Everything you ever wanted to know about Graduate School – but were afraid to ask!

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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 Dept.?
- 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

• **Preparation to practice 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)

• Doctoral Degree
  – needed for university faculty
  – research-oriented company/agency

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

• Professional Degree
  – if interested in law, medicine, etc.
Starting salaries for engineering
(2004 NACE Salary Survey: www.naceweb.org)

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

2015: EE-BS $64,081, CPE-BS $62,553
EE-MS $71,747, CPE-MS $70,650
Graduate Degrees in ECE at Auburn University

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

• **Master of Electrical Engineering (MEE)**
  - Requires coursework only

• **Doctor of Philosophy (PhD)**
  - Requires publishable research & dissertation
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/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:**
  - at least 18 credits of ECE courses
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 110% of #hours required for the degree
  - Maximum of one masters and one doctoral degree
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 110% of #hours required for the degree
  - Maximum of one masters and one doctoral degree
Samuel Ginn College of Engineering
Woltosz Fellowships

- Created to attract and support top doctoral candidates.
- **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

Department of Electrical and Computer Engineering
## Electrical Engineering Programs

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<thead>
<tr>
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<th>2005</th>
<th>2006</th>
<th>2013</th>
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</thead>
<tbody>
<tr>
<td>Auburn University</td>
<td>55th</td>
<td>49th</td>
<td>51st</td>
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</table>
ECE Graduate Enrollment
(Fall semesters, 1998-2013)

Electrical and Computer Engineering Graduate Enrollment
(Fall Semester)

- Total
- Masters
- Doctoral

Enrollment numbers:
- Total: 152
- Masters: 91
- Doctoral: 61
ECE Research Expenditures
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:
  wired 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 ...

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

- Vishwani Agrawal, *James J. Danaher Professor*
- Fa Foster Dai, *Ed & Peggy Reynolds Family Professor*
- Robert Dean, *McWane Associate Professor*
- Thomas Denney, *AU MRI Research Center Director*
- Mark Halpin, *Alabama Power Distinguished Professor*
- J. David Irwin, *Earle C. Williams Eminent Scholar*
- Shiwen Mao, *Ginn Professor & WERE Center Director*
- 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)
### Graduate School Application Time Table (continued)

<table>
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<tr>
<th>Month/Season</th>
<th>Events</th>
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<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>
</tr>
<tr>
<td>August/September</td>
<td>– Get to work!</td>
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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
- GradSchools.com: www.gradschools.com
- GradView: www.gradview.com
- American Society of Engineering Education (ASEE) www.asee.org – profiles of colleges/universities
- GradNet (www.gradnet.iec.org)
- ACM Graduate Assistantship Directory (info.acm.org/gad/)
- Government agency & private foundation web sites (fellowship information)
Questions?

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