Department of Electrical and Computer Engineering

Graduate Program Guidelines

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1. INTRODUCTION

University requirements for graduate degrees are given in the University of Idaho General Catalog. While these requirements are quite specific in many instances, individual departments retain considerable discretion with respect to their interpretation and implementation. The purpose of the "Graduate Program Guidelines for the Department of Electrical and Computer Engineering" is to summarize and document policies and procedures followed in implementing the requirements of the General Catalog. These guidelines are intended for use by faculty, graduate students, and prospective graduate students in planning and executing graduate study programs in electrical engineering or computer engineering.

Additional information on the graduate program in electrical engineering and computer engineering may be obtained from the web at http://www.ece.uidaho.edu, or by contacting:

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2. GRADUATE DEGREES OFFERED

The Department of Electrical and Computer Engineering offers three graduate degrees in electrical engineering: Master of Engineering (MEngrEE), Master of Science (MSEE), and Doctor of Philosophy (PhDEE) and two graduate degrees in computer engineering: Master of Engineering (MECompE) and Master of Science (MSCompE). The Master of Engineering degree is a non-thesis degree. Students whose work experience is such that additional course work is more beneficial to them than the master's thesis frequently seek it. The master's degree requires a combination of course and thesis work and is most frequently sought by on-campus students. Most students take six credits of thesis work for the master's degree. The PhDEE degree is awarded for high achievement in scholarly and research activity.

3. ADMISSION REQUIREMENTS

Electrical Engineering Computer Engineering Regular enrollment may be granted by the graduate dean Regular enrollment may be granted by the graduate to a student who has a bachelor's degree in electrical dean to a student who has a bachelor's degree in engineering from an accredited institution and has an computer engineering from an accredited institution undergraduate grade point average (GPA) of 3.0 or and has an undergraduate grade point average (GPA) higher. Students with a bachelor's degree from an of 3.0 or higher. Students with a bachelor's degree unaccredited institution or a degree that is not in from an unaccredited institution or a degree that is not engineering must submit scores from the general portion in engineering must submit scores from the general of the Graduate Record Examination. Foreign students portion of the Graduate Record Examination. Foreign must have: 1) a TOEFL score of at least 79 (Internet or students must have: 1) a TOEFL score of at least 79 iBT version) or 550 (old written test) and 2) a minimum (Internet or iBT version) or 550 (old written test) and overall GRE score of 1200 (with a minimum 740 2) a minimum overall GRE score of 1200 (with a quantitative score and a 4.0 or higher analytical essay minimum 740 quantitative score and a 4.0 or higher score). Additional requirements for admission to the analytical essay score). PhD program are given in Section 5. Partial enrollment in the graduate program may be Partial enrollment in the graduate program may be granted to electrical engineering seniors with a GPA of granted to computer engineering seniors with a GPA of 3.0 or higher. 3.0 or higher. Students who are not BSEE graduates may be admitted Students who are not BSCompE graduates may be to the graduate program if they meet the following admitted to the graduate program if they meet the minimum requirements: following minimum requirements: 1. Bachelor degree in any engineering discipline or in a 1. Bachelor's degree in electrical engineering, computer supporting area of study such as mathematics or science, or another engineering discipline or in a supporting area of study such as mathematics or physics. 2. Demonstrated proficiency in the foundation areas of physics. electrical engineering emphasized in the 2. Demonstrated proficiency in the foundation areas of undergraduate curriculum. The basic areas and the computer engineering emphasized in the courses whose passage demonstrate proficiency in undergraduate curriculum. The basic areas and the those areas are listed below and are described in the courses whose passage demonstrates proficiency in University's General Catalog which is available on those areas are listed below and are described in the the university web page. University's General Catalog which is available on the university web page. Area Courses Circuits ECE 210, 211, 212, 213 Area Courses Chemistry CHEM 111 Electronics ECE 310, 311 CS 112 Computer Science Chemistry **CHEM 111** English **ENGL 102 Computer Engineering** ECE 240, 241 Engineering Science ENGR 210 & ENGR 220 Computer Science CS 121 Mathematics MATH 310 & 330 **Mathematics** MATH 175, 176, 310 **Physics** PHYS 211, 212 **Physics** PHYS 211, 212 **Statistics STAT 301** Statistics **STAT 301**

| 3. Demonstrated proficiency in at least three of the following junior level background study courses: | 3. At least two advanced courses in electrical engineering, computer engineering, or computer science. |
|---|---|
| ECE 319 Electronics (lab not required) | |
| ECE 329 Electrical Machines (lab not required) | Students with undergraduate course deficiencies in any |
| ECE 339 Electromagnetic Theory | of the foundation areas of computer engineering must |
| ECE 349 Digital Computer Fundamentals ECE 359 Signals and Systems Analysis | remove these deficiencies either prior to admission or in the first three semesters of graduate work. Such |
| ECE 539 Signals and Systems Analysis | deficiency courses cannot be used for graduate credit. |
| 4. Two 400's level courses as prescribed by the | deficiency courses cannot be used for graduate credit. |
| student's committee. | |
| With respect to making up deficiencies, the prospective | |
| student should be aware that: | |
| 1. While it is possible to take a required 300-level | |
| course without formally completing the course | |
| prerequisites, the student may wish to take some, or | |
| all, of the prerequisites to help ensure success in the | |
| required course. | |
| 2. It may be possible to substitute a vertically related | |
| 400-level course for a required 300-level course. | |
| For example: ECE 470 instead of ECE 359 or ECE | |
| 440 instead of ECE 349. | |
| 3. Deficiency courses do not satisfy any part of the | |
| credit requirements for a graduate degree. | |
| 4. Prospective students must finish all deficiency course work prior to graduate admission. | |
| work prior to graduate admission. | |

4. DEGREE PROCEDURES

The procedural steps required in the master's and doctor's programs are summarized below. These tables have been adapted from the General Catalog and modified to reflect procedures followed in the Department of Electrical and Computer Engineering. For more detailed information please refer to the General Catalog.

REQUIREMENTS FOR A MASTER'S DEGREE (Adapted from the University's General Catalog)

| STEP | PROCEDURE | TIME ELEMENT |
|--------------------------------------|---|--|
| Admission to the College of Graduate | Contact the department office and Graduate | At least three months before intended |
| Studies | Admissions Office. | registration. |
| Appointment of major professor and | Prepared by student. File form, | During first semester and whenever a |
| committee | Appointment of Major Professor and/or | change is needed. |
| | Committee Form. Approval by major | |
| | professor (and committee), departmental | |
| | administrator, and graduate dean required. | |
| | If a change is made, file form "Committee | |
| | Change Form." | |
| Study Plan | Prepared by student, major professor and | Will not be processed unless the |
| | committee. Student creates form online in | Appointment of Major Professor and/or |
| | Vandal Web. Approval by major | Committee Form for the master's |
| | professor, departmental administrator, and | degree have/has been approved by the |
| | graduate dean required and is done online. | graduate dean. |
| | If a change is made, student does this online | |
| | in the degree audit planner. | |
| Graduate Handbook for Theses & | Student picks up from graduate college web | Shortly into your program to assist in |

| Dissertation | page. | preparation of your thesis. |
|--|---|---|
| Application for Degree (commencement | Student and major professor certify | Completed the semester prior to the one |
| excuse) | requirements completed or will do so by | the student intends to graduate. Date |
| | completion of current registration. Student | appears in the graduation page of the |
| | applies online for graduation at the | Registrar's website. |
| | Registrar's website. You must notify | |
| | graduate dean if you will not be | |
| | participating in commencement. | |
| Final Semester Registration | M.S. students must register for thesis credit | Date appears in the academic calendar |
| | during the semester of expected defense. | on the Registrar's website. |
| | M.E. students must register for non- | |
| | research credit (ECE 599) during the | |
| | semester of expected defense or completion | |
| | of non-thesis requirements. | |
| Request to Proceed with Final Defense | Students request this form from the | When ready to defend thesis. |
| of Thesis | graduate college. Form requires major | |
| | professor and committee members' | |
| | signatures. Students return form to | |
| | graduate college before defense of thesis. | |
| Final Defense Report (for M.S. degree) | Issued by the graduate college upon receipt | To be taken to final defense for |
| | of the Request to Proceed with Final | completion and returned to graduate |
| | Defense form. | college following defense. Due date |
| | | for results appears in the academic |
| | | calendar on the Registrar's website. |
| Non-thesis Requirement (for M. Engr. | Major professor files forms, Non-thesis | After completion of most of degree |
| Degree) | Requirement with graduate college and | requirements. Due date for results |
| | Report of Comprehensive Examinations | appears in the academic calendar on the |
| | with department. | Registrar's website. |

REQUIREMENTS FOR A DOCTORAL DEGREE (Adapted from the University's General Catalog)

| STEP | PROCEDURE | TIME ELEMENT | |
|------------------------------------|---|---|--|
| Admission to the Graduate College | Contact the department office and the | At least three months before intended | |
| | Graduate Admissions Office. | registration. | |
| Appointment of Major Professor and | Approval by departmental administrator | During first semester and whenever a | |
| Committee. | and graduate dean is required. File form, | change is needed. | |
| | Appointment of Major Professor and/or | | |
| | Committee Form. If a change is made, file | | |
| | form, Committee Change Form. | | |
| Study Plan | Prepared by student and major professor. | Will not be processed unless the | |
| | Student creates form online in Vandal | Appointment of Major Professor and/or | |
| | Web. If a change is made, student does | Committee Form has been approved by | |
| | this online in the degree audit planner. | the graduate dean. | |
| | Approved by graduate dean. | | |
| Graduate Handbook for Theses & | Student picks up from graduate college | Shortly into your program to assist in | |
| Dissertation | web page. | preparation of your thesis. | |
| Preliminary Examination | Time and place set by major professor. | When majority of courses on study plan | |
| | | are completed. | |
| Advancement to Candidacy | Major professor certifies all requirements | Immediately after successful completion | |
| | for advancement to candidacy have been | of preliminary examination. | |
| | met; file form, Report of Preliminary | | |
| | Examination and Advancement to | | |
| | Candidacy. | | |
| Application for Degree | Student and major professor certify | Date appears on the graduation page of | |
| (commencement excuse) | requirements completed or will do so by | the Registrar's website. | |
| | completion of current registration. Student | | |
| | applies online at the Registrar's website. | | |

| | You must notify graduate dean if you will not be participating in commencement. | |
|--------------------------------------|---|---|
| Final Semester Registration | Student must register for dissertation credit during the semester of expected defense. | Date appears in the academic calendar of the Registrar's website. |
| Request to Proceed with Dissertation | Student will present the graduate college with the form by this name signed by the committee. | Must be filed with the Request to Proceed with Final Defense form of graduate college at least 10 working days before the scheduled defense. |
| Final Defense Report | Issued by the graduate college on receipt of the Request to Proceed with Final Defense. | To be taken to final defense for completion and returned to the graduate college following the defense. Due date for results appears in the academic calendar on the Registrar's website. |

5. DEGREE REQUIREMENTS

Each student is required to prepare a study plan during his or her first semester in the program. The study plan is generally organized around one major, and two minor areas of study to provide depth and breadth is required for EE and optional for computer engineering. The major area normally encompasses about half, or more, of the student's course work, while each minor area includes about a quarter of the course work. The major and minor areas currently recognized by the department are: 1) Electronics, 2) Power, 3) Electromagnetics, 4) Digital, 5) Systems, and 6) Semiconductor Devices. In certain cases other minor specialty areas may be specified by the committee.

Students interested in entering the Ph.D. program are expected to have completed a master's program in engineering first. Exceptional cases will be considered for admission directly into the Ph.D. program.

Note that lower division and 300 level courses will not be given graduate credit or accepted toward any of the graduate degrees described below. Also, please see the specific degree requirements listed in the University's General Catalog.

5.1 Master of Engineering: The M.Engr. degree is a non-thesis degree requiring 30 credits of course work beyond an approved bachelor's degree. With the assistance of their major professor, students prepare their own program as soon as possible during their first semester and submit it to the faculty members for approval. To be approved, programs must satisfy both the university requirements governing the M.E. degree and the department requirements. At least 18 of the required 30 credits must be in courses numbered 500 and above. Three or more electrical engineering courses numbered above 500 in a given area for depth and at least one course in each of two areas (outside the areas selected for depth) to provide breadth are required. Enrollment in ECE 591 Electrical Engineering Research Colloquium, during each semester of on-campus enrollment, is also required. Students must contact the ECE 591 instructor if they have a time conflict with this course.

In addition to the formal course requirements, the non-thesis ME degree requires a professional quality technical presentation and oral examination. The presentation audience will include the student's supervisory committee, other interested faculty and students.

The supervisory committee will consist of the major professor and a minimum of two additional faculty members, at least one of which must also be from the Department of Electrical and Computer Engineering. For computer engineering students, the department requires that at least one of the three committee members be from the Department of Computer Science and one be from the Department of Electrical and Computer Engineering. The committee may also conduct an oral examination on topics relevant to the ME degree, as the committee deems appropriate.

The subject matter for the presentation must be a technical topic relevant to the student's course of study and must be approved by the major professor. A literature search and bibliography are required, as part of the preparation for the presentation, and a brief written summary plus the bibliography must be submitted to the major professor for review prior to the presentation. Appropriate technical topics for the presentation may be suggested by the student's

course work, such as exploring a course topic in greater depth than was covered in class, or investigating a related topic in the literature.

- **5.2 Master of Science:** The M.S. degree requires 30 credits beyond an approved bachelor's degree (six credits are usually taken in ECE 500, Master's Research and Thesis). At least 24 credits of course work must be taken in addition to thesis credits and 18 of the required 30 credits must be in courses numbered 500 and above (including the six credits of ECE 500, Master's Research and Thesis). Two or more electrical engineering courses numbered above 500 in a given area for depth and at least one course in each of two areas (outside the areas selected for depth) to provide breadth are required. Enrollment in ECE 591 Electrical Engineering Research Colloquium, during each semester of on-campus enrollment is also required. No written final exam is required for the M.S. degree. However, an oral examination covering the student's course work is frequently an integral part of the student's thesis presentation. One copy of the final master's thesis must be supplied to the Department of Electrical and Computer Engineering.
- **5.3 Doctor of Philosophy:** The Doctor of Philosophy degree is awarded in recognition of high achievement in scholarly research activity. Admission to the doctoral program is granted only to those who have a recognized potential for completing the degree. Admission is also based on the student's prior academic performance, potential for doing research, personal recommendations, TOEFL and GRE scores, and availability of research faculty in the student's area of interest. Students interested in entering the Ph.D. program are encouraged to complete a master's program in engineering first.

<u>Credit Requirements:</u> A minimum of 78 credits beyond the bachelor's degree is required. At least 52 of these credits must be in courses numbered 500 and above. At least 39 of the 78 credits must be in courses other than ECE 600 (Doctoral Research and Dissertation). Normally 18 to 30 credits are taken in ECE 600.

<u>Advancement to Candidacy:</u> A graduate student becomes a Ph.D. candidate only after the student passes the preliminary examination and the committee approves the student's research proposal.

- (a) Preliminary Examination: The preliminary examination is administered after completion of most of the course work. It is offered twice a year; once during the week following Thanksgiving break and once during the week following spring break. Consult the department secretary for exact dates. The examination includes both written and oral parts. The written examination in the major area is normally four hours in length, and each of the minor area examinations are normally two hours in length. The oral examination is normally two hours in length and covers the student's major and minor areas of study. Upon passing the examination, the student has shown competency in subject areas supporting his/her research field. A student may also retake the exam in accordance with policies stated in the University's General Catalog.
- (b) Research Proposal: The research proposal describes the proposed research in a form similar to that used by the National Science Foundation. An oral presentation of the proposal to the committee is required.

Residency: In addition to the residency requirement of the College of Graduate Studies, the department requires a minimum of two consecutive semesters (excluding summer term) in residence on the Moscow campus beyond the master's degree level. The student shall carry a full load of graduate level course work and/or research. This period of intense study, reflection, and discussion with other scholars, without the distraction of outside responsibilities, is considered essential to provide an environment for creative research and to fulfill the spirit of the doctor of philosophy degree. In certain cases, all or part of the on-campus residency may be satisfied at other graduate research centers such as the Idaho Falls Center for Higher Education and UI Engineering Education in Boise, provided that the intent of the residency is still met. Prior approval of the committee and the department chair is required in those cases.

Foreign Language Requirement: The department does not currently require proficiency in a foreign language.

<u>Dissertation Copies:</u> One copy of the final, signed and approved, version of the doctoral dissertation must be supplied to the Department of Electrical Engineering.

6. ENGINEERING OUTREACH PROGRAM

The University of Idaho Engineering Outreach Program provides an opportunity for students to take 400-level and 500-level DVD courses applicable to both master and doctoral degrees. For additional information, contact: Engineering Outreach, University of Idaho, Moscow, Idaho 83844-1014, by dialing 1-800-824-2889 or by going on the web at http://www.uidaho.edu/evo/newhtml/eomain.htm.

7. FINANCIAL ASSISTANCE

A number of teaching and research assistantships are available each year and are awarded on a competitive basis both spring and fall semesters. Written application should be made to the department chairman for one of these positions. Applications are also available on the department web page at http://www.ee.uidaho.edu/ee/research/gradapp.html.

8. GRADUATE PROGRAM STATISTICS

The table below lists the enrollment numbers for the last four academic years in our graduate degree programs.

| DEGREE | 2005/06 | 2006/07 | 2007/08 | 2008/09 |
|--|--------------------------|--------------------------------|--|---------|
| MASTERS: On Campus Engineering Outreach | 108 43 | 98 49 | 91 (9 of which took a course through EO.) | |
| PhD | 43 (12 in Engr. Outreach | 28 (7 in Engr. Outreach) | 18 | |
| TOTALS | 194 | 175 | 109 | |

9. GRADUATE FACULTY

Touraj Assefi, Professor and Director of Microelectronics Research and Communications Institute; Ph.D., 1973, University of Southern California; control systems and signal image processing (tassefi@ece.uidaho.edu)

David H. Atkinson, Professor, Ph.D., 1989, Washington State University; electromagnetics and planetary radio sciences (datkinson@ece.uidaho.edu)

Suat U. Ay, Assistant Professor, Ph.D., 2005, University of Southern California, analog electronics, mixed signal VLSI design, image sensors (<u>suatay@uidaho.edu</u>)

Fred Barlow, Associate Professor, Ph.D., 1999, Virginia Polytechnic Institute, electronic packaging and microelectronics (fbarlow@ece.uidaho.edu)

Gregory W. Donohoe, Associate Professor, PhD., 1989, University of New Mexico, microelectronic system design, reconfigurable processors, signal and image processing applications (gdonohoe@ece.uidaho.edu)

David P. Egolf, Professor, Ph.D., 1976, Purdue University; electro-acoustic sensors and actuators, wave propagation, active/adaptive control of sound, numerical simulation of nonlinear systems (degolf@ece.uidaho.edu)

Aicha Elshabini, Dean of College of Engineering and Professor, Ph.D., 1978, University of Colorado, electronic packaging and microelectronics (*elshabini@uidaho.edu*)

James F. Frenzel, Associate Professor, Ph.D., 1989, Duke University; digital systems design and testing (*jfrenzel@ece.uidaho.edu*)

Karen Z. Frenzel, Assistant Professor, Ph.D., 1986, Duke University; signal processing and communications (kfrenzel@ece.uidaho.edu)

Herbert L. Hess, Professor, Ph.D., 1993, University of Wisconsin; power electronics, electric machine drives, power quality, and CMOS design of on-chip power circuitry (hhess@ece.uidaho.edu)

Brian K. Johnson, Professor, Ph.D., 1992, University of Wisconsin; power systems transients, power systems protection, utility applications of power electronics, power quality, T&D applications of superconductors, and intelligent transportation systems (bjohnson@ece.uidaho.edu)

Joseph D. Law, Associate Professor, Ph.D., 1991, University of Wisconsin; electrical machines, power electronics, power systems stability, and electrical disturbances in power systems (joel@ece.uidaho.edu)

Kenneth V. Noren, Associate Professor, Ph.D., 1992, Michigan State University; analog electronics (knoren@ece.uidaho.edu)

Dennis Sullivan, Professor, Ph.D., 1987, University of Utah; electromagnetic simulation, hyperthermia cancer therapy simulation, and quantum semiconductor simulation (dsullivan@ece.uidaho.edu)

Richard W. Wall, Professor; Ph.D., 1989, University of Idaho; distributed processing, embedded precision control, digital control theory, digital signal processing, power system transient modeling, power systems protection. (rwall@ece.uidaho.edu)

Richard B. Wells, Professor, Ph.D., 1985, University of Idaho; neural networks and computational neuroscience, communications, coding and information theory, adaptive signal processing, electrophtography, and analog electronics (*rwells@ece.uidaho.edu*)

Jeffrey L. Young, Professor, Ph.D., 1989, University of Arizona; time-domain numerical solvers for Maxwell's equations, antenna design and development, wave propagation in complex media, microwave ferrite devices (*jyoung@ece.uidaho.edu*)