MS in Electrical Engineering & MS in Computer Engineering

Choosing a Degree Program Specialization Area & Degree Option

Useful Hints
Volgenau School of Engineering

Seven Departments:

| ECE | BENG | CS | AIT | CEIE | STAT | SEOR |

ECE – Electrical and Computer Engineering
BENG – Bioengineering
CS – Computer Science
AIT – Applied Information Technology
CEIE – Civil, Environmental and Infrastructure Engineering
STAT – Statistics
SEOR – Systems Engineering and Operations Research
Academic Programs run by the ECE Department

Undergraduate Degrees

BS in Electrical Engineering
BS in Computer Engineering

Master Degrees

MS in Electrical Engineering
MS in Computer Engineering
MS in Telecommunications
MS in Computer Forensics

PhD Degrees

PhD in Electrical and Computer Engineering
ECE Department

Programs

MS in Electrical Engineering
MS EE
- BIOENGINEERING
- COMMUNICATIONS & NETWORKING
- SIGNAL PROCESSING
- CONTROL & ROBOTICS
- MICROELECTRONICS/NANOELECTRONICS
- SYSTEM DESIGN

MS in Computer Engineering
MS CpE
- DIGITAL SYSTEMS DESIGN
- MICROPROCESSORS & EMBEDDED SYSTEMS
- DIGITAL SIGNAL PROCESSING
- COMPUTER NETWORKS
- NETWORK & SYSTEM SECURITY

Specializations
Three Degree Options

8 courses + 2 semesters of ECE 799 Master’s Thesis

OR

9 courses
+ 1 semester of ECE 798 Research Project
+ Scholarly Paper (typically equivalent to ECE 798 report)

OR

10 courses + Scholarly Paper
**MS EE**

- 2 out of 6 core courses
- Up to 8 elective courses
- Minimum: THREE 600+ courses from a chosen specialization area
- Maximum: TWO non-ECE courses (including TCOM)

**MS CpE**

- 2 out of 5 core courses
- Up to 8 elective courses
- Selected from over 40 ECE, CS, ISA, SWE, TCOM, CFRS courses
- 5 pre-approved electives separate for each specialization area
- Up to 50% of non-ECE courses
Choosing a Degree Program and Specialization Area

MS CpE vs. MS EE
<table>
<thead>
<tr>
<th>I am interested in...</th>
<th>I want to specialize primarily in...</th>
<th>Recommended program &amp; specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLSI</td>
<td>CAD tools &amp; Design Automation</td>
<td>MS CpE Digital Systems Design</td>
</tr>
<tr>
<td>Digital Systems Design</td>
<td>Hardware Description Languages</td>
<td></td>
</tr>
<tr>
<td>ASICs &amp; FPGAs</td>
<td>FPGAs &amp; Reconfigurable computing</td>
<td></td>
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<tr>
<td>VHDL/Verilog</td>
<td>Computer Arithmetic</td>
<td></td>
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<tr>
<td>CAD Tools</td>
<td>Front-end ASIC Design</td>
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<tr>
<td></td>
<td>(algorithmic downto gate level)</td>
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<tr>
<td>Reconfigurable</td>
<td>Back-end ASIC Design</td>
<td></td>
</tr>
<tr>
<td>Computing</td>
<td>(circuit and mask layout levels)</td>
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<tr>
<td>Microelectronics</td>
<td>Analog &amp; Digital Circuit Design</td>
<td></td>
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<tr>
<td>VLSI Fabrication</td>
<td>VLSI Fabrication</td>
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<tr>
<td>Nanoelectronics</td>
<td>Microelectronics</td>
<td></td>
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<tr>
<td>Semiconductor Devices</td>
<td>Nanoelectronics</td>
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<td>MS EE Microelectronics/</td>
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<tr>
<td></td>
<td></td>
<td>Nanoelectronics</td>
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<tr>
<td>I am interested in...</td>
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<td>Recommended program &amp; specializations</td>
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<tr>
<td>Communications,</td>
<td>Application layer</td>
<td>MS CpE</td>
</tr>
<tr>
<td>Computer Networks,</td>
<td>Network Security</td>
<td>Computer Networks</td>
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<tr>
<td>Networking,</td>
<td>Performance analysis &amp; evaluation</td>
<td>MS EE</td>
</tr>
<tr>
<td>Telecommunications,</td>
<td>Network layer</td>
<td>Communications &amp; Networking</td>
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<tr>
<td>etc.</td>
<td>Link layer</td>
<td></td>
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<tr>
<td></td>
<td>Physical layer</td>
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<td></td>
<td>Communication theory</td>
<td></td>
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<tr>
<td>I am interested in…</td>
<td>I want to specialize primarily in…</td>
<td>Recommended program &amp; specialization</td>
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<tr>
<td>Computer Architecture</td>
<td>Computer architecture</td>
<td>MS CpE Microprocessors &amp; Embedded Systems</td>
</tr>
<tr>
<td>Microprocessors</td>
<td>Microprocessors</td>
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<tr>
<td>Microcontrollers</td>
<td>Microcontrollers</td>
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<tr>
<td>Embedded Systems</td>
<td>Embedded systems</td>
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<tr>
<td>Real Time Systems</td>
<td>Real-time systems</td>
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<tr>
<td>Robotics</td>
<td>Robotics</td>
<td></td>
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<tr>
<td>Control</td>
<td>Control systems</td>
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<tr>
<td></td>
<td>Optimal control theory</td>
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</tbody>
</table>

**Recommended program & specialization**

- MS CpE Microprocessors & Embedded Systems
- MS EE Control & Robotics
I am interested in ...

Recommended program & specialization

Algorithms and transformations of Digital Signal Processing

Algorithms and transformations of Digital Image Processing

Design, modeling, and analysis using Matlab

Implementation of DSP algorithms using microprocessors, microcontrollers, and digital signal processors

Implementation of DSP algorithms using ASICs

Implementation of DSP algorithms using FPGAs
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<thead>
<tr>
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<tr>
<td><strong>Computer Network Security</strong></td>
<td><strong>MS CpE</strong></td>
</tr>
<tr>
<td>Cryptography</td>
<td>Network and System Security</td>
</tr>
<tr>
<td>Performance and implementation aspects of security systems</td>
<td></td>
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<tr>
<td>Implementations of cryptography in software and/or hardware</td>
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<tr>
<td>Attacks against implementations</td>
<td></td>
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<tr>
<td>Systems architecture design</td>
<td><strong>MS EE</strong></td>
</tr>
<tr>
<td>System integration and architecture evaluation</td>
<td>Architecture Based System Integration</td>
</tr>
</tbody>
</table>
MS CpE
Specialization Areas
Summary
<table>
<thead>
<tr>
<th>Pre-Approved Electives</th>
<th>Suggested Electives</th>
<th>Professors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CpE</strong></td>
<td><strong>CpE</strong></td>
<td><strong>K. Gaj, H. Homayoun, J. Kaps, T. Storey</strong></td>
</tr>
<tr>
<td>ECE 545 Digital System Design with VHDL</td>
<td>ECE 510 Real-Time Concepts</td>
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<tr>
<td>ECE 586 Digital Integrated Circuits</td>
<td>ECE 511 Microprocessors</td>
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<tr>
<td>ECE 645 Computer Arithmetic</td>
<td>ECE 611 Advanced Microprocessors</td>
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<tr>
<td>ECE 681 VLSI Design for ASICs</td>
<td>ECE 612 Real-Time Embedded Systems</td>
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<tr>
<td>ECE 682 VLSI Test Concepts or ECE 699 Digital Signal Processing Hardware Architectures</td>
<td>ECE 641 Computer System Architecture</td>
<td></td>
</tr>
<tr>
<td>ECE 584, 684, ... (technology)</td>
<td>CS 540, 583 (languages, algorithms)</td>
<td></td>
</tr>
<tr>
<td>ECE 511, 611, ... (microprocessors)</td>
<td>CS 635 (parallel machines)</td>
<td></td>
</tr>
<tr>
<td>ECE 646, 746, ... (applications)</td>
<td>ECE 542, 642, 742 (networks)</td>
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<tr>
<td></td>
<td>ECE 645, 681 (digital design)</td>
<td></td>
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<td></td>
<td>ECE 548 (sequential mach. theory)</td>
<td></td>
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<td>Suggested Electives</td>
<td>Professors</td>
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</tr>
<tr>
<td><strong>CpE</strong> Computer Networks</td>
<td><strong>CpE</strong> Network and System Security</td>
<td><strong>CpE</strong></td>
</tr>
<tr>
<td>ECE 542 Computer Network Architectures and Protocols</td>
<td>ECE 646 Cryptography and Computer Network Security</td>
<td></td>
</tr>
<tr>
<td>ECE 642 Design and Analysis of Computer Networks</td>
<td>ECE 746 Advanced Applied Cryptography</td>
<td></td>
</tr>
<tr>
<td>ECE 646 Cryptography and Computer Network Security</td>
<td>ISA 656 Network Security</td>
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<tr>
<td>ECE 742 High-Speed Networks or ECE 741 Wireless Networks</td>
<td>ECE 899 Cryptographic Engineering</td>
<td></td>
</tr>
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<td><strong>Pre-Approved Electives</strong></td>
<td><strong>Suggested Electives</strong></td>
<td><strong>Professors</strong></td>
</tr>
<tr>
<td>CS 672, CS 756 (performance)</td>
<td>ISA 562, 564, 674, 765, 767 (network security)</td>
<td>K. Gaj, J. Kaps</td>
</tr>
<tr>
<td>ECE 746, 899 (security)</td>
<td>ECE 642, 741, 742 (computer networks)</td>
<td></td>
</tr>
<tr>
<td>ECE 511, 611 (microprocessors)</td>
<td>ECE 545, 645 (hardware implementations)</td>
<td></td>
</tr>
<tr>
<td>ECE 531, 630, 633, 731, 732, 733, 737, 739 (communications)</td>
<td>ECE 511, 611 (microprocessors)</td>
<td></td>
</tr>
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<td>Pre-Approved Electives</td>
<td>Suggested Electives</td>
<td>Professors</td>
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</table>
| ECE 535 Digital Signal Processing  
ECE 545 Digital System Design with VHDL  
ECE 645 Computer Arithmetic  
ECE 699 Digital Signal Processing Hardware Architectures  
ECE 537 Introduction to Digital Image Processing or  
ECE 768 Advanced Digital Signal Processing | ECE 681 (ASIC)  
ECE 511, 611 (microprocessors)  
ECE 528 (math background)  
ECE 635, 754 (advanced DSP)  
CpE Graduate Coordinator

Kris Gaj

Responsibilities:

• admission decisions

• initial interviews with the potential candidates helping them to choose the right specialization area

• keeping a record of students pursuing particular specialization areas and graduating within a given specialization area

• approving transfers between two specialization areas

• dealing with any exceptional circumstances.
Transfers and Degree Requirements
Transfer between Programs

• possible only after one semester of studies at GMU

• requires permission from the directors of the proposed and the current programs

• especially easy within the ECE Department, i.e., between the MS EE and MS CpE programs

Transfer of Credit

In order to be applied to a given specialization area, all course credits transferred from
- other universities
- non-degree status
must be approved by the student’s advisor prior to being presented for the final approval
to the Department Chair.

Limitations:
- up to 12 credit hours, including courses taken at GMU in non-degree status
- all courses taken within 6 years of first enrollment at GMU
- grade of B or better
Plan of Study

A tentative plan of study must be submitted by each student to the student’s advisor and the main ECE office no later than before the end of the second semester in the degree program at GMU.
Degree Requirements

- total degree GPA of 3.0 (B) or better (degree GPA takes into account only courses applied toward graduation)

- no more than two C grades applied toward graduation

- graduate students who receive grades of F in two courses, or nine credit hours of unsatisfactory grades (C or worse) are very likely to be dismissed from the university. Exceptions are extremely rare.
Seminar Requirements

• minimum of 10 approved departmental seminars
• recorded on the attendance sheet and in the personal record
Choosing an Option within a Degree

MS EE & MS CpE
MS EE & MS CpE

- **MS Thesis Option**
  - 8 courses
  - ECE 799 Master’s Thesis (6 cr. hrs)

- **Research Project Option**
  - 9 courses
  - ECE 798 Research Project
  - Scholarly paper

- **Scholarly Paper Option**
  - 10 courses
  - Scholarly paper
Master’s Thesis (1)

Recommended for students interested in research and considering pursuing Ph.D. studies in the future

Topic typically proposed by a faculty member. Topics suggested by a student and/or related to the student’s job allowed

RA positions available for selected topics

Student works closely with his/her academic advisor, for at least two semesters

Conference/journal publication expected as a result of the student’s research
Master’s Thesis (2)

Student must register (and pay for) at least 6 credit hours of ECE 799 Master’s Thesis

After registering for ECE 799 once, the students must register for at least one credit hour of ECE 799 every Spring and Fall semester until they graduate.

Oral defense open to general public in front of a three-faculty-member thesis committee.

Temporary grades for all but last ECE 799 are IP = In Progress. These grades are changed after the successful defense to S – Satisfactory.

Taking ECE 799 does not affect your GPA.
Scholarly Paper (1)

Mandatory for all students who choose not to write an MS research thesis.

Survey of new technologies, new methodologies, or new applications. Comparative analysis or case study.

Topic typically proposed by a faculty member. Topics suggested by a student and/or related to the student’s job allowed.

Student works with minimum supervision of the professor.

The role of the professor is to verify that the scholarly paper meets the requirements for graduation. The professor is under no obligation to approve the paper.
Scholarly Paper (2)

The paper must follow accepted standards for
- English
- technical writing
- citation of references
- GMU Honor Code.

The paper should be delivered to the advisor at least five weeks before the end of the classes in the given semester.

A seminar should be presented in front of the advisor and one additional faculty member.

The seminar should be announced at least two weeks before the presentation date.
Rules regarding all written work

• Honor Code
  – Do not copy other student’s work
  – Do not copy from the web without using quotation marks around copied work
  – Usually no more than 40% of content may be directly quoted
  – All quotations must have a reference cited
  – ECE students are sent to the honor court each year

Based on Prof. Allnutt, TCOM Fall 2006 Orientation, telecom.gmu.edu, Aug. 2006
Rules regarding all written work

- Honor Code
  - Do not copy other students’ work
  - Do not copy from the web without using quotation marks around copied work
  - Usually no more than 40% of content may be directly quoted
  - All quotations must have a reference cited

- About 1% of TCOM students are sent to the honor court each year

Based on Prof. Allnutt, TCOM Fall 2006 Orientation, telecom.gmu.edu, Aug. 2006
Funding Your Education
Options available for international students

- Teaching Assistantships (TA)
- Research Assistantships (RA)
- Work on Campus
ECE Teaching Assistantships

10 or 20 hours per week
Salary + out-of-state to in-state tuition release

Grading, recitations, and labs for selected
ECE undergraduate and a few ECE and TCOM graduate courses

About 20 20-hr-per-week positions available each semester.
Applications need to be submitted to the
ECE main office before the end of the preceding semester

Preference given to senior students maintaining good GPA,
with no C’s or F’s

Practical skills, such as documented knowledge of
Matlab, PSpice, VHDL, Aldec Active HDL, Xilinx ISE, FPGA boards,
microcontrollers, measurement equipment, etc. very welcome
VSE Teaching Assistantships

20 hours per week
Salary + out-of-state to in-state tuition release

Limited number of positions available in the VSE Labs
   - system administrators (requires documented experience
     in administration of systems running Windows, Unix, or
     Linux)
   - lab monitors.
Decisions made by the Director of Computing Resources,
Mr. Jonathan Goldman.
Applications need to be submitted to Mr. Goldman before
the end of the preceding semester.

Limited number of TA positions available in other Departments;
rarely granted to ECE students.
Research Assistantships

10 or 20 hours per week, salary + tuition

Research in the area of interest of a given ECE faculty member

Work on a research grant of a given professor

Candidates selected individually by each professor

Preference given to students maintaining good GPA, with no C’s or F’s, with excellent grades in courses taught by the given faculty member

Documented practical skills and experience in the area of research of the given faculty member very welcome

MS Thesis option, earlier publications, and PhD plans a plus

Very rarely granted to students in the first semester of their studies
Work on Campus

Up to 20 hours per week, salary, no tuition

Requirement to take 9 credit hours per semester to maintain the full-time status

Available positions
- department offices
- GMU library
- post-office
- computer labs
- bookstore
- cafeteria, etc.
Tips-n-Hints for Success

Graduate courses require much more outside work/study than undergraduate courses. You may want to limit your enrollment to just one course if you work full time, and two courses if you work part time.

Higher level courses require a larger amount of work than lower level courses and build on material from the lower level courses.

Courses with projects are particularly time consuming. Try to take no more than one such course per semester if possible.

Your degree is not a race. Get understanding, not just a credit. Give yourself enough time for each subject.
Tips-n-Hints for Success – cont.

Plan your courses ahead. Talk with your advisor. Make your plan of study coherent. Avoid a mere hodge-podge of various courses.

Study groups are particularly helpful, but be aware of the GMU honor code rules.

Start early; if you fail the first midterm or the first project, it might be already impossible to catch up.

Talk with instructor and your advisor if you start to think you might be having problems (academic or personal).

Listen to friends, believe faculty.
Thank you!

Questions???