Everything You Ever Wanted to Know About Graduate School*

*(but were afraid to ask)*

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Electrical and Computer Engineering
Auburn University
What Questions Should I Ask?

- What is graduate school?
- Why should I go?
- What degree(s) do I want?
- When should I go?
- Where should I go?
- How do I get in?
- How long will it take to finish?
- How am I going to pay for it?
- What are my opportunities in Auburn’s ECE Department?
- Where can I find more information?
What is graduate school?

• **Advanced study beyond the bachelors degree**
  – usually focus on a specialized area
  – build on foundation from previous study
  – many programs prepare you to do research

• “**Professional**” schools prepare for practice of a specific profession
  – law, medicine, dentistry, pharmacy
Why should I go to grad school?

- **Career/Vocational Goals** (*Study the market!*)
  - Does the job require an advanced degree?
  - improve/update skills & marketability
  - change careers (mobility)
  - higher salary/greater potential for advancement

- **Personal fulfillment**
  - love of the field
  - satisfy intellectual curiosity
  - the challenge of mastering a field

- **Postpone facing the “real world”??**
What degree(s) do I want?

• **Masters Degree**
  – higher starting salary
  – increased responsibility (immediate impact)
  – thesis (research) vs. non-thesis options

• **Doctoral Degree**
  – requires a research dissertation
  – needed for university faculty
  – research-oriented company/agency

• **Master of Business Administration (M.B.A.)**
  – if interested in engineering management

• **Professional Degree**: law, medicine, etc.
Graduate Degrees in ECE at Auburn University

• Master of Science (MS)
  – Requires coursework, research & thesis

• Master of Electrical Engineering (MEE)
  – Requires coursework & project (non-thesis)
    (Coursework-only, effective Fall 2014)

• Doctor of Philosophy (PhD)
  – Requires publishable research & dissertation
Starting salaries for engineering

Forbes: EE 3rd best field for masters degree improving salary

2013: EE-BS $63,400, CPE-BS $71,700
EE-MS $67,200, CPE-MS 73,900
Where should I go?

• First decide what you want to study
  – “electrical engineering” is too general
  – more specific: “wireless network security”

• Research the school’s reputation/activity in your technical interest area
  – Professors working in that area
  – publications & research funding in that area
  – courses taught in that area
  – research facilities, computing labs, library
  – industrial partnerships
  – who hires the graduates
Other considerations

- Availability of financial assistance
- Level of faculty/student interaction
- Degree requirements (credit hours, thesis vs. non-thesis, time to completion)
- Other – geographic location, extracurricular activities, cost of living, size of school
- Multiple degrees from the same school?
  - grad courses build on lower-level courses
  - different schools provide different perspectives
- *Apply to several schools!*
When should I go?

• **Right after bachelors degree?**
  – have academic “momentum” and discipline
  – fewer responsibilities when younger
  – improve marketability for first job
  – hard to give up a job later to return to school

• **After gaining work experience?**
  – work experience provides more perspective
    • better understanding of your field
    • learn what problems need to be solved/researched
  – may be “burned out” after 16+ years of school
  – can save money for school and/or pay off debts
  – **employer might pay for school**
How do I get in?

• **Request materials** (indicate desired program)
• **Submit application and fee**
• **Other items you may be asked to provide:**
  – Official transcripts (have your registrar send them)
  – Graduate Record Exam (GRE) scores
  – Letters of recommendation
    • address your skills, dedication, accomplishments, potential
  – A “statement of purpose”
    • explain your area of interest, experience, reason for applying
  – Your resume
What is the admissions committee looking for?

• **Evidence of academic potential**
  – grades* - especially math, science & engineering courses
  – reputation of school(s) attended
  – GRE scores*
  – TOEFL scores* (if international)
    
    *some departments require minimum GPA/GRE

• **Motivation for graduate study**
  – statement of purpose
  – recommendation letters
  – other scholarly activity (undergrad research, etc.)

• **Background** (areas of previous study)
Auburn ECE Masters Program
Entrance Requirements

• Bachelors degree in ECE or closely-related field from an accredited program
• GPA of accepted applicants usually > 3.0
  – lower GPAs can be offset by outstanding GRE scores and/or recommendation letters
• GRE general test
• TOEFL exam (international applicants)
• *Exceptional undergrad’s can apply for direct admission to ECE doctoral program*
Graduate school entrance tests

- **GRE** – engineering & most other disciplines
  - General test has verbal, quantitative, and writing sections (V/Q scored 130-170 on each section, W scored 1-6)
  - Some schools may require a “subject test”
  - [www.gre.org](http://www.gre.org) for test dates/places/info

- **TOEFL** – required for international applicants
  - some allow IELTS – *Int’l English Lang. Test Syst.*)

- **Professional/business schools** (instead of GRE)
  - GMAT for Business School
  - LSAT for Law School
  - MCAT for Medical School

- **Fundamentals of Engineering (FE)** – for professional registration (not a grad school requirement)
How long will it take?

• “It depends...”
  – degree requirements
  – work responsibilities (assistantship, job)
  – availability of courses
  – time for thesis/dissertation research and writing
  – your level of dedication

• Time to complete a masters degree
  – typically about 2 years if doing a thesis
  – non-thesis programs can take less time if full load taken every semester

• Doctoral degree typically 3-5 years
  – depends on time to research and write a dissertation
Masters degree requirements

- Typically about 30 semester credit hours
  - might require a set of “core” courses (plus electives)
  - might be entirely elective
- Thesis option:
  - identify a problem, conduct research, write the thesis
  - “defend” the thesis in front of a committee
- Non-thesis option:
  - might require coursework only
  - might require a “project”
  - might require a comprehensive exam (oral and/or written)
Auburn ECE Masters Degree Requirements

• 30-33 credits of 6000/7000 course work
  – at least 21 credits in major area & 24 credits at Auburn
  – at least one course in each of three ECE areas

• M.S. degree (30 credits) includes:
  – 4 to 6 hours of research & thesis (ELEC 7990)
  – final oral exam, defending the thesis

• M.E.E. degree (33 credits) includes:
  – 3-credit project (ELEC 7980)
  – written and oral project reports serve as the final exam
    (“Thesis” is published, “Project” report is not)
Auburn ECE Ph.D. Degree Requirements

• 60 semester hours beyond B.S.
  – At least 30 hours of graded graduate course work (6000-level or higher)
  – At least 30 additional hours of graduate course work (10 hours of 8990, ungraded, etc.)

• At least 30 hours at Auburn

• 9 hours in a minor area
  – Within or outside of ECE

• Dissertation
How am I going to pay for it?

- **Graduate assistantship** – receive stipend/tuition for work in the department
  - Teaching (conduct labs, grade papers, etc.)
  - Research
- **Fellowships** (university or external)
  - often grants not tied to specific work obligations
- **Loans** (use wisely – consider level of personal debt)
- **Outside employment**
- **Employer-sponsored**
Graduate Teaching Assistants

• GTAs assist with undergraduate instruction
  – laboratory sessions, grading homework

• Stipend depends on work load
  – typical is 1/6 time work load per lab section
    (varies with lab/grading assignment)
  – 1/3 time stipend = $853/month (1st yr. ECE M.S.)

• 1/3 -time or higher GTAs ($808/month) qualify for tuition waiver
  – Up to 40 hours (MS), 43 hours (MEE)
  – Up to 80 hours (PhD)
Graduate Research Assistants

- GRAs assist faculty in research activities
- Appointed by faculty with funded projects
- Stipend is a function of work load, as assigned by the appointing faculty member
  - 1/3 time = $1122/month (1st yr. ECE M.S.)
- 1/3-time or higher GRAs ($808/month) qualify for tuition waiver
  - Up to 40 hours (MS), 43 hours (MEE)
  - Up to 80 hours (PhD)
Samuel Ginn College of Engineering
Woltosz Fellowships

- **Dean's Fellowship:**
  - Offered by the college of engineering.
  - Minimum stipend of $32,000 per year plus tuition fellowship and are renewable.

- **College Fellowship:**
  - Awarded to outstanding applicants throughout the college.
  - Minimum stipend of $24,000 per year plus tuition fellowship and are renewable.

- **Departmental Fellowship:**
  - Offered to top candidates in each engineering department
  - Minimum stipends of $20,000 per year plus tuition fellowship and are renewable.
Auburn University
Electrical & Computer Engineering

Graduate Faculty and Programs
## U.S. News & World Report Graduate Program Rankings

### Electrical and Computer Engineering

<table>
<thead>
<tr>
<th>Electrical Engineering Programs:</th>
<th>2005</th>
<th>2006</th>
<th>2013</th>
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<tbody>
<tr>
<td>Auburn University</td>
<td>55th</td>
<td>49th</td>
<td>51st</td>
</tr>
</tbody>
</table>

- Table showing rankings for Auburn University in Electrical Engineering programs from 2005 to 2013.
ECE Graduate Enrollment
(Fall semesters, 1998-2013)

Electrical and Computer Engineering Graduate Enrollment
(Fall Semester)

2013: PhD  67
      MS  131
      Total 198
ECE Research Expenditures

ECE Research Expenditures

$0
$1,000,000
$2,000,000
$3,000,000
$4,000,000
$5,000,000
$6,000,000
$7,000,000
$8,000,000
$9,000,000

Total Expenditure

$0
$1,000,000
$2,000,000
$3,000,000
$4,000,000
$5,000,000
$6,000,000
$7,000,000
$8,000,000
$9,000,000

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$9,000,000

2000...
2001...
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2009...
2010...
2011...
2012...

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The ECE “Stems”  
(loose organization of the 27 faculty)

Electronics:  
microelectronics, amplifiers, analog, digital, and RF integrated circuits, MEMS …

Digital Signal Processing & Communications:  
massage of complex electrical signals for information extraction, compression, correction …

Wireless:  
wireless and wireless data transmission, signal modulation, coding theory, information theory …

Automatic Control Systems:  
electronic feedback techniques for process control, motor control, aerodynamics …

Electromagnetics:  
generation and reception of electromagnetic waves, antennas, lasers, radar …

Power Engineering:  
generation, transmission, distribution of electricity for commercial and residential …

Logic & Computing Devices:  
architecture, VLSI design, testing, hardware, and software for computers and peripherals …

Circuits & Systems:  
basic electrical circuit network theory, analysis of electrical signals …
Major Research Focus Areas in ECE

- MEMS (MicroElectroMechanical Systems)
- SiGe (Silicon-Germanium)
- VLSI design and test
- NanoTechnology
- High-performance computing
- Electric power engineering
- Electronic packaging
- Wireless networks
- Security
- Signal processing
- Smart antennas
ECE Research Sponsors

**Government**
- AFOSR
- ARO
- DARPA
- DOE
- NASA
- NIH
- NSF
- ONR
- Sandia National Labs

**Industry**
- Diamler/Chrysler
- Henkel
- IBM
- Motorola
- Northrup/Grumman
- Semiconductor Research Corp.
- Southern Company
- Texas Instruments
- Whirlpool Corporation
Named Professorships in ECE

- Prathima Agrawal, *Sam Ginn Distinguished Professor*
- Vishwani Agrawal, *James J. Danaher Professor*
- Thomas Denney, *Ed & Peggy Reynolds Family Professor*
- Mark Halpin, *Alabama Power Distinguished Professor*
- J. David Irwin, *Earle C. Williams Eminent Scholar*
- Shiwen Mao, *McWane Associate Professor*
- Guofu Niu, *Alumni Professor*
- Adit D. Singh, *James B. Davis Professor*
- Jitendra Tugnait, *James B. Davis Professor*
- Bogdan M. Wilamowski, *AMSTC Director*
IEEE Fellows

- Prathima Agrawal
- Vishwani Agrawal
- Fa (Foster) Dai
- S. Mark Halpin
- John Hung
- David Irwin
- R. Mark Nelms
- Adit Singh
- Jitendra K. Tugnait
- Bogdan Wilamowski
- Chwan-Hwa (John) Wu
ECE Faculty
National/International Awards

- Eta Kappa Nu National Outstanding Teacher Award
- (2) IEEE Undergraduate Teaching Award
- (2) IEEE Power Engineering Outstanding Educator Awards
- (2) IEEE McGraw Hill/Jacob Millman Awards
- (4) IEEE Third Millenium Medals
- (2) International Microelectronics and Packaging Society Technical Achievement Awards
- IEEE Computer Society Outstanding Contribution Award
- IEEE Richard M. Emberson Award
- (13) IEEE Fellows
ECE Faculty Scholarship & Professional Service

• Editors of International Journals—11
• Associate Editors of International Journals—40
• Books Published—38
• Book Chapters Published—32
• Patents—122
• Average Journal Papers Published/Faculty/Year—2
• Presidents of Technical Societies—10
• Chairs of Technical Conferences—40
• Technical Society Governing Board/AdCom Positions—31
Graduate School Application
Time Table

- During undergraduate studies, consider participating in a research project with faculty/grad students
- **Junior year** – begin investigating
  - browse guides, catalogs, web sites
  - talk to faculty, friends
  - sign up for GRE and/or other entrance tests
- **September/October of senior year**
  - take GRE and/or other tests
  - write statement of purpose
  - request recommendation letters from faculty

(continued)
<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Events</th>
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<tbody>
<tr>
<td>November/December</td>
<td>- applications typically due in December/January</td>
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<tr>
<td></td>
<td>- submit applications (on-line or mailed)</td>
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<td></td>
<td>- order official transcripts from Registrar’s Office</td>
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<tr>
<td></td>
<td>- apply for fellowships, grants, assistantships</td>
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<tr>
<td>January/March</td>
<td>- ask about visiting and/or /interviews</td>
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<tr>
<td>March/April</td>
<td>- consider acceptances, rejections, career options</td>
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<tr>
<td>August/September</td>
<td>- Get to work!</td>
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</table>
Application Deadline
Auburn ECE Graduate Programs

• **Fall Semester**
  – International Applicants: February 1
  – Domestic Applicants: July 1

• **Spring Semester**
  – International Applicants: August 1
  – Domestic Applicants: October 1
Where can I find information?

**Informal Sources:**
- Your professors
- Academic advisor or college career center
- Current grad students (email or web pages)
- Friends who have gone to graduate school
- Department web sites & university bulletins
- Education resources on engineering professional society web sites
  (IEEE, ASME, ASCE, AIChE, IIE, AIAA, etc.)
World-Wide Web Resources

- Peterson’s guides: [www.petersons.com](http://www.petersons.com)
- GradSchools.com: [www.gradschools.com](http://www.gradschools.com)
- GradView: [www.gradview.com](http://www.gradview.com)
- American Society of Engineering Education (ASEE) [www.asee.org](http://www.asee.org) – profiles of colleges/universities
- GradNet ([www.gradnet.iec.org](http://www.gradnet.iec.org))
- ACM Graduate Assistantship Directory ([info.acm.org/gad/](http://info.acm.org/gad/))
- Government agency & private foundation web sites (fellowship information)
Questions?

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