ELECTRICAL and COMPUTER ENGINEERING

Undergraduate Program Guide

Bachelor of Science in Electrical Engineering
Bachelor of Science in Computer Engineering
Supplement to 2017 - 2018 GMU Catalog

Last Updated: 06/13/2017
BACHELOR OF SCIENCE DEGREE PROGRAMS

IN

ELECTRICAL ENGINEERING

AND

COMPUTER ENGINEERING

The undergraduate Electrical Engineering (EE) and Computer Engineering (CpE) programs are offered by the Electrical and Computer Engineering Department (ECE). All university policies and program requirements for both majors can be found by visiting http://catalog.gmu.edu.

This program guide contains supplemental information that describes the course progression and degree requirements of undergraduate ECE degree programs. It contains other useful information to guide the students in progressing through the major as smoothly as possible. Students are expected to meet all program requirements to earn the degree and to abide by Departmental and University policies as outlined here and in the catalog.
For Additional Information

Inquiries concerning Electrical and Computer Engineering programs should be directed to:

George Mason University
The Electrical and Computer Engineering Department
Nguyen Engineering Building Room 3100
MS 1G5
4400 University Drive
Fairfax, VA 22030-4444

Phone: 703-993-1569
Fax: 703-993-1601
Email: ece@gmu.edu
Web page: http://ece.gmu.edu

Facebook Page:
Latest news about the ECE Department can also be found by visiting The ECE Department at the Volgenau School of Engineering facebook page:

https://www.facebook.com/EceDepartmentAtGmu

LinkedIn:
Connect with ECE students, faculty and alumni on LinkedIn.

https://www.linkedin.com/in/gmuece/
Program Educational Objectives of the Electrical Engineering and Computer Engineering Programs

Graduates of the Electrical Engineering and the Computer Engineering programs are expected within three to five years of graduation to have:

- Established themselves as successful and productive engineering professionals or engaged in advanced study such as a graduate degree program.
- Worked effectively in team environments and individually.
- Fulfilled their responsibilities in the areas of ethics, continuing professional development and effective communications.

Electrical Engineering and Computer Engineering Student Outcomes

Below are student outcomes that prepare graduates to attain the electrical and computer engineering program educational objectives:

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
The Mason Honor Code

Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

The link below contains further information about the GMU honor code. All students are expected to fully understand the honor code and to abide by it:
http://oai.gmu.edu/

IEEE Code of Ethics

All Electrical and Computer engineering students should strive to adopt and abide by the IEEE code of ethics stated below throughout their education in the ECE department. The code of ethics reproduced here is aimed at increasing awareness and familiarizing students about ethical issues and for providing guidelines of ethical and professional behavior in their chosen field of study. They are expected to continue to abide by this ethical code once they transition to a career upon graduation from the program.

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

- To accept responsibility in making decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
- To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
- To be honest and realistic in stating claims or estimates based on available data;
- To reject bribery in all its forms;
- To improve the understanding of technology; its appropriate application, and potential consequences;
- To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
- To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
- To treat fairly all persons and to not engage in acts of discrimination based on race, religion, gender, disability, age, national origin, sexual orientation, gender identity, or gender expression;
- To avoid injuring others, their property, reputation, or employment by false or malicious action;
- To assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

http://www.ieee.org/about/corporate/governance/p7-8.html
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BACHELOR of SCIENCE in
ELECTRICAL ENGINEERING
BACHELOR of SCIENCE in ELECTRICAL ENGINEERING

The electrical engineering program is accredited by the Engineering Accreditation Commission of ABET. The curriculum places an emphasis on developing analytical abilities and design skills in electrical engineering.

Electrical engineering is a major field of modern technology. Electrical engineers are involved in research, development, design, production, and operation of a wide variety of devices and systems, including integrated circuits and microwave and laser devices, communication systems, control systems, radar, robots, large telecommunication networks, and power networks.

The curriculum requirements include senior technical electives, advanced engineering labs and a Senior Design Project. If desired, students may choose to specialize in one of five areas offered by the department which are bioengineering, computer engineering, electronics, communications and signal processing, and control systems and robotics by declaring a concentration.

Career opportunities exist in engineering research and development, system design, system integration, engineering management, engineering consultancy, technical sales, and patent law, among others. The program provides a strong preparation for graduate study.
REQUIRED COURSES SHOWN IN A SAMPLE SCHEDULE FOR BS IN ELECTRICAL ENGINEERING

<table>
<thead>
<tr>
<th>1st Semester:</th>
<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 113 Analytic Geometry &amp; Calculus I</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>ENGR 107 Introduction to Engineering</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CS 112 Introduction to Computer Program</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ENGH 101 English Composition</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECON 103 Micro-Economics</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
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</table>

<table>
<thead>
<tr>
<th>2nd Semester:</th>
<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 114 Analytic Geometry &amp; Calculus II</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>ECE 101 Intro. to Electrical and Computer Eng.</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 160 University Physics I</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 161 University Physics I Lab</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>CS 222 Computer Programming for Engineers</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
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<th>3rd Semester:</th>
<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 213 Analytic Geometry &amp; Calculus III</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>MATH 203 Matrix Algebra</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 260 University Physics II</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 261 University Physics II Lab</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>ECE 201 Introduction to Signal Analysis</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Literature Mason Core Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>4th Semester:</th>
<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MATH 214 Elementary Differential Equations</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 285 Electric Circuit Analysis I*</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ECE 220 Signals and Systems I</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ECE 331 Digital System Design</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 332 Digital Systems Design Lab</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>HIST 100 History of Western Civilization</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>or HIST 125, Introduction to World History</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A - GMU requires at least 45 hours of courses numbered 300 or above to be submitted as part of the degree requirements. If you transferred to GMU, you may need to take extra course work to meet this requirement. Note, **transfer courses labeled with an "L" in the GMU equivalent course number do not count towards the 45 hours of "300 level or above" courses**. See the Department Academic Advisor if you have any credit hours of "L" labeled transfer courses that you are intending to apply towards the GMU BSEE degree, to discuss your options.

B - Volgenau School requires 24 hours of approved social science and humanities course work. This is normally satisfied by the 24 hours of Mason Core courses. All transfer students, even those with associates or bachelor degrees, must also meet this requirement. This may require taking additional course work to meet this requirement.

C - If you qualify for a substitution or waiver of ECE 101 you must get a written/email statement from the Department Academic Advisor approving the course that will fill in for the missing credit hours due to the waiver or the list of course/s that are going to be substituted in place of the ECE-101 requirement. A copy of this approval must be submitted when you submit your Department Graduation Application package. **If you are unable to provide this documentation, the ECE department has the right to refuse the waiver and you may be required to enroll in the course to complete the missing program requirement.**
### 5th Semester:

<table>
<thead>
<tr>
<th>Course</th>
<th>Lec. Hrs</th>
<th>Lab Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 421 Classical Systems and Control Theory</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 286 Electric Circuit Analysis II*</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ECE 333 Linear Electronics I</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 334 Linear Electronics I Lab</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>STAT 346 Probability for Engineers</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>COMM 100 Intro to Oral Communications</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>or COMM 101 Interpersonal and Group Interaction</td>
<td></td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

**Total Credits:** 16

### 6th Semester:

<table>
<thead>
<tr>
<th>Course</th>
<th>Lec. Hrs</th>
<th>Lab Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 433 Linear Electronics II</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 445 Computer Organization</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 460 Communication and Information Theory</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ENGH 302 Advanced Composition (natural sciences and tech)</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 15

### 7th Semester:

<table>
<thead>
<tr>
<th>Course</th>
<th>Lec. Hrs</th>
<th>Lab Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts Mason Core Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 305 Electromagnetic Theory</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Advanced Engineering Lab</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Technical Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Global Understanding Mason Core Elective</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECE 491 Engineering Senior Seminar</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ECE 492 Senior Advanced Design Project I</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

**Total Credits:** 15

### 8th Semester:

<table>
<thead>
<tr>
<th>Course</th>
<th>Lec. Hrs</th>
<th>Lab Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 493 Senior Advanced Design Project II</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Advanced Engineering Lab</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Technical Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Technical Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 262 University Physics III</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 263 University Physics III Lab</td>
<td></td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total Credits:** 13

**Notes:**

- **D** - Students are strongly encouraged to try to plan a math sequence that will allow taking MATH 214 (Differential Equations) prior to ECE 220. i.e. Summer classes, AP credits.

- **E** - Students desiring to "lighten" their course load during the 6th semester are suggested to consider taking only two or three of these courses depending on their interests or need for the corresponding course material as prerequisites for specific technical electives to be taken in the 7th or 8th semester, or for their Senior Design Project. Students planning on postponing ECE 460 are advised to move STAT 346 into the semester just before taking ECE 460 (substituting a course such as ECE 305 or a non-technical Mason Core elective course for the relocated 5th semester STAT 346 Probability course).

- **F** – Advanced lab courses can be selected from the list below:
  - ECE 429 Control Systems Lab (Spring semester only)
  - ECE 434 Linear Electronics II Lab
  - ECE 461 Communication Engineering Lab
  - ECE 467 Network Implementation Lab
  - ECE 447 **Single-Chip Microcomputer**
  - ECE 448 **FPGA and ASIC Design with VHDL (Spring semester only)**
  - ECE 435 Digital Circuit Design Lab**

  **(credit for one technical elective and one advanced laboratory course)**
***The ECE 435 Lab is offered very infrequently

G - Technical Electives which students may select from the 300-400 level (and with permission 500 level) courses are listed on pages 6 - 7 for their 12 hours of Technical Electives. One Technical Elective may be selected from outside of ECE. The decision to approve non-ECE courses as well as graduate courses as technical electives is at the discretion of the department based on a review of the course content and the student's academic record. Please contact ECE Associate Chair, Dr Pelin Kurtay (paksoy@gmu.edu) to obtain permission. Students have the option of choosing a concentration area to be shown on their transcript by selecting their Technical Electives from one of the Concentrations outlined on pages 10 - 12 and submitting a Change of Major form prior to their graduation semester to declare the concentration.

H - The Global Understanding elective, the Arts elective and the Literature elective should be selected from the Provost’s list of approved Mason Core courses listed under each category by visiting the Provost’s website: http://catalog.gmu.edu/mason-core/

I - The Mason Core Synthesis requirement is met by satisfactory completion of ECE 492/493.

J - Students must complete each ECE, ENGR, BENG, CS, MATH, PHYS and STAT course presented as part of the required 121 credits for the degree with a grade of C or better.

Furthermore, students must also complete any course required by the program that is a prerequisite to another course applicable to the degree with a grade of C or better.

K- ECE 491 and 492 require the prior completion of at least 90 credit hours of coursework applicable to the major and all ECE 2xxx courses as a prerequisite. If this requirement is not met prior to ECE 491 or ECE 492, registration in these courses will be denied.

Students who would like to complete a more challenging senior design project have the option of enrolling in ECE 392 to gain a semester head start in the design process.

L - *Note that ECE 285/ECE 286 courses taken at GMU prior to fall 2013 or transferred to GMU prior to Fall 2014 do NOT meet the circuit analysis requirement. Students who fit in either category should contact the department as soon as possible to discuss their options.
Electrical Engineering Progression of Core Courses

This is not a suggested schedule. It only illustrates dependencies and shows courses in earliest possible semester.

*) Math 203 can be taken concurrently with ECE 220
Catalog Year 2017/2018

<table>
<thead>
<tr>
<th>Prerequisite</th>
<th>Co-Requisite</th>
<th>Co-Requisite +</th>
<th>Recommended</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must be taken in sequence</td>
<td>Should be taken concurrently but not earlier</td>
<td>Suggested to be taken in sequence</td>
<td>Strongly recommended to be taken in sequence</td>
<td>Courses between dashed lines can be taken concurrently</td>
</tr>
</tbody>
</table>
## BSEE TECHNICAL ELECTIVE COURSES

### Senior Level Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits : Lect. Hrs : Lab Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 350</td>
<td>Embedded Systems and Hardware Interfaces</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 370</td>
<td>Robot Design</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 410</td>
<td>Applications of Discrete-Time Signal Processing</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 422</td>
<td>Digital Control Systems (offered infrequently)</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 430</td>
<td>Principles of Semiconductor Devices</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td></td>
<td>(offered infrequently)</td>
<td></td>
</tr>
<tr>
<td>ECE 431</td>
<td>Digital Circuit Design</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 446</td>
<td>Device Driver Development</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 447</td>
<td>Single-Chip Microcomputers</td>
<td>(4:3:3)</td>
</tr>
<tr>
<td></td>
<td>(credit for one technical elective and one advanced laboratory course)</td>
<td></td>
</tr>
<tr>
<td>ECE 448</td>
<td>FPGA and ASIC Design with VHDL</td>
<td>(4:3:3)</td>
</tr>
<tr>
<td></td>
<td>(credit for one technical elective and one advanced laboratory course)</td>
<td></td>
</tr>
<tr>
<td>ECE 450</td>
<td>Introduction to Robotics</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 462</td>
<td>Data and Computer Communications</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 463</td>
<td>Digital Communications Systems</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 465</td>
<td>Computer Networking Protocols</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 470</td>
<td>Introduction to Humanoid Robotics</td>
<td>(3:3:0)</td>
</tr>
<tr>
<td>ECE 499</td>
<td>Special Topics in Electrical Engineering</td>
<td>(3:3:0)</td>
</tr>
</tbody>
</table>

Some graduate courses and courses outside the ECE department may be taken to fulfill the technical elective requirement with the permission of the department. The decision to approve non-ECE courses as well as graduate courses as technical electives is at the discretion of the department based on a review of the course content and the student's academic record. Please contact ECE Associate Chair, Dr Pelin Kurtay (paksoy@gmu.edu) to obtain permission if you decide to pursue this option.
## TECHNICAL ELECTIVES and ADVANCED LABS LISTED by ELECTRICAL ENGINEERING AREA

### COMMUNICATIONS and NETWORKS

<table>
<thead>
<tr>
<th>Course</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>ECE 410</td>
<td>Applications of Discrete-Time Signal Processing</td>
</tr>
<tr>
<td>ECE 461</td>
<td>Communication Engineering Laboratory</td>
</tr>
<tr>
<td>ECE 462</td>
<td>Data and Computer Communication</td>
</tr>
<tr>
<td>ECE 463</td>
<td>Digital Communication Systems</td>
</tr>
<tr>
<td>ECE 465</td>
<td>Computer Networking Protocols</td>
</tr>
<tr>
<td>ECE 467</td>
<td>Network Implementation Lab</td>
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</table>

### COMPUTERS

<table>
<thead>
<tr>
<th>Course</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 431</td>
<td>Digital Circuit Design</td>
</tr>
<tr>
<td>ECE 435</td>
<td>Digital Circuit Design Lab</td>
</tr>
<tr>
<td>ECE 446</td>
<td>Device Driver Development</td>
</tr>
<tr>
<td>ECE 447</td>
<td>Single-Chip Microcomputer</td>
</tr>
<tr>
<td>ECE 448</td>
<td>FPGA and ASIC Design with VHDL</td>
</tr>
<tr>
<td>ECE 450</td>
<td>Introduction to Robotics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 470</td>
<td>Introduction to Humanoid Robotics</td>
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</table>

<table>
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<tr>
<th>Course</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>CS 471</td>
<td>Operating Systems</td>
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### CONTROL SYSTEMS

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>ECE 422</td>
<td>Digital Control Systems</td>
</tr>
<tr>
<td>ECE 429</td>
<td>Control Systems Laboratory</td>
</tr>
<tr>
<td>ECE 447</td>
<td>Single-Chip Microcomputers</td>
</tr>
<tr>
<td>ECE 450</td>
<td>Introduction to Robotics</td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>ECE 470</td>
<td>Introduction to Humanoid Robotics</td>
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### ELECTRONICS

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>ECE 430</td>
<td>Principles of Semiconductor Devices</td>
</tr>
<tr>
<td>ECE 431</td>
<td>Digital Circuit Design</td>
</tr>
<tr>
<td>ECE 434</td>
<td>Linear Electronics II Laboratory</td>
</tr>
<tr>
<td>ECE 435</td>
<td>Digital Circuit Design Lab</td>
</tr>
<tr>
<td>ECE 447</td>
<td>Single-Chip Microcomputer</td>
</tr>
<tr>
<td>ECE 448</td>
<td>FPGA and ASIC Design with VHDL</td>
</tr>
<tr>
<td>ECE 461</td>
<td>Communications Engineering Lab</td>
</tr>
</tbody>
</table>
BSEE DEGREE CONCENTRATION REQUIREMENTS

Bioengineering, Communications/Signal Processing, Computer Engineering, Control Systems, and Electronics are areas of concentration that are available, but optional, within the electrical engineering Program. Completion of specific courses and submitting a Change of Major form declaring the concentration will lead to one of these designations on the student's transcript upon graduation.

BIOENGINEERING

The bioengineering concentration for EE students focuses on bioinstrumentation. Students will gain familiarity with living systems, and the challenges of taking measurements from such systems. This concentration provides a strong basis upon which to build a variety of careers, such as bioengineering, biomedical engineering, medical electronics or medical school.

Students must complete (with a grade of C or better):

- BENG 301 – Bioengineering Measurements (3)
- BENG 302 Bioengineering Measurements Lab (1)
- ECE 434 Linear Electronics II Laboratory, or
- ECE 429 Control Systems Laboratory
- ECE 492/493 Senior Advanced Design Project (bioengineering topic)

and two courses from the following:

- BENG 304 Modeling and Control of Biomedical Systems (3)
- BENG 313 Physiology for Engineers (3)
- BENG 406 Introduction to Biomechanics (3)
- BENG 420 Bioinformatics for Engineers (3)
- BENG 525 Neural Engineering (3)
- BENG 538 Medical Imaging (3)
- BENG 499 Special Topics in Bioengineering (0-4, minimum 3 credits needed)
- BENG 590 Selected Topics in Bioengineering (3)
- ECE 499 Special Topics in Electrical Engineering (0-4, bioengineering topic only; minimum 3 credits needed)
- ECE 590 Selected Topics in Engineering (3, bioengineering topic)

NOTE: All 499 and 590 special topics courses must be pre-approved by an advisor. Students in the bioengineering concentration should make sure they will have at least 45 upper division credits by the time they graduate. Additional upper level coursework may be necessary if they fall short of this requirement.

COMMUNICATIONS/SIGNAL PROCESSING

This concentration is for students who want to develop their knowledge of signal processing and communication systems and engineering. The student will learn the underlying, mathematically based theory of communication systems and signals, and experience the hardware aspects of communication systems in the lab. Students can develop in-depth knowledge of signal processing, data and digital communication, optical communication, or random processes as related to communication engineering.

Students must complete (with a grade of C or better):

- ECE 461 Communication Engineering Laboratory
- ECE 492/493 Senior Advanced Design Project (Communications or signal processing topic)
and three courses from the following:

- ECE 410 Applications of Discrete-Time Signal Processing
- ECE 462 Data and Computer Communications
- ECE 463 Digital Communication Systems
- ECE 465 Computer Networking Protocols
- ECE 499 Special Topics in Electrical Engineering (Communications or signal processing topic only; Must be preapproved by advisor)
- ECE 528 Intro. to Random Processes in Electrical and Computer Engineering
- ECE 535 Digital signal processing
- ECE 567 Optical Fiber Communications
- ECE 590 Selected Topics in Elec. and Comp. Engr. (Communications or signal processing topic; Must be preapproved by advisor)
- PHYS 306 Wave Motion and Electromagnetic Radiation

**COMPUTER ENGINEERING**

This concentration is for students who want to develop their knowledge of computer systems and engineering. The student will learn the varied concepts of computer architectures, design and interfacing, and experience the hardware aspects of microcomputer systems in the lab. Students can develop in-depth knowledge of digital circuit design, computer design and interfacing, microprocessor systems, advanced computer architectures and machine theory, or operating systems.

Students must complete (with a grade of C or better):

- ECE 447 Single-Chip Microcomputers (includes Advanced Lab)
- ECE 492/493 Senior Advanced Design Project (computer engineering or digital design topic)

and two courses from the following:

- ECE 350 Embedded Systems and Hardware Interfaces
- ECE 431 Digital Circuit Design
- ECE 446 Device Driver Development
- ECE 448 FPGA and ASIC Design with VHDL (includes Advanced Lab)
- ECE 450 Introduction to Robotics
- ECE 470 Introduction to Humanoid Robotics
- ECE 499 Special Topics in Electrical Engineering (Must be preapproved by advisor)
- ECE 510 Real-Time Concepts
- ECE 548 Sequential Machine Theory
- ECE 590 Selected Topics in Elec. and Comp. Engr. (Must be preapproved by advisor)
- CS 471 Operating Systems

**CONTROL SYSTEMS**

This concentration is for students who want to develop their knowledge of control systems. The student will learn the underlying, mathematically based, theory of control systems, and will experience the hardware aspects of control systems in the lab. Students can develop in-depth knowledge of digital control systems, microprocessor control, robotics, linear systems theory, random processes, or neural networks.

Students must complete (with a grade of C or better):

- ECE 429 Control systems Laboratory
- ECE 492/493 Senior Advanced Design Project (control systems or robotics topic)

and three courses from the following:

- ECE 370 Robot Design
ECE 422 Digital Control Systems  
ECE 447 Single-Chip Microcomputers (includes Advanced Lab)  
ECE 450 Introduction to Robotics  
ECE 470 Introduction to Humanoid Robotics  
ECE 499 Special Topics in Electrical Engineering (Must be preapproved by advisor)  
ECE 511 Microprocessors  
ECE 521 Modern Systems Theory  
ECE 528 Intro. to Random Processes in Electrical and Computer Engineering  
ECE 590 Selected Topics in Elec. and Comp. Engr. (Must be preapproved by advisor)

**ELECTRONICS**

This concentration is for students who want to develop their knowledge of microelectronics or photonics/electromagnetic theory. Students will further their knowledge of linear and digital electronics and experience the hardware aspects of advanced analog or detailed digital circuit design in the lab. Students can develop an in-depth knowledge of device electronics; analog and digital circuit or system design; or advanced photonics/electromagnetic theory.

Students must complete (with a grade of C or better):
- **ECE 434** Linear Electronics II Laboratory, or
- **ECE 435** Digital Circuit Design Laboratory
- **ECE 492/493** Senior Advanced Design Project (analog or digital design, devices or electromagnetism topic)

and three courses from:
- **ECE 430** Principles of Semiconductor Devices
- **ECE 431** Digital Circuit Design
- **ECE 447** Single-Chip Microcomputers (includes Advanced Lab)
- **ECE 448** FPGA and ASIC Design with VHDL (includes Advanced Lab)
- **ECE 499** Special Topics in Electrical Engineering (Must be preapproved by advisor)
- **ECE 513** Applied Electromagnetic Theory
- **ECE 565** Introduction to Optical Electronics
- **ECE 567** Optical Fiber Communications
- **ECE 584** Semiconductor Device Fundamentals
- **ECE 586** Digital Integrated Circuits
- **ECE 587** Design of Analog Integrated Circuits
- **ECE 590** Selected Topics in Elec. and Comp. Engr. (Must be preapproved by advisor)
- **PHYS 306** Wave Motion and Electromagnetic Radiation
- **PHYS 308** Modern Physics with Applications
CHANGES to the BSEE DEGREE PROGRAM and IMPACT on NOVA STUDENTS

A number of accommodations have been arranged with NOVA to minimize the impact on Northern Virginia Community College (NOVA) students transferring to the EE program at GMU. Changes and notes on their impact on NOVA students:

1. ECE 101, Introduction to Electrical and Computer Engineering, for BSEE program will be waived if transfer courses include NOVA required EGR 251, Electric Circuits I and EGR 255, Electric Circuits Lab. The 3 credit hours will need to be made up. See the Department Academic Advisor. Students who have completed only EGR 251 and EGR 252 without EGR 255 do not qualify for the ECE 101 waiver and should plan on taking ECE 101 at GMU in order to gain relevant hands-on lab experience.

2. ECE 285, Electric Circuit Analysis I may be satisfied by NOVA required EGR 251, Electric Circuits I and EGR 255, Electric Circuits Lab. ECE 286, Electric Circuit Analysis II may be satisfied by NOVA required EGR 252, Electric Circuits II and EGR 255, Electric Circuits Lab. ECE 285 and ECE 286 maybe satisfied by NOVA required EGR 251 and EGR 252 and EGR 255. Students who have completed only EGR 251 and EGR 252 without EGR 255 do not qualify for the ECE 101 waiver and should plan on taking ECE 101 at GMU in order to gain relevant hands-on lab experience.

3. NOVA EGR 265 Digital Logic, will not satisfy the BSEE or BSCpE requirement for ECE 331/332. It will transfer as equivalent to ECE L301, Digital Electronics, which does not satisfy any BSEE or BS CpE requirement.

4. Students transferring to George Mason, under the GAA-Guaranteed Admission Agreement will be considered to have met the Mason Core requirements of ENGH 101, Literature, HIST 100/125, Fine Arts and Global Understanding. These students will still need to satisfy the BSEE requirement for COMM 100/101, ECON 103 and ENGH 302 (natural sciences and technology section) by taking the George Mason courses or equivalent transfer courses. Students transferring to George Mason without a GAA will need to meet all the Mason Core courses required at the time of admission to George Mason.

5. A student with a prior Bachelor’s degree from an accredited institution in the U.S. may also have satisfied the GMU Mason Core requirements of ENGH 101, ENGH 302, Literature, HIST 100/125, Arts and Global Understanding. These students will still need to satisfy the BSEE requirement of COMM 100/101 and ECON 103. See the Department Academic Advisor for more details.

7. All students, regardless of any prior AS or BS degree must present 24 credit hours of approved non-technical course work for any degree within Volgenau School. See the Department Academic Advisor if you have a question regarding this requirement.
BACHELOR of SCIENCE in COMPUTER ENGINEERING
BACHELOR of SCIENCE in COMPUTER ENGINEERING

The computer engineering program is accredited by the Engineering Accreditation Commission of ABET. The computer engineering curriculum incorporates an innovative approach to the integration of science and engineering components of Electrical Engineering, the abstract mathematical concepts and programming aspects of Computer Science and humanities and social science requirements. The major distinction between Computer Engineering and Computer Science is that Computer Engineering is more concerned with the physical implementation of computing devices, the interaction between hardware and software, and the methodologies for designing digital systems.

Career opportunities exist in engineering research and development, product design, digital system design and integration, engineering management, engineering consultancy, technical sales, and patent law, among others. The program provides a strong preparation for graduate study.
REQUIRED COURSES SHOWN IN A **SAMPLE** SCHEDULE FOR B.S. IN COMPUTER ENGINEERING

<table>
<thead>
<tr>
<th>1st Semester:</th>
<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 113 Analytic Geometry &amp; Calculus I</td>
<td>4</td>
<td>4</td>
<td></td>
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<tr>
<td>ENGR 107 Introduction to Engineering</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CS 112 Intro to Computer Programming</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ENGH 101 English Composition</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECON 103 Micro-Economics</td>
<td>3</td>
<td>3</td>
<td></td>
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<td></td>
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<thead>
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<th>2nd Semester:</th>
<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 114 Analytic Geometry &amp; Calculus II</td>
<td>4</td>
<td>4</td>
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<tr>
<td>MATH 125 Discrete Mathematics</td>
<td>3</td>
<td>3</td>
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<tr>
<td>PHYS 160 University Physics I</td>
<td>3</td>
<td>3</td>
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<tr>
<td>PHYS 161 University Physics I Lab</td>
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<tr>
<td>CS 211 Object Oriented Programming</td>
<td>3</td>
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<td></td>
</tr>
<tr>
<td>ECE 101 Intro. to Electrical and Computer Eng.</td>
<td>3</td>
<td>2</td>
<td>3</td>
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<td></td>
<td></td>
<td></td>
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<thead>
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<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
<th>Credits</th>
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<tr>
<td>MATH 213 Analytic Geometry &amp; Calculus III</td>
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<tr>
<td>MATH 203 Matrix Algebra</td>
<td>3</td>
<td>3</td>
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<tr>
<td>PHYS 260 University Physics II</td>
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</tr>
<tr>
<td>PHYS 261 University Physics II Lab</td>
<td>3</td>
<td>1</td>
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<tr>
<td>ECE 201 Introduction to Signal Analysis</td>
<td>3</td>
<td>2</td>
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<tr>
<td>Literature Elective</td>
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<th>4th Semester:</th>
<th>Lec. Hrs.</th>
<th>Lab Hrs.</th>
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<tbody>
<tr>
<td>MATH 214 Elementary Differential Equations</td>
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<td>3</td>
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<tr>
<td>ECE 285 Electric Circuit Analysis I*</td>
<td>3</td>
<td>2</td>
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<tr>
<td>ECE 220 Signals and Systems I</td>
<td>3</td>
<td>2</td>
<td>3</td>
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<tr>
<td>ECE 331 Digital System Design</td>
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<td>ECE 332 Digital Systems Design Lab</td>
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<tr>
<td>CS 222 Computer Programming for Engineers</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

A - GMU requires at least 45 hours of courses numbered 300 or above to be submitted as part of the degree requirements. If you transferred to GMU, you may need to take extra course work to meet this requirement. Note, **transfer courses labeled with an "L" in the GMU equivalent course number do not count towards the 45 hours of "300 level or above" courses.** See the Department Academic Advisor if you have any credit hours of "L" labeled transfer courses that you are intending to apply towards the GMU BSEE degree, to discuss your options.

B - Volgenau School requires 24 hours of approved social science and humanities course work. This is normally satisfied by the 24 hours of Mason Core courses. All transfer students, even those with associates or bachelor degrees, must also meet this requirement. This may require taking **additional** course work to meet this requirement.

C - Students are strongly encouraged to try to plan a math sequence that will allow taking MATH 214 (Differential Equations) **prior** to ECE 220, i.e. Summer classes, AP credits.
5th Semester:

<table>
<thead>
<tr>
<th>Course</th>
<th>Lec. Hrs</th>
<th>Lab Hrs</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ECE 333 Linear Electronics I</td>
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<td></td>
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<tr>
<td>ECE 334 Linear Electronics I Lab</td>
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</tr>
<tr>
<td>ECE 445 Computer Organization</td>
<td>3</td>
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</tr>
<tr>
<td>ECE 286 Electric Circuit Analysis II*</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CS 310 Data Structures</td>
<td>3</td>
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<tr>
<td>ENGH 302 Advanced Composition (For natural sciences and tech)</td>
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6th Semester:

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<tbody>
<tr>
<td>ECE 448 FPGA and ASIC Design with VHDL</td>
<td>3</td>
<td>3</td>
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<tr>
<td>CS 471 Operating Systems</td>
<td>3</td>
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<td>3</td>
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<tr>
<td>COMM 100 Public Speaking or COMM 101 Interpersonal and Group Interaction</td>
<td>3</td>
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<td>3</td>
</tr>
<tr>
<td>PHYS 262 University Physics III</td>
<td>3</td>
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<tr>
<td>STAT 346 Probability for Engineers</td>
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7th Semester:

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<th>Lec. Hrs</th>
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<tbody>
<tr>
<td>ECE 492 Senior Advanced Design Project I</td>
<td>1</td>
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<tr>
<td>ECE 447 Single Chip Microcomputers</td>
<td>3</td>
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<tr>
<td>Technical Elective</td>
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<td></td>
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</tr>
<tr>
<td>HIST 100 History of Western Civilization or HIST 125, Introduction to World History</td>
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<tr>
<td>ECE 491 Engineering Senior Seminar</td>
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<tr>
<td>Global Understanding Elective</td>
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8th Semester:

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<th>Lec. Hrs</th>
<th>Lab Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 493 Senior Advanced Design Project II</td>
<td>2</td>
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<td>2</td>
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<tr>
<td>ECE 465 Computer Networking Protocols</td>
<td>3</td>
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<td>3</td>
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<tr>
<td>Technical Elective</td>
<td>3</td>
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</tr>
<tr>
<td>Technical Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Arts Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

D - If you qualify for a substitution or waiver of ECE 101 you must get a written/email statement from the Department Academic Advisor approving the course that will fill in for the missing credit hours due to the waiver or the list of course/s that are going to be substituted in place of the ECE-101 requirement. A copy of this approval must be submitted when you submit your Department Graduation Application package. **If you are unable to provide this documentation, the ECE department has the right to refuse the waiver and you may be required to enroll in the course to complete the missing program requirement.**

E - The Technical Electives requirement is satisfied by a student selecting one of the **pre-approved** technical electives specialization areas and completing three courses listed in the selected specialization area.

A student may, with the prior approval of one of the Computer Engineering Advisors (Drs. Kaps, Gaj, Lorie, Homayoun, Sasan or Chen) or Department Associate Chair, create an **individualized technical course listing** by selecting a coherent sequence of three technical electives. This would require the student to fill out the Computer Engineering Custom Specialization Area Form and obtain the approval of one of the computer engineering advisors prior to taking the listed courses.

**F -** The Global Understanding elective, the Arts elective and the Literature elective should be selected from the Provost’s list of approved Mason Core courses listed under each category by visiting the Provost’s website: [http://catalog.gmu.edu/mason-core/](http://catalog.gmu.edu/mason-core/)

**G -** The Mason Core Synthesis requirement is met by satisfactory completion of ECE 492/492.

**H -** Students must complete each ECE, ENGR, BENG, CS, MATH, PHYS and STAT course presented as part of the required 126 credits for the degree with a grade of C or better.

Furthermore, students must also complete any course required by the program that is a prerequisite to another course applicable to the degree with a grade of C or better.

**I -** ECE 491 and 492 require the prior completion of at least 90 credit hours of coursework applicable to the major and all ECE 2xxx courses as a prerequisite. If this requirement is not met prior to ECE-491 and ECE-492, registration in these courses will be denied.

Students who would like to complete a more challenging senior design project have the option of enrolling in ECE 392 to gain a semester head start in the design process.

**J -** *Note that ECE 285/ECE 286 courses taken at GMU prior to fall 2013 or transferred to GMU prior to Fall 2014 do NOT meet the circuit analysis requirement. Students who fit in either category should contact the department as soon as possible to discuss their options.*
Computer Engineering Progression of Core Courses

This is not a suggested schedule. It only illustrates dependencies and shows courses in earliest possible semester.

---

Prerequisite:
- Must be taken in sequence

Co-Requisite:
- Should be taken concurrently but not earlier

Co-Requisite +
- Suggested to be taken in sequence

Recommended:
- Strongly recommended to be taken in sequence

Semester:
- Courses between dashed lines can be taken concurrently

---

BSCPE COURSE PROGRESSION CHART

Catalog Year 2017/2018

*) Math 203 can be taken concurrently with ECE 220
COMPUTER ENGINEERING PRE-APPROVED TECHNICAL ELECTIVE SPECIALIZATIONS COURSE LISTINGS

Note that the pre-approved specialization areas listed below may be used to select technical electives by computer engineering students and do not require the prior approval or completion of any form. Once a specialization area is selected, students need to select three courses from that specific specialization area only. Some graduate courses may be taken to fulfill the technical elective requirement with the permission of the department. The decision to approve graduate courses as technical electives is at the discretion of the department based on a review of the course content and the student's academic record. Please contact ECE Associate Chair, Dr Pelin Kurtay (paksoy@gmu.edu) to obtain permission if you decide to pursue this option.

ROBOTICS AND EMBEDDED SYSTEMS

Select three of the following courses:

Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 350</td>
<td>Embedded Systems and Hardware Interfaces</td>
<td>CS 222, ECE 280, 285 or BENG 380, ECE 301 or ECE 331 and 332</td>
</tr>
<tr>
<td>ECE 370</td>
<td>Robot Design</td>
<td>ECE 220, CS 222, ECE 280, 285 or BENG 380, ECE 301 or ECE 331 and 332</td>
</tr>
<tr>
<td>ECE 421</td>
<td>Classical Systems and Control Theory</td>
<td>ECE 220</td>
</tr>
<tr>
<td>ECE 446</td>
<td>Device Driver Development</td>
<td>ECE 445</td>
</tr>
<tr>
<td>ECE 450</td>
<td>Introduction to Robotics</td>
<td>CS 112, ECE 280, 331,and 332 or 301</td>
</tr>
<tr>
<td>ECE 470</td>
<td>Introduction to Humanoid Robotics</td>
<td>CS 112, ECE 280 or ECE 285 or BENG 380, ECE 331 and ECE 332 or ECE 301</td>
</tr>
<tr>
<td>ECE 510</td>
<td>Real-Time Concepts</td>
<td>ECE 450 or 447</td>
</tr>
<tr>
<td>ECE 530</td>
<td>Sensor Engineering</td>
<td></td>
</tr>
</tbody>
</table>

COMPUTER NETWORKS

Select three of the following courses:

Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 460</td>
<td>Communication and Information Theory</td>
<td>ECE 220, STAT 346</td>
</tr>
<tr>
<td>ECE 462</td>
<td>Data and Computer Communications</td>
<td>ECE 220, STAT 346, ECE 331</td>
</tr>
<tr>
<td>ECE 463</td>
<td>Digital Communications Systems</td>
<td>ECE 460</td>
</tr>
<tr>
<td>IT 466</td>
<td>Network Security II</td>
<td>See CpE faculty</td>
</tr>
</tbody>
</table>
### SIGNAL PROCESSING

Select three of the following courses:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 320 Signals and Systems II</td>
<td>ECE 220</td>
</tr>
<tr>
<td>ECE 410 Applications of Discrete-Time Signal Processing</td>
<td>ECE 320, STAT 346</td>
</tr>
<tr>
<td>ECE 460 Communications and Information Theory</td>
<td>ECE 220, STAT 346</td>
</tr>
<tr>
<td>ECE 535 Digital Signal Processing</td>
<td>ECE 320 and STAT 346</td>
</tr>
</tbody>
</table>

### INTEGRATED CIRCUITS

Select three of the following courses:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 430 Principles of Semiconductor Devices</td>
<td>ECE 305, 333, MATH 214</td>
</tr>
<tr>
<td>ECE 431 Digital Circuit Design</td>
<td>ECE 331, 333</td>
</tr>
<tr>
<td>ECE 433 Linear Electronics II</td>
<td>ECE 333</td>
</tr>
<tr>
<td>ECE 565 Introduction to Optical Electronics</td>
<td>ECE 305 and 333</td>
</tr>
</tbody>
</table>
COMPUTER ENGINEERING TECHNICAL ELECTIVES FOR A CUSTOM SPECIALIZATION AREA

Note that CpE majors can create a custom specialization area with prior approval of a computer engineering faculty advisor by filling out the “Computer Engineering Custom Specialization Area Form” available on the following ECE website or at the ECE Department office:

CHANGES to BSCPE DEGREE PROGRAM and IMPACT on NOVA STUDENTS

A number of accommodations have been arranged with Northern Virginia Community College (NOVA) to minimize the impact on NOVA students transferring to the CPE program at GMU. Changes and their impact on NOVA students:

1. ECE 101, Introduction to Electrical and Computer Engineering for BSCpE program will be waived if transfer courses include NOVA required EGR 251, Electric Circuits I and EGR 255, Electric Circuits Lab. The 3 credit hours will need to be made up. See the Department Academic Advisor. Students who have completed only EGR 251 and EGR 252 without EGR 255 do not qualify for the ECE 101 waiver and should plan on taking ECE 101 at GMU in order to gain relevant hands-on lab experience.

2. ECE 285, Electric Circuit Analysis I may be satisfied by NOVA required EGR 251, Electric Circuits I and EGR 255, Electric Circuits Lab. ECE 286, Electric Circuit Analysis II may be satisfied by NOVA required EGR 252, Electric Circuits II and EGR 255, Electric Circuits Lab. ECE 285 and ECE 286 maybe satisfied by NOVA required EGR 251 and EGR 252 and EGR 255. Students who have completed only EGR 251 and EGR 252 without EGR 255 do not qualify for the ECE 101 waiver and should plan on taking ECE 101 at GMU in order to gain relevant hands-on lab experience.

3. NOVA EGR 265, Digital Logic, will not satisfy the BSEE or BSCpE requirement for ECE 331/332. It will transfer as equivalent to ECE L301, Digital Electronics, which does not satisfy any BSEE or BS CpE requirement.

4. Students transferring to George Mason, under the GAA-Guaranteed Admission Agreement will be considered to have met the Mason Core requirements of ENGH 101, Literature, HIST 100/125, Fine Arts and Global Understanding. These students will still need to satisfy the BSEE requirement for COMM 100/101, ECON 103 and ENGH 302 (natural sciences and technology section) by taking the George Mason courses or equivalent transfer courses. Students transferring to George Mason without a GAA will need to meet all the Mason Core courses required at the time of admission to George Mason.

5. A student with a prior Bachelor’s degree from an accredited institution in the U.S. may also have satisfied the GMU Mason Core requirements of ENGH 101, ENGH 302, Literature, HIST 100/125, Arts and Global Understanding. These students will still need to satisfy the BSEE requirement of COMM 100/101 and ECON 103. See the Department Academic Advisor for more details.

6. All students, regardless of any prior AS or BS degree must present 24 credit hours of approved non-technical course work for any degree within Volgenau School. See the Department Academic Advisor if you have a question regarding this requirement.
ACCELERATED MASTER’S PROGRAMS in EE and CpE

The B.S/Accelerated MS programs are intended for those highly capable students who are interested in immediately continuing their undergraduate academic program in electrical or computer engineering into a graduate program in their respective discipline. This program allows for the completion of both a Bachelor’s degree and a Master’s degree within a shorter amount of time than it would take to complete each degree separately. Students in the BS in Bioengineering program may be considered for the accelerated MS in electrical engineering.

Admission
1. Students in the electrical engineering program or computer engineering program should apply for the accelerated MS/BS program in EE or CpE, during the semester in which they expect to complete 90 undergraduate credits applicable toward the BS degree, but no later than their next-to-last semester.
2. An overall **GPA of at least 3.25** at the time of application is required.
3. Criteria for admission to the accelerated MS/BS program in EE or CpE is identical to the criteria for admission to the MS EE or MS CpE programs.
4. Application is made using an Accelerated Program application form specifying up to 6 hours of graduate courses to be applied to the undergraduate degree and detailing the undergraduate GPA required for approval.

Degree Requirements
1. Students must complete at least 24 credit hours beyond those required by their undergraduate degree that satisfy all the requirements for both the BS degree and the MS degree.
2. Students will take up to 6 credit hours of 500 level courses either as part of their technical electives or substituting for required courses as part of their 120+ credit hour undergraduate program. Students taking 6 credit hours will need to submit 24 credit hours of approved graduate work to earn the MS degree. Students taking 3 credit hours will need to submit 27 credit hours for the MS degree. The specific graduate courses that may be taken as part of the accelerated program and applied to the undergraduate degree will be specified by the ECE Department for the EE program and for the CpE program.
3. Students in the BS/Accelerated MS program may request to take additional graduate level courses (beyond the six hours described above) as technical electives, as part of the 120+ credit hours required for the BS degree. These additional graduate level courses will be considered part of the 120+ credit hour BS degree and will not count toward the MS degree. Students will still need to complete 24 or 27 credit hours beyond the 120+ hour BS degree in order to earn the MS degree.

Degree Conferral
1. Students in the accelerated MS/BS program may apply to have the BS (in EE or CpE) conferred during the semester in which they expect to complete the BS requirements.
2. The MS degree will be awarded upon completion of the MS requirements.
DOUBLE MAJORS

Double Majors are possible for students who want a stronger or broader academic background. Combinations of majors that are popular include: EE/Physics, EE/Math, CpE/Computer Science, CpE/EE, EE/Computer Science, EE/Mechanical Engineering, CPE/Mechanical Engineering. Completion of a Double Major requires that all the requirements of both majors be satisfied. Since the engineering programs are very structured with minimal flexibility, a student is strongly advised to start work on the Double Major early by researching the requirements of both majors and talking to advisors for both majors. Sample Schedules for double majors are available in the ECE Department. George Mason requires that at least 18 hours of courses different from (in addition to) those submitted as part of the 120+ hours needed to earn the BS degree with the first major or those submitted for a minor must be presented in order to be awarded the second major as part of the BS degree.

MINORS IN BUSINESS, COMPUTER SCIENCE, MATH, PHYSICS AND OTHERS

In addition to the minors listed below, students may want to consider other minors offered by other Departments across the University such as: Bioinformatics, Computational and Data Sciences, Computer Game Design, Data Analysis, Entrepreneurship Practice, Entrepreneurship Studies, Geographic Information Systems, Leadership, Renewable Energy Interdisciplinary, Software Engineering, Sustainability Studies and Systems Engineering and Operations Research Minor. The requirements for all minors can be found in the George Mason University catalog. Requirements for the minor may be obtained by consulting the catalog and doing a “what-if analysis” to generate a degree audit.

Mechanical Engineering Minor: The ME minor is available to CpE and EE students who would like to obtain knowledge and understanding in the mechanical engineering discipline, especially in relation to electro-mechanical systems.

Computer Science (CS) Minor: The CS Minor is suggested for Electrical/Computer Engineering students who want to further increase their knowledge of the computer science discipline.

Physics Minor: The Physics Minor is suggested for those students who want to increase their knowledge of physics as it applies to computer or electrical engineering.

Math Minor: The Math Minor is suggested for those students who want to increase their knowledge of basic and theoretical math which can be applied to engineering problems.

Business Minor: The Business Minor is suggested for those students who want to increase their knowledge of processes and techniques used in the business world.
GENERAL INFORMATION FOR ALL ECE STUDENTS

Read this program guide (cover to cover) and the GMU Catalog. Plan on checking the ECE website regularly. Advisor-Advisee listings, changes in degree requirements, student organizations events, and many other useful information is available.

ACADEMIC STATUS

Academic Status is determined using the cumulative GPA and the number of credit hours (GMU attempted, transfer, AP, credit by exam) a student has on their GMU record. Having a cumulative GPA less than a 2.00 results in an Academic Status designation ranging from Warning to Suspension, depending on the student’s Credit Level. Credit Level includes credit hours of the original course as well as the repeat course when a student repeats a specific course. The Cumulative GPA is determined only by the credit hours and grade of the most recent course, however all attempts at the course appear on the transcript. Students are responsible for being aware of their Credit Hour Level and the corresponding GPAs for Warning, Probation and Suspension. For full details go to the Registrar’s website or link directly via:

http://registrar.gmu.edu/students/academic-standing/

REPEATING A COURSE

George Mason allows undergraduate students to repeat (almost) any course for a new grade. Upon completion of the repeated course the old grade will be “flagged” as “Excluded from cumulative GPA”, but will remain on the transcript. The new grade will become part of the cumulative GPA, even if it is lower than the previous grade! This Repeat policy can help a student increase their GPA, particularly if a low GPA was due to D or F grades. Repeating a course by taking it away from George Mason (i.e. at NOVA) will not remove the Mason grade from the cumulative GPA. See also REPEATING VOLGENAU SCHOOL COURSES.

REPEATING VOLGENAU SCHOOL COURSES

Students can take a Volgenau School course two times without any restrictions. However to take a Volgenau course for a third time requires the approval of the Department offering the course. Before the offering Department will approve such a request, a BSEE or BSCpE student must first get the written approval of their own academic advisor and the ECE Associate Chair.

TERMINATION FROM THE MAJOR

No math, science, or Volgenau School of Engineering course that is required for the major may be attempted more than three times. Those students who do not successfully complete such a course within three attempts will be terminated from the major. To be a successful completion, a student must earn a grade of C or better. Grades of C-, D or F are all considered not-successful completions. If Terminated from the Major, a student is assigned the status of University Undeclared and can apply for
acceptance into another major department (although admission may be challenging, depending on the
departmental policies in place). For more information, see the Termination from the Major section
under Academic Standing in the George Mason University catalog.

**GENERAL ADVICE**

Listen to friends, believe faculty.

Math is vital: get understanding, not merely grades.

You will definitely need knowledge learned in prerequisite courses when you take subsequent courses.
Do not do a memory dump as you walk out of a final exam. Master the knowledge and skills. You can
easily fail a course if you do not have full knowledge of the prerequisite course material

Plan on spending about three hours of time "studying" for each hour of time you spend in a technical class
(math, physics, computer science, engineering). To succeed in engineering courses you MUST do
assigned homework (as a minimum!). This means putting pencil to paper and writing out the total
problem solution, not merely looking at the problem and thinking, "I know how to do that one."
"Reading" the textbook is not "studying".

Most faculty only *assign* enough homework to "acquaint" you with the types of material you must know
and understand, not necessarily enough homework for you to "master" the material. Hence, you should
do more problems than are assigned. Use study groups to get support with doing extra problems.

Take Probability (STAT 346) just before ECE 460 or ECE 465 (whichever you do first.) These are the
courses that use probability. If you take the math too early you will not have the familiarity with it that is
needed for success in them. Probability is hard to learn but easy to forget!

Take ECE 491, Senior Seminar, during the semester just prior to your graduation semester. Among the
many topics discussed, are resume, cover letter, and interviewing preparation. By taking the course at
this time you will be prepared to participate in the job fairs and on-campus interviewing events during
those important last two semesters of your degree program.

If you are interested in computer engineering or the computer area of electrical engineering and think you
might do a senior design project that involves microcontrollers (many, many students do!), then you need
to plan on taking ECE 447, Single Chip Microcomputers, the semester before taking ECE 492, Senior
Design Project I, or the same semester as ECE 492. It is hard to have to learn microcontroller technology
while you are implementing or designing your Senior Design Project.

The lab course associated with a lecture/lab courses pair may be taken *after* taking the lecture course
except for ECE 331 and ECE 332 which must be taken together. This allowed “lab after lecture”
includes physics lecture/lab pairs.

Do not take ENGH 302 (Natural Sciences and Technology) until after completing ECE 280/285 and ECE
331. In ENGH 302 (Natural Sciences and Technology) you will learn to write and critique writing “in the
technology” of your major. Completing the above courses will allow you to read basic electrical or
computer engineering technical journal articles.

Take COMM 100/101 before ECE 491 and ECE 492 because it is a prerequisite for both courses.
ECE 491 or ECE 492, require as a prerequisite, that a student has completed at least 90 credit hours applicable to their major, including all ECE 2xx coursework, prior to the ECE 491 or ECE 492 semester. The easiest way to determine whether you are eligible to enroll in ECE 491 or ECE 492 is to count up the credit hours needed to finish your degree program, including any courses planned for the ECE 491 or ECE 492 semester.

ADVISING

All EE and CpE students are strongly advised to see their Faculty Advisor prior to course registration each semester. Students who are considering changing their major to the electrical or computer engineering program should consult with the Volgenau School of Engineering Coordinator of Undergraduate Advising, 2500 Nguyen Engineering Building. Students may also obtain general advising through the Center for Academic Advising, Retention and Transitions: http://advising.gmu.edu/

The Role of Academic Advisors at the ECE Department

As an electrical engineering or computer engineering major you have access to two academic advisors: your Faculty Advisor (FA) and the Department Academic Advisor (DAA).

During orientation, an advisor will be available to advise you in planning your first semester. Toward the end of September (for fall) or February (for spring) of your first semester at George Mason University, an individual Faculty Advisor (FA) from the ECE Department will be assigned to you. This assignment is shown in the listing on the bulletin board outside the Department office (room 3100, Engineering Building). You will also be able to retrieve this information including the name and contact information of your assigned FA using your MASON email ID at the ECE website by using the “Lookup Advisor” tool (https://ece.gmu.edu/lookup-advisor)

Faculty Advisors have weekly office hours during which you may just walk-in for advising. If your classes conflict with your FA’s office hours, email your FA to arrange another time for your meeting, or to discuss your questions via email. If for any reason you have a problem with contacting an advisor, please inform the ECE Department office.

The Faculty Advisor is your primary source of advising and faculty contact for questions such as:

- Advice about selecting a concentration area within EE or CpE
- Course selection
- Plan of study
- Issues related to course progress
- Advice about taking a part-time or summer job that is related to your study
- Career issues
- Other issues

You are strongly advised to see your FA each semester. Two courses in the department: ECE 331 and ECE 491 have assignments that require you to meet with your advisor and obtain his or her signature on your plan of study.

Your faculty advisor plays two major roles:

- Your faculty advisor can help you with career related and academic issues such as the plan for completing your present academic program, in the selection of a
subsequent graduate degree program and in finding internships. Your faculty advisor can refer you to other faculty, specializing in other areas of electrical or computer engineering, to discuss careers or what alternative paths can be pursued upon graduation.

When you attempt to obtain employment in the workforce or decide to attend graduate school upon completion of your BS degree, you will need either references for jobs or recommendations for admissions to graduate school. If you work closely with your faculty advisor, you could get a personal recommendation, one that would be difficult to obtain in another way.

The Department Academic Advisor (DAA) is your secondary source of advising and is responsible for the more detailed and specific technical matters of advising such as:

- transfer of credits from NOVA or other colleges
- GMU equivalencies
- Selecting a major or changing your major to another
- Applicability of prerequisites, credit hours
- Providing overrides for course pre-requisites, time conflicts, etc.
- Course waivers and substitutions
- Degree evaluation prior to graduation
- Orientation sessions for incoming freshmen and transfer students

Please do not attempt to contact the DAA if you have not contacted and met with your FA first. The DAA handles specialized advising issues and is not meant to serve as a substitute for obtaining general advising by your regular FA. The DAA is Ms. Smriti Kansal. She is located in the Engineering Building room 3917 and may be contacted via email (skansal@gmu.edu) or by telephone (703-993-1510). You may visit her during walk-in office hours or contact her for an advising appointment.

The department also organizes an “Advising Day” held each semester on the Friday prior to the beginning of registration for the forthcoming semester. During advising day, all Faculty Advisors are available for walk-in advising for the duration of a few hours (usually between 1:00-4:00 p.m.)

GRADUATE DEGREE PROGRAMS

The ECE Department also offers Master of Science degrees in Computer Engineering, Electrical Engineering, Telecommunications, Computer Forensics and the PhD in Electrical and Computer Engineering. A PhD in Information Technology with a specialization in EE or CpE is offered through Volgenau School of Engineering. Separate brochures describing these degree programs are available at the ECE department office upon request. The catalog also contains degree and admissions requirements for each of these programs.

STUDY GROUPS

Three to five students who want to assist each other in any courses can form a study group. Those groups are very helpful for studying technical coursework, such as Math, Physics, CS, ECE and BENG. Group members find them academically helpful (the group can do extra problems and compare answers) and
psychologically helpful (students realize others also find the material difficult).

In a study group, students learn by teaching or being assisted by each other. They can also go as a group to an instructor for course help.

Study groups are different from group studying. They create a learning environment that is focused and group interactive.

**COOPERATIVE EDUCATION and INTERNSHIPS**

While all degree requirements must be satisfied by academic course work, recruiters are strongly and positively influenced by co-op or internship experiences. Students should plan on obtaining this experience prior to graduation. Cooperative Education, coordinated by the Career Services Office at GMU, provides students with the opportunity to integrate paid, career-related work experience with classroom learning. Internships are paid (normally) or non-paid (unusual in technical positions) work experience related to the student’s major. i.e. working in a junior electrical or computer engineering position in industry. The Career Services Office is an excellent source of internship listings so it would be highly advisable for all students to register for “HireMason”, the GMU job/internship database and to post their resumes. It is also recommended that students visit the job/internship fair held on campus once every semester as well as to attend talks given by companies visiting the campus which are regularly scheduled by Volgenau School of Engineering in collaboration with Career Services.

**SCHOLARSHIPS and FINANCIAL AID**

In addition to the usual financial aid available to all students through the Office of Student Financial Planning and Resources, CpE and EE majors are eligible to apply to various scholarships provided by professional societies and industrial organizations, such as the Armed Forces Communications and Electronics Association, and the Institute of Electrical and Electronics Engineers.

**REGISTRATION**

You will be required to register before each semester. Be on the lookout for when the schedule of classes is posted on PatriotWeb in October (for spring classes) and February (for fall classes), and see the Faculty Advisor (FA) as soon as possible. Do not wait until the week before you register as you may not be able to contact your FA in time. This will delay your registration and hence you may not get into the courses/sections you want. Take advantage of registering as soon as possible after your assigned registration time in order to get maximum advantage from your "priority" which is based on completed and in-process courses. It is your responsibility to check (i.e. a day or two after your request to make sure you are enrolled in all the courses you want and no courses that you do not want.

Some courses may need co-requisites (e.g. ECE 331 needs ECE 332). You will need to enroll in the co-requisite course first (e.g. ECE 332) before the registration system will allow you to enroll in the primary course (ECE 331).
WARNING/SUSPENSION CREDIT HOUR LIMIT

All students in Warning Status (from having designated credit hour levels and designated cumulative GPA ranges) and all students returning from Suspension are limited to no more than 13 credit hours. Be careful, any IN grade counts like an "F" for this calculation!

This GMU policy will be implemented by the Registrar two weeks before the first day of classes of each semester by automatically dropping the last course a student enrolled in, to try to drop the total hours down to 13. If necessary, additional "last course enrolled in" courses will be dropped. The automatic process does not look for 1 credit courses-it just looks at the date/time a class was enrolled in. Thus it is possible that the automatic drop could drop a student below 12 hours and trigger a potential financial aid, visa, insurance, etc. problem. For example, if such a student is enrolled for 14 hours (ECE 331[3], ECE 332[1], ECE 333[3], ECE 334[1], STAT 344[3] and ECE 320[3]) and the last course they enrolled in was ECE 320, the automatic drop would drop ECE 320[3], bringing the student down to 11 hours. Once a course is dropped the student loses all "rights" to the course. Other students can add and cause the course to close and the student who was dropped will not be able to get back in.

FORCE ADD/COURSE PERMIT/OVERRIDE

When a class is full/closed you may ask if it is possible to be added above the limit by using a "force add" (Course Permit or Capacity Override) option. Under certain exceptional circumstances the Associate Chair of the department can allow additional students (if room capacity allows) into the class by force adding them. This can be done prior to, or during the first week of classes. Students may not be force added into any lab section.

CLOSED CLASS

Class sizes are determined primarily by academic considerations, and also by the room size limit. Whenever a class (section) has been enrolled to the maximum, it becomes a closed class (section). Some departments maintain "wait lists" for selected closed classes. If you find a section is closed, be sure to check for the existence of a Waitlist or use appropriate course/section search options to see if other "unpublished", open, sections might exist, or check with the department offering the course for possible actions. See http://registrar.gmu.edu/registration/waitlist.html for details on working with Waitlists. In some cases it may be possible to add a student above the limit by using the "force add" option, but this is an exceptional action and can only be given by the Associate Chair.

OVERLOAD

If you wish to take more than 18 hours, it is considered an OVERLOAD. You will have to obtain permission from the ECE department as well as the Dean's office. You may pick up the forms and instructions at room 2501, Engineering Building, the office of the Associate Dean for Undergraduate Studies. A copy of the form is also found in the following link: http://registrar.gmu.edu/wp-content/uploads/CO.pdf
DROPPING A COURSE

If you want to drop a course you can only do so within the first 4 weeks of the Fall and Spring semesters. If you do so, it will not appear on your transcript. It is your responsibility to check (i.e. next day) and make sure any dropped course is actually dropped by the GMU computer system. Please note that the tuition penalty increases with each passing week during this time. Usually, there is no tuition penalty for courses dropped before the last day to add classes for the semester. After the 4th week, you cannot "drop" a course. See the academic calendar each semester to familiarize yourself with the add/drop dates for that semester.

You may petition through Volgenau School Associate Dean's office to "withdraw" from courses. Academic reasons ("I'm not doing well."  "I did not have the prerequisites." etc.) cannot be submitted as reasons for Dean's permission based withdrawals. You may pick up forms and instructions at room 2501, Engineering Building, the office of the Associate Dean for Undergraduate Studies. You may alternatively download the form from the registrar’s website: http://registrar.gmu.edu/forms

See also SELECTIVE WITHDRAWAL FOR UNDERGRADUATES below.

SELECTIVE WITHDRAWAL FOR UNDERGRADUATES

Undergraduates enrolled in degree programs are eligible to withdraw from a limited number of classes without dean’s approval and at the student’s own discretion. Students may process a maximum of three such elective withdrawals during their entire undergraduate career at Mason. The Withdrawal period for Fall or Spring is from the last day to drop a class through the ninth week - proportionally shorter for shorter Summer sessions. Timelines are published in the academic calendar for the given semester. The following link contains information about the selective withdrawal process as well as a link to the electronic form:
https://registrar.gmu.edu/topics/selective-withdrawal/

COURSES AT OTHER UNIVERSITIES

If you need to take a course away from George Mason (i.e. summers if you live elsewhere; if your work or other commitments conflict with a needed course) you need special permission from the Associate Chair of the ECE department, the Associate Dean of the Engineering school as well as the Dean of the college that offers the GMU course before registering at the other school or the course will not be allowed as a transfer course. For example: if you wish to take MATH 114 elsewhere, the Associate Chair of the ECE department will have to sign the form, followed by the Associate Dean of the Engineering school followed by the Dean of the College of Science at GMU. You may not take a course elsewhere if you have already taken it and earned a grade at GMU. You may download the “Permission to study elsewhere” form from the registrar’s website: http://registrar.gmu.edu/forms

TRANSFER COURSE EQUIVALENCIES

If you feel your transfer equivalency sheet does not indicate that you have received transfer credit for specific courses that would be applicable to the your degree program, or if only "elective" credit is shown for a course you feel meets a specific degree requirement, then you should contact the Department Academic Advisor. This must be done no later than the end of your first semester at George Mason.
ENGLISH EXEMPTION

It is possible to "test out" of ENGH 101 or ENGH 302 (Natural Sciences and Technology). For ENGH 101 there is a free three hour Proficiency Exam given in the summer and in January. A passing score earns a Waiver (no credit and no grade) for ENGH 101. Consequently you may need to take an approved course to make up for the missing 3 credits due to the Waiver. See the Department Academic Advisor. For ENGH 302 (Natural Sciences and Technology) there is a two part process. The first part (permited after you have completed 45 hours of academic course work) is submission of a portfolio of long and short written works. This is evaluated and if approved, the second part, a two hour written exam, is scheduled. Satisfactory completion of both parts of the process earns a Waiver (no credit and no grade) for ENGH 302 (Natural Sciences and Technology). Consequently you may need to take an approved course to make up for the missing 3 credits due to the Waiver. See the Department Academic Advisor. See the English Department (Robinson A487) if you wish to pursue either of these opportunities.

ANNUAL ACADEMIC AWARDS

Outstanding academic performance is recognized at graduation via the ECE Department Outstanding Academic Achievement Award. The Chairman’s Award is given to students who have made significant contributions in supporting the department. The ECE Department also selects one or more “Outstanding Senior Design Project” Awards each semester if truly exceptional work has been done by a senior design team. In addition to these, the ECE department has also introduced the Innovation Award. This award is given to a student or group of students who have designed something truly innovative in their field of study.

STUDENT ORGANIZATIONS

Participation in student organizations can yield valuable results in three areas. One very important capability recruiters look for, is teamwork and leadership. Student organizations provide a means to develop and demonstrate the ability to work in teams/groups and to develop leadership ability. A second important skill for engineers is the ability to communicate, including speaking to large groups. Again, this is not often a part of regular classes. Participating in student organization activities gives you the opportunity to learn and practice speaking skills. A final advantage to student organization participation is networking. Networking is interacting with others in your discipline. In student organizations you will connect to students from freshman level to about to graduate. You can take advantage of these students’ knowledge to assist in your academic program - good electives to take, when to take them. But even more important you can connect with students as they graduate from George Mason. As graduates, in industry, they know where good jobs are. You can get email addresses from them just before they graduate and then easily keep in touch with them. Connections with just three to four graduates per year for three years means you know a dozen people in many companies by the time you are looking for your first job. These are people who know you, who know the George Mason engineering curricula, who know your capabilities and most likely want to help you.

Technically related student organizations open to students include student chapters of: the Institute of Electrical and Electronic Engineers (IEEE), the Armed Forces Communications-Electronics Association (AFCEA), the National Society of Professional Engineers (NSPE), the Association of Computing Machinery (ACM), the Society of Women Engineers (SWE), the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), Information Society Movement (ISM),
and Electrical and Computer Hacking Organization (ECHO). All these organizations are open to any and all students who want to join. A list of all student organizations at Mason is available on the following link: https://getconnected.gmu.edu/organizations

GRADUATION

During your next to last semester, you need to initiate your graduation process by filling out a web-based, on-line, form. During your last semester, you need to come to the ECE Department office to pick up the rest of your graduation application material and complete a Graduation Checklist.

In order to obtain proper graduation application material if you intend to use any catalog requirements other than the ones that existed at the time you entered GMU you must file for a change of catalog year ASAP, but no later than the semester before your graduation semester. You are allowed to use any set of requirements that are published in one catalog that comes into existence during your first semester at GMU or later. You can see a Degree Evaluation by accessing your records from the GMU homepage (follow the "Students" and then the "Patriot Web or Academics <Semester Year> links) using your Web browser. Check early and often. Don't get caught missing a degree requirement!

Transfer courses marked with an L can be submitted as meeting some of the graduation requirements, but cannot be counted toward the 45 hours of 300 level or above courses which must be submitted for graduation.

GRADUATION GPA AND GRADE REQUIREMENTS

The different academic statuses (Good Status, Warning, Suspension, and Dismissal) are dependent on your cumulative GPA. You must present a cumulative GPA of 2.000 or above in order to graduate with a BSEE or BSCpE degree.

Students must complete each ECE, ENGR, BENG, CS, MATH, PHYS and STAT course presented as part of the required 120+ credits for the degree with a grade of C or better.

Furthermore, students must also complete any course required by the program that is a prerequisite to another course applicable to the degree with a grade of C or better.
# ELECTRICAL ENGINEERING DEGREE REQUIREMENTS WORKSHEET/CHECKLIST

2017-2018 CATALOG

<table>
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<tr>
<th>Completed/Grade(s)</th>
<th>Needed</th>
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## MASON CORE REQUIREMENTS (24)
- Composition: ENGH 101 (100), 302 [Nat. Sci. & Tech] (6)
- Literature: From provost list of approved courses (3)
- COMM 100/101 (3)
- ECON 103 (3)
- Western Civilization: HIST 100/125 (3)
- Arts: From provost list of approved courses (3)
- Global Understanding: From provost list of approved courses (3)

## MATHEMATICS AND BASIC SCIENCES (32)
- MATH 113, 114 (4,4)
- MATH 213, 214 (3,3)
- MATH 203 (3)
- STAT 346 (3)
- PHYS 160, 161 (3,1)
- PHYS 260, 261 (3,1)
- PHYS 262, 263 (3,1)

## ENGINEERING AND COMPUTER SCIENCES (65)
- ENGR 107 (2)
- CS 112, 222 (4,3)
- ECE 101 (3)
- ECE 201 (3)
- ECE 220 (3)
- ECE 285/286 (6)
- ECE 331, 332 (3,1)
- ECE 333, 334 (3,1)
- ECE 305 (3)
- ECE 421 (3)
- ECE 433 (3)
- ECE 445 (3)
- ECE 460 (3)
- Advanced Engineering Labs (list courses) (2)
- Senior technical electives (list courses) (12)

## Reminders:
- No C- or D grades in BENG, CS, ECE, ENGR, MATH, PHYS or STAT courses may be submitted for graduation. Students must also complete any prerequisite course to another course applicable to the degree with a grade of C or better.
- A minimum cumulative GPA of 2.000 must be presented to be approved for graduation.
- MINIMUM HOURS TO GRADUATE: 121
## COMPUTER ENGINEERING DEGREE REQUIREMENTS

### WORKSHEET/ CHECKLIST

**2017 - 2018 CATALOG**

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<tr>
<th>Completed/ Grade(s)</th>
<th>Needed</th>
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## MASON CORE REQUIREMENTS (24)

- **Composition:** ENGH 101 (100), 302 [Nat. Sci. & Tech] (6)
- **Literature:** From provost list of approved courses (3)
- **COMM 100/101 (3)**
- **ECON 103 (3)**
- **Western Civilization:** HIST 100/125 (3)
- **Arts:** From provost list of approved courses (3)
- **Global Understanding:** From provost list of approved courses (3)

## MATHEMATICS AND BASIC SCIENCES (34)

- **MATH 125 (3)**
- **MATH 113, 114 (4,4)**
- **MATH 213, 214 (3,3)**
- **MATH 203 (3)**
- **STAT 346 (3)**
- **PHYS 160, 161 (3,1)**
- **PHYS 260, 261 (3,1)**
- **PHYS 262 (3)**

## ENGINEERING AND COMPUTER SCIENCES (68)

- **ENGR 107 (2)**
- **CS 112, 211 (4,3)**
- **CS 222, 310 (3,3)**
- **CS 471 (3)**
- **ECE 101 (3)**
- **ECE 201 (3)**
- **ECE 220 (3)**
- **ECE 285/286 (6)**
- **ECE 331, 332 (3,1)**
- **ECE 333, 334 (3,1)**
- **ECE 445 (3)**
- **ECE 447 (4)**
- **ECE 448 (4)**
- **ECE 465 (3)**
- **Computer Engineering technical electives (list courses) (9)**
  1.  
  2.  
  3.  

Reminders:
- No C- or D grades in ECE, ENGR, CS, BENG, MATH, PHYS or STAT courses may be submitted for graduation. Students must also complete any prerequisite course to another course applicable to the degree with a grade of C or better.
- A minimum cumulative GPA of 2.000 must be presented to be approved for graduation.
- **MINIMUM HOURS TO GRADUATE: 126**
FULL-TIME ELECTRICAL and COMPUTER ENGINEERING FACULTY

BERRY, A.K., Associate Professor, Ph.D. University of Missouri, 1985. Growth and characterization of semiconductor materials, thin films, and photovoltaics.


EPHRAIM, Y., Professor, D.Sc. Technion-Israel Institute of Technology, Israel, 1984. Statistical signal processing; array signal processing; speech processing.

GAJ, K., Associate Professor, Ph.D., Warsaw University of Technology, Poland, 1992. Communication systems and networks; computer-network security; VLSI design and testing; VLSI CAD; computer architectures.

GRIFFITHS, L.J., Professor and Dean Emeritus, Volgenau School of Engineering, Ph.D. Stanford University, 1970. Signal processing.

HAYES, M., Chair, Electrical and Computer Engineering, and Professor, ScD., Massachusetts Institute of Technology, 1981. Signal processing, image processing, machine learning, computational cameras.

HINTZ, K.J., Associate Professor, Ph.D. University of Virginia, 1981. Microprocessors; self-organizing machines; pattern recognition; signal processing.

HOMAYOUN, H., Assistant Professor, PhD University of California Irvine, 2010. Power, thermal, and reliability-aware 3D processor architecture design; power-energy management and performance improvement; power and reliability-aware memory design optimizations.

HUANG, L., Associate Professor, PhD Virginia Tech, 2003. Power Systems, Electromechanical wave propagation


JABBARI, B., Professor, Ph.D. Stanford University, 1981. Digital communications; computer communication networks; switched telecommunication networks.

JONES, J., Associate Professor, Ph.D. George Mason University, 2008. Digital Forensics, data and intelligence analysis, malware behavior and detection, cyber warfare.

KAPS, J-P., Associate Professor, Ph.D. Worcester Polytechnic Institute, 2006. Cryptography; ultra-low power digital circuit design; computer arithmetic; efficient cryptographic algorithms; computer and network security.

KATONA, P., Professor, Sc.D. Massachusetts Institute of Technology, 1965. Biomedical engineering with emphasis on control of the cardiovascular and respiratory systems.

KURTAY, P.A., Associate Chair and Associate Professor, Ph.D. George Mason University, 2005. Engineering education; networks and telecommunications; optoelectronics; consumers and technology.

LEVIS, A.H., University Professor, Sc.D. Massachusetts Institute of Technology, 1968. Distributed intelligence systems; variable structure distributed architectures; Petri nets.


LOFARO, D. M., Assistant Professor, Ph.D. Drexel University, 2013. Complex control systems; Robotics.
LORIE, C., Associate Professor, Ph.D. University of Virginia, 2005. Analog and digital VLSI; digital systems; computer architecture.

MANITIUS, A.Z., Professor, Ph.D. Warsaw University of Technology, Warsaw, Poland, 1968. Control of time-delay; distributed parameter systems; adaptive control; computational methods in control.

MARK, B.L., Professor, PhD. Princeton University, 1995. Design and performance of computer network architectures and protocols.

MULPURI, V.R., Professor, Ph.D. Oregon State University, 1985. Large bandgap semiconductor (SiC, GaN, etc) materials, and devices (ion-implantation doping, ohmic contacts, device fabrication, material and device characterization) Semiconducting opto-electronic materials; microwave devices.

NELSON, J. K., Associate Professor, Ph.D. University of Illinois, 2005. Equalization techniques for communications in the presence of inter-symbol interference; low-complexity equalizers in a high-SNR regime; universal equalizers; digital signal processing.


OSGOOD, R., Director of MS in Computer Forensics and Associate Professor, MS Telecommunications. George Mason University, 2003. Computer forensics; cyber-crime; enterprise criminal organizations; espionage; counter-terrorism; software tools for computer forensic law enforcement.

PACHOWICZ, P., Associate Professor, Ph.D., Stanislaw Staszic Technical University (AGH), Krakow, Poland, 1984. Machine vision/perception; automatic target recognition; machine learning for engineering problems; evolving self-adaptive systems; knowledge-based systems; autonomous agents; intelligent systems; simulation and modeling; intelligent robotics.

PANDULA, S., Instructor, Ph.D. George Mason University, 2008. Communication theory; Information theory and statistical signal processing; MIMO, OFDM and CDMA systems.

PARIS, B-P., Director of MS in Telecommunications Program and Associate Professor, Ph.D. Rice University, 1990. Multiuser communications systems; multiple-access control strategies and code-division multiple-access; fading multi-path channels and traffic control.

PEIXOTO, N., Associate Professor, Ph.D. University of Sao Paulo, 2001. Neuro-engineering; biomedical engineering.

SASAN, A., Associate Professor, Ph.D. University of California, Irvine, 2010. Near-threshold computing, Approximate computing, IOT, Embedded system design

TIAN, G., Professor, Ph.D. George Mason University, 2000. Signal processing, communications, detection and estimation.

WAGE, K., Associate Professor, Ph.D. Massachusetts Institute of Technology and Woods Hole Oceanographic Institution, 2000. Signal processing and array antennas for underwater acoustic wave propagation.

ZENG, K., Associate Professor, Ph.D. Worcester Polytechnic Institute, 2008. Cyber-physical system security and privacy, physical layer security, cognitive radio networks, network forensics.

ZHANG, F., Assistant Professor, Ph.D. Michigan State University, 2014. Bioinspired Robots, Non-linear Control, Mechatronics, Underwater Vehicles