E. degree and obtain the Master's degree by completing the M.E. degree requirements.

The M.E. degree project option requires a minimum of 27 credit hours of courses (not including the Graduate Seminar) and 3 credit hours of Master’s project course (ECE 698) that includes an oral defense examination.

The M.E. degree course option requires a minimum of 30 credit hours of courses (not including the Graduate Seminar) and a written comprehensive examination at the end of the course work. The examination is offered every fall and spring semesters, and the student needs to pass the examination in no more than two attempts. The second attempt, if necessary, should be taken at the next offered examination.

These degree programs are available to full-time and part-time students seeking to improve their professional skills in electrical and computer engineering. Students are required to complete at least one course that meets the department's mathematics requirement. The current list of courses that meet this requirement is given next.

ECE 601  Linear Systems  3
ECE 611  Numerical Methods in Engineering Analysis  3
ECE 623  Electromagnetism  3
ECE 651  Statistical Analysis and Simulation  3

The remaining courses are chosen to meet the student's career objectives. To earn a Master's degree (both M.S. and M.E.), a student needs to take at least five courses at the 600 or higher level, and no more than three courses at the 500 level. Also, no more than three graduate courses can be taken in other departments. All course selections must be reviewed by the graduate program director, and for M.S. students course selection should be made in coordination with the students' research/thesis adviser. The graduate course descriptions are included in the graduate catalog and are also listed on the department's website. Additional graduate courses are offered through the Commonwealth Graduate Engineering Program and the Virginia Consortium for Engineering and Science. All funded Master's students are required to attend Graduate Seminar (ECE 731).

Doctor of Philosophy, Engineering

Degree Description

The Department offers a strong doctoral program leading to the Doctor of Philosophy (Ph.D.), Engineering degree. The Ph.D. degree is awarded to candidates who have displayed an in-depth understanding of the subject matter and demonstrated the ability to make an original contribution to knowledge in their chosen field of specialty. A very important component of the Ph.D. degree is the original research pursued by the student which culminates in a written dissertation, as well as an oral defense of this work. Ph.D. students usually publish the result of their research in highly reputable nationally and internationally refereed journals. In addition, the students are expected to present their work at national and international conferences.

Admission Requirements

Applicants to a doctoral degree in electrical and computer engineering are expected to have completed a master's degree in electrical engineering and/ or computer engineering or a closely related technical field with a minimum grade point average of 3.5 (on a 4.0 scale) in graduate course work.

The applications are submitted through the Office of Admissions of Old Dominion University. Together with the completed application form, three letters of recommendation, transcripts from all colleges and universities attended, GRE scores, a resume, and a personal statement of objectives are required. TOEFL scores are required for international applicants. At least two of the recommendation letters should be submitted by faculty or work supervisor familiar with the applicant's graduate work. The Frank Batten College of Engineering and Technology at Old Dominion University has the Direct Bachelor-to-Ph.D. and Integrated Bachelor/Ph.D. programs that allow exceptionally well-qualified undergraduate students to apply for admission directly to a Ph.D. program. The programs are described in the college section of the catalog.

Degree Requirements

The Ph.D. degree requires:

- 24 credit hours of graduate-level courses beyond the master's degree (not including Graduate Seminar),
- 24 research credit hours,
- successful completion of a written diagnostic examination,
- successful completion of written and oral candidacy examinations,
- successful completion of dissertation research proposal, and
- successful completion and public defense of a dissertation.

The eight graduate-level courses are chosen together with the research adviser, and approved by the graduate program director. At least 1 credit hour of Graduate Seminar (ECE 831) is required too. It is required that at least five of the courses be at the 800 level (not including ECE 831), and no more than three graduate courses can be taken in other departments. Additional course work or appropriate research background may be required to meet prerequisites for courses or in preparation for the diagnostic examination. All funded students are required to enroll in ECE 831. The graduate course descriptions are included in the catalog and are also listed on the department's website. Additional graduate courses are offered through the Commonwealth Graduate Engineering Program and the Virginia Consortium for Engineering and Science. All funded Ph.D. students are required to attend Graduate Seminar (ECE 831).

All Ph.D. students are required to take the department's Ph.D. Diagnostic Examination for the first time before the end of their second semester in the Ph.D. program. The examination is offered every fall and spring semesters, and the student needs to pass the examination in no more than two attempts. The second attempt, if necessary, should be taken at the next offered examination. The topics for the examination and samples of previous examinations are posted in the department's website. The examination rules are given on the first page of each examination.

It is required that the written and oral candidacy examinations be taken in the semester when a student is completing the graduate course work or during the following semester. Once a student has completed the course work, passed the candidacy examinations, and has gained approval for the research proposal, the student advances to candidacy. It is a university requirement that students who have advanced to candidacy be enrolled for at least one credit hour every fall, spring, and summer until graduation.

Doctor of Engineering

The Department offers a Doctor of Engineering (D.Eng.) degree with concentration in Electrical and Computer Engineering in accordance with the D.Eng. program criteria and requirements specified for the Batten College of Engineering and Technology in this catalog.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
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<tbody>
<tr>
<td>CS 361</td>
<td>Advanced Data Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CS 381</td>
<td>Introduction to Discrete Structures</td>
<td>3</td>
</tr>
</tbody>
</table>