GRADUATE STUDENT MANUAL
(POLICIES AND PROCEDURES)

2012 - 2013

DEPARTMENT OF ELECTRICAL ENGINEERING
The Marlan and Rosemary Bourns College of Engineering
University of California, Riverside
Suite 343 Winston Chung Hall
Riverside, California 92521
# TABLE OF CONTENTS

## I. GENERAL INFORMATION 4

A. INTRODUCTION 4
B. ADMISSION 4
C. FINANCIAL ASSISTANCE 4
D. ADVISING 6
E. COLLOQUIA/SEMINARS 6
F. KEY PERSONNEL AND POINTS OF CONTACT 6

## II. AREAS OF STUDY AND DEGREE REQUIREMENTS 8

A. AREAS OF STUDY 8
B. INFORMAL AND INTERDISCIPLINARY COURSES 8
C. GENERAL REQUIREMENTS 9
   1. FULL-TIME ENROLLMENT 9
   2. M.S. PROGRAM 9
   3. PH.D. PROGRAM 10
   4. GRADE REQUIREMENTS AND TIME LIMITS 10
   5. TRANSFER OF CREDITS TAKEN AT OTHER UNIVERSITIES 12
   6. UNDERGRADUATE COURSES 12
   7. DEADLINES 13
   8. GRADING 13
   9. STUDENT PROGRESS 13
   10. LEAVES OF ABSENCE 13
D. MASTER OF SCIENCE (M.S.) DEGREE PROGRAM 14
   1. THESIS COMMITTEE (PLAN I) 14
   2. COMPREHENSIVE EXAMINATION (PLAN II) 15
   3. ADVANCEMENT TO CANDIDACY AND DEGREE CONFERRAL 16
E. DOCTOR OF PHILOSOPHY (PH.D.) DEGREE PROGRAM 17
   1. PH.D. PRELIMINARY EXAMINATION 17
   2. PH.D. QUALIFYING EXAMINATION 17
   3. PH.D. QUALIFYING COMMITTEE 18
   4. ADVANCEMENT TO CANDIDACY 19
   5. THE PH.D. DISSERTATION COMMITTEE 19
   6. PH.D. DISSERTATION PROPOSAL EVALUATION 20
   7. PH.D. DISSERTATION DEFENSE AND DEGREE CONFERRAL 20

## III. MAJOR AREA COURSES 22

## IV. FACULTY PROFILES 25

A. EE DEPARTMENTAL FACULTY 25
B. ADJUNCT FACULTY MEMBERS 27
C. COOPERATING FACULTY MEMBERS 28

## V. EE FACILITIES 30

A. ELECTRICAL ENGINEERING TEACHING & RESEARCH LABORATORIES 30
B. CENTER FOR RESEARCH IN INTELLIGENT SYSTEMS (CRIS) 30
C. COLLEGE OF ENGINEERING - CENTER FOR ENVIRONMENTAL RESEARCH AND TECHNOLOGY 30

## VI. MISCELLANEOUS INFORMATION 31

A. FACILITY ACCESS AND KEYS 31
B. Office and Desk Space 31
C. Mail 31
D. Remuneration and Disbursement 31
E. Telephone/Facsimile 31
F. Photocopying 32
G. Machine Shop 32
H. Safety 32
I. Computers 32
J. Theses and Dissertations 33
K. University Letterhead 33
L. Deadlines 33
M. Timetable to File Appropriate Forms 33
   1. M.S. Degree 33
   2. Ph.D. Degree 33
I. GENERAL INFORMATION

A. INTRODUCTION

The Department of Electrical Engineering (EE) at the University of California, Riverside (UCR) offers advanced study in specialized areas of electrical engineering. The information contained in this manual is intended to help graduate students in this Department and particularly students new to the UCR campus. Other sources of information include:

- UCR General Catalog
  http://www.catalog.ucr.edu
- Graduate Division Publications, Handbooks, and Forms
  http://graduate.ucr.edu/pub_forms.html
- GradSuccess
  http://graduate.ucr.edu/success.html
- Graduate Division General Website
  http://graduate.ucr.edu

The Department may specify more rigorous requirements for the degree than listed in the other sources. Therefore, when there appears to be a conflict in requirements for the degree, the more rigorous requirements must be satisfied. In addition to degree requirements, this manual also summarizes EE policies and procedures. The Department reserves the right to modify the departmental procedures and requirements outlined in this manual. Such modifications generally will not be considered retroactive.

B. ADMISSION

All applicants for admission to the EE graduate program must be approved first by the EE Graduate Advisor then by the Dean of Graduate Division (Graduate Dean). To be approved by the EE Graduate Advisor, an applicant should have a B.S. degree in engineering with a grade point average above 3.0 (based on a 4.0 point system) in the last two years of undergraduate work, a combined (verbal and quantitative) GRE score above 1100 and 3 good supporting reference letters. Students from non-English speaking countries also must have a minimum TOEFL score of 550 on the paper-based test, 213 on the computer-based test, or 80 in the internet-based test. Typical scores are normally higher for admitted students. Students with undergraduate degrees outside engineering, who meet the above criteria, may be required to complete remedial undergraduate course work before being granted official admission into the EE graduate program. This remedial work may not be used to satisfy graduate degree requirements.

C. FINANCIAL ASSISTANCE

Financial awards include research or teaching assistantships, and fellowships. Typically, teaching and research assistantships are awarded annually, on a competitive basis, and include:

- full or part-time salary, up to $16,000 per academic year and, in addition,
- payment of the Graduate Student Health Insurance Plan (GSHIP) fee and a Partial Fee Remission (PFR).
Non-resident students may also receive a partial or full non-resident tuition (NRT) remission.

All students with fellowship are required to maintain a quarterly and cumulative GPA of 3.0 or higher, or they will be subject to losing their fellowship.

Assistants are expected to aid faculty members in the instructional or research programs. A 50% appointment requires an average of 20 hours per week. Administration and selection of teaching assistants (TAs) is done through the EE department. Research assistantships (Graduate Student Researchers, GSRs) are selected by the faculty members directing the project and not by the department, and are supported by research contracts and/or grants. However, faculty members consult with the Graduate Advisor and Academic Program Assistant concerning the availability of qualified students seeking support.

*Any EE Ph.D. graduate student whose native language is not English (in particular, international students) must pass the SPEAK test or must score 23 or above on the Speaking portion of internet-based TOEFL (iBT) test.* The purpose of both tests is to evaluate English proficiency and comprehensibility.

Scores on the SPEAK test are as follows:
- 50 – 60: Clear Pass
- 40 – 45: Conditional Pass
- 20 - 35: Fail

The iBT is administered by EST and students take the test online. The score for the Speaking portion should be 23 or above to have the SPEAK test requirement waived.

EE Ph.D. student who has not received a “Clear Pass” in the SPEAK test or does not have a score of 23 or above on the Speaking portion of the iBT test, does not meet the language requirement to graduate with a Ph.D. degree.

Any EE Ph.D. student who is assigned a TA position and does not have a “Clear Pass” in the SPEAK test must attend the English language classes offered at the UCR Extension Center until a “clear pass” is obtained. Students are provided with one quarter of free instruction at UCR Extension Center. If a student still not able to obtain a Clear Pass, he/she is responsible for paying for the instruction until a “clear pass” is obtained on the SPEAK test. The estimated cost per quarter is $380. A student with a “conditional pass” can be appointed as a TA. However, these appointments will only be approved for one quarter at a time. Every quarter, a student with conditional pass can continue serving as TAs only if approved by the Graduate Dean. This decision is made on the basis of:

- Departmental recommendation, including an assessment of the student's academic ability;
- Student teaching evaluations;
- Other evidence of commitment to/performance in teaching (e.g., faculty evaluations or statements of support, videotapes);
- Evidence of a good-faith effort to improve English skills; and
- Relative proximity to the level of competence represented by a clear pass.

All TAs are required to take the TADP workshop series offered by the Learning Center in the beginning of every quarter. The TA training should be completed in the first quarter a TA begins teaching. Students sign up for the workshop series online at [http://www.tadp.ucr.edu/](http://www.tadp.ucr.edu/).
D. ADVISING

Upon admission to the EE graduate program by the Graduate Division, each student is assigned a preliminary Faculty Advisor (generally by the Graduate Advisor) to assist with course selection and general curriculum guidance. New graduate students are required to consult with their Advisor before registering for classes. During the first or second quarter of graduate studies, students must select a Faculty Advisor. This Advisor becomes, in effect, the chairperson of the student’s M.S. or Ph.D. committee(s). These committees are described in the Degree Requirements section of this manual.

The Ph.D. program is qualitatively different from the undergraduate or Master’s program. The Ph.D. program prepares a student for a career in research. The core component of the Ph.D. program is the independent research culminating in a Ph.D. thesis. Ph.D. students admitted with a UCR Fellowship have been chosen and sponsored by a specific Professor based on the student’s previous experience and stated interests. The sponsoring Professor will be the Fellowship student’s Ph.D. advisor. Upon arrival at UCR, the Fellowship student is expected to join the sponsoring Professor’s laboratory and begin participating in research activities under the Professor’s direction.

Graduate study is individual in nature and requires frequent interaction between the student and Advisor. The Faculty Advisor must be consulted in the planning of programs of study, research directions, and forming of committee(s). Other consultations should be arranged with the Advisor as needed. The Graduate Advisor or Academic Program Assistant may also be of assistance and provide counsel in non-degree related matters such as health services, housing, communication deficiencies, and career development.

It is the responsibility of the student to register and submit forms by the deadlines specified in the quarterly Schedule of Classes. Therefore, advisement meetings with the degree Advisor should be scheduled in anticipation of these deadlines.

E. COLLOQUIA/SEMINARS

Students are expected to register for three quarters of EE 259 Colloquium in Electrical Engineering course. Colloquia announcements will be posted on Department bulletin boards, on the EE website, and via email. It is the student’s responsibility to watch for the announcements and attend all Department colloquia. If a course/TA/Lab assignment conflicts with the scheduled seminar a student must notify the Academic Program Assistant via email prior to the start of the seminar. Only 2 unexcused absences are allowed for this course each quarter.

F. KEY PERSONNEL AND POINTS OF CONTACT

The administrative staff is located in Suite 343 of Winston Chung Hall (WCH). A listing of key contact personnel in the EE Department and the College of Engineering with whom graduate students may interact is given below. The complete directory for the Department of Electrical Engineering is available at http://www.ee.ucr.edu/people.

- Adrienne Thomas, Academic Program Coordinator, Room 347 WCH, phone: 827-2484, e-mail: grad-admn@ee.ucr.edu
- Ertem Tuncel, Associate Professor & Graduate Advisor, Room 426 WCH, phone: 827-7718, e-mail: ertem@ee.ucr.edu
• Jay Farrell, Professor & Chair, Room 341 WCH, phone: 827-2159, e-mail: farrell@ee.ucr.edu

• Bill Bingham, Department Manager, Room 344 WCH, phone: 827-2397, e-mail: bill@ee.ucr.edu

• Trudi Loder, Administrative Analyst, Room 345 WCH, phone: 827-2727, e-mail: trudi@ee.ucr.edu

• Steven Haughton, Information Technology Manager / Computer Systems Administrator, Room 109 WCH, phone: 827-2452, e-mail: systems@ee.ucr.edu

• Elmar Palma, Asc. Development Engineer / Department Safety Coordinator, Room 137 WCH, phone: 827-2220, e-mail: epalma@ee.ucr.edu

• Center for Research in Intelligent Systems (CRIS), Professor Bir Bhanu, Director, Room 219 WCH, phone: 827-3954, e-mail: bhanu@ee.ucr.edu

• College of Engineering-Center for Environmental Research Technology (CE-CERT), 1200 Columbia Avenue, Professor Matt Barth, Director, phone: 781-5791, e-mail: barth@ee.ucr.edu
II. AREAS OF STUDY AND DEGREE REQUIREMENTS

A. AREAS OF STUDY

The Department of Electrical Engineering offers advanced study and research designed to educate students in a range of technical areas within electrical engineering. Current areas of specialization offered in the EE graduate program are:

- Integrated Circuits and VLSI System Design
- Control and Robotics
- Intelligent Systems
- Nano-materials, Devices, and Circuits
- Communication and Signal Processing

Individual programs of study can be designed to specialize in one of these areas, or in two related areas, or in other newly evolving areas of electrical engineering. The student and the student’s advisor make the choice. Proposed M.S. and Ph.D. programs for other emphases must be approved by the EE Graduate Committee and must include applicable basic core courses prescribed by the EE Department.

B. INFORMAL AND INTERDISCIPLINARY COURSES

In addition to the courses given on the regular basis, faculty can offer Informal Courses. These courses are:

**EE 290 Directed Studies** – If you will study a particular subject under direction of a faculty member, and a regular course in that subject is not offered, you may enroll in EE 290. Students are required to file a petition no later than the third week of class to enroll in EE 290 to be able to use the units earned towards degree requirement.

**EE 297- Non-thesis Research** – If you are doing research under advisement of a faculty and this research is not directed toward your thesis or dissertation, you may enroll in EE 297.

**EE 299- Research for the Thesis or Dissertation** – If you are doing research under the supervision of your Faculty Advisor and this research is directed toward your thesis or dissertation, you may enroll in EE 299.

Informal courses require a narrative description on a request form and should be approved and signed by the instructor and Graduate Advisor. The EE 290 Petition form may be found in Room 347 WCH. EE 297 approval should be verified on the Quarterly Advising form.

EE graduate students also take Interdisciplinary Engineering Courses. These courses improve analytical, computational, and engineering skills required for advanced studies in the EE program. These include courses in Mathematics, Statistics, Physics, Computer Science, and other Engineering areas.

*Only graduate and upper-division undergraduate courses (numbered 125 and above) are counted toward the degree requirements described in the following sections.* Typical sample programs and course recommendations are listed in Section III. Registration for courses is done by the Academic Program Assistant after the courses are approved by the Graduate Advisor.
C. GENERAL REQUIREMENTS

1. Full-time Enrollment

All graduate students are expected to carry a full academic course load unless good reasons exist for not doing so. Graduate students are considered to be full-time if they are carrying 12 graduate units. When the student takes both graduate and undergraduate courses, the following table is used to calculate the appropriate course load:

<table>
<thead>
<tr>
<th>No. Graduate Units + No.Undergraduate Units = Fulltime</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 + 16 = Fulltime</td>
</tr>
<tr>
<td>1 + 15 = Fulltime</td>
</tr>
<tr>
<td>2 + 13 = Fulltime</td>
</tr>
<tr>
<td>3 + 12 = Fulltime</td>
</tr>
<tr>
<td>4 + 11 = Fulltime</td>
</tr>
<tr>
<td>5 + 9 = Fulltime</td>
</tr>
<tr>
<td>6 + 8 = Fulltime</td>
</tr>
<tr>
<td>7 + 7 = Fulltime</td>
</tr>
<tr>
<td>8 + 5 = Fulltime</td>
</tr>
<tr>
<td>9 + 4 = Fulltime</td>
</tr>
<tr>
<td>10 + 3 = Fulltime</td>
</tr>
<tr>
<td>11 + 2 = Fulltime</td>
</tr>
<tr>
<td>12 + 0 = Fulltime</td>
</tr>
</tbody>
</table>

2. M.S. Program

M.S. degree can be earned by completing one of two plans:

**Plan I**: completion of a thesis that reports an original investigation of a defined problem, or **Plan II**: passing a comprehensive examination.

No more than two attempts to pass the exam may be allowed. If a student fails the exams once and then wants to switch to the Thesis Plan, he/she should contact the EE Graduate Advisor. If a student fails twice, he/she may NOT switch to the Thesis Plan.

_Course requirements:_

Completion of a minimum of 36 units of approved course work. Specific plan requirements are as follows:

- **Plan I**: 24 or more graduate-course units, maximum of 12 units in Thesis Research (299), maximum of 16 units in Research and Directed Studies: EE290, EE297, and EE299.
- **Plan II**: 18 or more graduate-course units, none in research (EE297 or EE299), maximum of 6 units in Directed Studies (EE290).
3. Ph.D. Program

The Ph.D. degree is conferred after a student passes the following four steps:

- Ph.D. Preliminary Examination
- Ph.D. Oral Qualifying Examination
- Ph.D. Dissertation Proposal Evaluation
- Defense and approval of the Ph.D. dissertation.

These procedures are shown in the Figure at the next page and are described in Section II E in more detail.

The main component and focus of the Ph.D. program is the independent research culminating in a Ph.D. thesis. Courses are taken as necessary to prepare the student to pass the Preliminary exam and to train the student in his or her research area. Courses are taken from the Electrical Engineering Department and other Departments as deemed necessary by the faculty advisor.

In preparation for the Preliminary exam, a Ph.D. student in Electrical Engineering is required to establish a major subject area.

4. Grade requirements and time limits

The M.S. Program in Electrical Engineering requires one year of academic residence. Normative (typical time) is 2 years. The Ph.D. Program requires at least 2 years of academic residence, with normative time 3.5 years for students holding an M.S. degree in Electrical Engineering and 5 years for other students. The maximum time limit for either degree is one year beyond the normative time, excluding approved leaves of absences.

In addition, M.S. and Ph.D. students must maintain a GPA (grade point average) above 3.00, with the scale of A (4.00), B (3.00), and C (2.00). Namely, the students are considered to be making unacceptable progress and become subject to dismissal when:

- the overall GPA falls below 3.00;
- the quarterly GPA falls below 3.00 for two consecutive quarters;
- they have 12 or more units of incomplete courses ("I") outstanding;
- they fail to fulfill program requirements such as exams or research in a timely and satisfactory manner;
- they have not completed their programs within one year after reaching the normative time;
- they fail to pass comprehensive or qualifying examinations in two attempts.
Ph.D. Preliminary Exam at the end of 3rd Quarter

Ph.D. Oral Qualifying Exam at the end of 1st year

Nominate Qualifying Exam Committee (5 members, at least 1 outside of department)

Nominate Dissertation Committee (at least 3 members)

Establish major area and choose Advisor by the end of 2nd Quarter.

Take exam second time within one month

Pass?

Academic Dismissal

Y

Choose topic, write a report explaining state-of-the-art and proposing new research directions.

Ph.D. Progress Proposal Evaluation at the end of 3rd year and no earlier than 6 months before PhD Defense. Must be accompanied by a written report

Incorporate recommended changes and do more research following new suggested directions.

Receive PhD!

Submit the dissertation to the committee and defend Ph.D. Dissertation in examination open to public.
5. Transfer of Credits Taken at Other Universities

Units from another University of California campus may be used to satisfy one of the three quarters of the residence requirement and may be counted for up to one half of the total units required for the M.S. degree. EE Department and Graduate Division approval must be obtained before such units can be accepted for credit.

A maximum of 8 quarter units from institutions outside the University of California may be counted toward the M.S. degree at UCR. All transfer work must have been completed in graduate standing with a minimum grade of "B." EE Department and Graduate Division approval must be obtained before these units can be accepted for credit. These units cannot be used to reduce the minimum residency requirement or minimum requirement in 200 series courses taken at this University. Unit credit only is posted on the UCR transcript (grade points are not transferred).

UCR undergraduates who have no more than two courses or 8 units of course work remaining in their bachelor's programs and who have been admitted to graduate status may begin course work for their advanced degrees at the beginning of the final quarter of undergraduate study. Bringing forward units from undergraduate status requires that the students inform the EE Graduate Advisor before beginning the course work in question and that they petition the Graduate Division for credit once they are enrolled as graduate students.

Students may apply Summer Session course work from any University of California campus toward their graduate degree requirements if they have prior approval of the EE Department and of the Graduate Dean.

UCR Extension is considered an outside institution that also offers "concurrent enrollment" courses (prefix XRC) as regularly offered UCR courses. The students may transfer in up to 8 units of concurrent enrollment credit if:

- A grade of "B" or better was received;
- These units were taken prior to graduate enrollment.

Matriculated graduate students may not use the University Extension concurrent enrollment mechanism. Graduate students who withdraw before completing their program are required to wait one year before applying XRC courses to their degrees. (Please note that a student could transfer-in 8 additional units from the category 'Non-UC Campuses' described above.)

6. Undergraduate Courses

Students wishing to use an undergraduate course to partially fulfill their graduate degree requirements must submit an approval request to the Graduate Advisor before the undergraduate course is taken. Retroactive approval will not be granted. Such courses are limited to upper division courses numbered 125 and above. Approval must be noted on the Quarterly Advising form.

Remedial courses, such as those required as prerequisites to the core EE graduate classes (EE 200 level), will not be allowed to count toward the degree requirements.
7. Deadlines

It is the responsibility of the student to meet all deadlines specified by the EE Department and the Graduate Division. Students should consult the *Graduate Student Handbook* of the Graduate Division and the quarterly *UCR Class Schedule* for deadline information.

8. Grading

For a graduate student only the grades A, A-, B+, B, B-, C+, C and S represent satisfactory scholarship and are applied toward degree requirements. A grade of C- at UCR may be accepted in partial satisfaction of the degree requirements if the student has a GPA of at least 3.0 in all courses applicable to the degree. These include all upper division undergraduate and graduate courses in the student's program of study, and must be taken while registered in graduate status.

Individual study and research, or other individual graduate work is normally evaluated by the grades Satisfactory/No Credit. Only the grade S is credited towards degree requirements. Academic work applicable to a graduate program may be graded S/NC only if the course descriptions so indicate. Undergraduate courses that do not have any significant relationship to the graduate program are considered as pure electives. These courses may be taken S/NC with the approval of the Graduate Dean, and do not count towards the student's degree requirements.

The grade Incomplete (I) is given only when a student's work is satisfactory but is incomplete because of circumstances beyond his or her control, and the student has been excused in advance from completing the quarter's work. Although incomplete grades do not affect the student's GPA, they are an important factor in evaluating academic progress. A student with 12 units of "I" grades is deemed to be making unacceptable progress. Students may not be employed as TA's, GSR's, or Teaching Fellows if they have more than 7 units of "I" grades.

The incomplete portion of the work needed to earn a grade must be received by the instructor no later than the last day of the quarter following the assignment of the "I". If not made up within the time allowed, the "I" lapses to an F ("Fail") or NC. An advanced degree cannot be awarded if there is an Incomplete on the student's record.

9. Student Progress

An overall written evaluation of each student's academic progress is done by the department faculty at least once each academic year. This evaluation includes a brief review of the student's work to date, with particular attention to the period since the last report. Evaluation criteria that need to be addressed are listed above in Section D. This report also addresses academic objectives for the next period. The Graduate Advisor, the Graduate Division, and the student receive copies of this report.

10. Leaves of Absence

A graduate student is expected to enroll for each regular academic session unless a formal Leave of Absence is granted. A Leave of up to one year's duration may be granted if it has been determined that the Leave is consistent with the student's academic objective. This must be approved by both the academic unit and the Graduate Dean.

Graduate students granted a Leave of Absence forfeit the use of University facilities and faculty time. The student who will be absent from the campus while continuing to pursue graduate research or scholarly activity should register (in absentia if outside the State of California). Students who must leave the academic
A Leave ordinarily may be granted when a student is to be away from the University of California for any of the following reasons:

- Serious illness or temporary disability
- An occupation not directly related to the student's academic program
- Temporary interruption of the student's academic program for other appropriate reasons, such as family responsibilities

Generally, Leaves of Absence are limited to a total of three regular academic quarters and may be granted retroactively, after the start of a quarter, under exceptional circumstances. A Leave may not be granted if a student has not completed at least one quarter's work, or has not demonstrated satisfactory academic progress. (A student who has more than eight units of "I" outstanding on their transcript is considered to be making unsatisfactory progress.)

While on a Leave of Absence, a student is not eligible for University fellowship support, University research grants, or financial aid. A graduate student on Leave may not usually work on campus and may not hold an appointment as a Graduate Student Researcher, Teaching Assistant, or similar academic employment which requires full-time registration as a graduate student.

The immigration status of foreign students might be affected by a Leave depending on circumstances and whether they are staying in the U.S., or, returning to their own country. It is imperative that foreign students considering a Leave of Absence seek counseling at the International Services Center.

Students should pick up a General Petition for a Leave of Absence from the Graduate Division or it can be downloaded from the Graduate Division's website. The petition must be signed by the Graduate Advisor, and a memo of justification from the department must be submitted with the petition.

The student is also required to secure the signatures of the Cashier and Business Office (to determine if there are any outstanding debts or loan provision that must be considered), and International Services (if foreign) before a final decision can be made. The petition must be into the Graduate Division by the published deadline dates. While a Leave of Absence may be granted retroactively to the beginning of the current quarter, a request for Leave submitted after beginning of classes ordinarily should be accompanied by an explanation of the circumstances justifying the late request. Students should not expect an answer until two weeks after their petition has been submitted.

**D. MASTER OF SCIENCE (M.S.) DEGREE PROGRAM**

As indicated above, the M.S. degree in Electrical Engineering can be earned by:

**Plan I**: completion of a thesis that reports an original investigation of a defined problem, or **Plan II**: passing a comprehensive examination.

1. **Thesis Committee (Plan I)**

M.S. thesis committees consist of three members. The committee is nominated by the Graduate Advisor or Department Chair after discussion with the student and faculty Advisor. Nominations are reported to the
Graduate Dean using the Advancement to Candidacy forms. The Graduate Dean reviews the nominations and appoints the Committee. The committee, once approved by the Graduate Dean, becomes fully responsible for the student's academic guidance and evaluation.

The chairman of the Committee is the director of the candidate's research and is normally a faculty member of the EE department, or a cooperating faculty member. A member may be appointed who is a researcher on campus, who is from off-campus, or who is a visiting lecturer within the department; however, a memo indicating the academic degree and affiliation of the nominated member, as well as a curriculum vitae, must accompany such a request. (Memos need not accompany the nomination of an Adjunct faculty member.) If a change in the thesis committee is made, a memo to the Graduate Dean must be submitted explaining why a change is being requested and who is being added or removed.

All three members of the committee must approve the thesis and sign the title page of the thesis upon completion. M.S. students conducting a thesis are required to give a seminar presentation of their thesis work.

2. Comprehensive examination (Plan II)

The exam is administered by the Graduate Committee and is combined with the Ph.D. Preliminary examination. The examination will normally be given twice a year; first on the weekend following the finals week of the Spring quarter, and then a month after that. The students should take the exam at the end of the third quarter of their studies.

A student may take the exam twice. A student who failed in the first attempt has two options. The student may switch to Plan I, or the student must take the examination again at the time of the next immediate examination (which is a month later). A student who has failed the examination twice is automatically removed from the program. A student who registered for the exam but did not show up is considered to have failed.

To complete their education, the students must pass the Comprehensive exam prior to the end of the second year of their studies. Exceptions can be made for those students who were admitted to the program with substantial deficiencies in their education, and for this reason were assigned to the remedial undergraduate courses covering these deficiencies. Students for whom the above requirements present an undue hardship, may petition the Graduate Committee for an appropriate extension of time.

The Comprehensive Examination is a five-hour written, closed-book exam held on one (1) day. A total of five questions must be answered. Students will choose three (3) questions from their major area, and two (2) questions taken from two other areas. For example, a student majoring in Communications & Signal Processing (CSP), can split 5 questions similar to one of the following formats:

- 3 – CSP
- 1 – Control & Robotics
- 1 – Intelligent Systems

OR

- 3 – CSP
- 1 – Control & Robotics
- 1 – NMDC

OR

- 3 – CSP
- 1 – NMDC
- 1 – Intelligent Systems

Test problems will draw primarily from material related to graduate courses; however, a minor portion of the test may involve problems drawn from related upper division courses.

If a student fails 3 or fewer questions on the first attempt, the student only needs to re-take the failed questions on the second attempt. If more than 3 questions are failed on the first attempt, the exam must be re-taken in its entirety.
To take the exam, the students must register by notifying the Academic Program Assistant at least one month prior to the exam date.

3. Advancement to Candidacy and Degree Conferral

Students must be advanced to candidacy for M.S. degree no later than the first week of the quarter in which their degree is expected to be awarded. Deadlines for submission are published each quarter in the Schedule of Classes and in the annual Graduate Division Calendar. If the application is not received by the deadline date, the degree may be deferred until the following quarter.

If the Master's degree requires a thesis (Plan I), a thesis committee should be nominated. The Student Affairs Section certifies the candidacy of the student and checks for the completion of the University and departmental requirements. The student is sent a "Certificate of Candidacy" when certified. All requirements for the degree must be satisfied within a calendar year from the time of completion of the required course work. Should the student be unable to complete the degree requirements within this time, candidacy will lapse. The student must then file a General Graduate Student Petition requesting a reinstatement of Master's Candidacy with the Graduate Division.

The Master's degree is conferred at the end of the academic quarter in which all requirements have been satisfied (the official conferral day is the last day of the quarter). The students must have been formally advanced to candidacy during the quarter in which they finish their degree. Ordinarily, a graduate student will be registered or on Filing Fee status the quarter in which all degree requirements are completed and the degree is to be conferred. However, students may complete the requirements during the quarter break. If they were enrolled or on Filing Fee status the quarter before, they may complete degree requirements before the next quarter officially begins and not be assessed registration fees for that quarter.

If a student wishes to complete degree requirements during the Summer months, they must have had student status (be enrolled or on Filing Fee status) every quarter of the previous academic year to complete without paying additional fees. If they were withdrawn or on Leave any one of those quarters, they must use Filing Fee status or enroll in two units of Summer Session course work to complete during the Summer.

If a student does not complete the necessary courses by the end of the quarter in which degree conferral is expected, or does not attain the required level of scholarship, registration for the next regular academic session is mandatory - otherwise student status will lapse and candidacy for the degree may lapse. Once student status lapses, the degree can be conferred only after readmission of the student, followed by at least one quarter of registration or Filing Fee status.

Students are advised by mail of formal degree award at the end of the quarter in which the degree is conferred. As soon as all degree requirements are completed, the student may request a formal letter of certification of completion bearing the Graduate Dean's signature and University Seal from the Graduate Division. A formal certification of completion is the equivalent of the diploma or the official academic transcript posting for employment and career advancement purposes.

Once the diploma is ready, the Registrar will notify students by postcard that they may pick-up their diploma at that office. If they want it mailed to them they must pay the Registrar for postage. They should make these arrangements with the Registrar's Office.

A graduate student pursuing the Master's degree as a terminal degree may not continue to register as a graduate student once the degree has been awarded unless they have been formally admitted to another program.
E. DOCTOR OF PHILOSOPHY (PH.D.) DEGREE PROGRAM

The Ph.D. degree provides an opportunity for students to pursue a program of in-depth research in a specialized area. As pointed in Section II B, the procedure consists of four parts:

- Passing the Ph.D. Preliminary Examination
- Passing the Ph.D. Oral Qualifying Examination
- Going through the Ph.D. Dissertation Proposal Evaluation
- Defense and approval of the Ph.D. dissertation.

1. Ph.D. Preliminary Examination

The purpose of the preliminary examination is to screen candidates for continuation in the doctoral program. The examination is administered by the graduate program committee and is combined with the M.S. comprehensive examination. The main difference between the PhD preliminary examination and M.S. comprehensive examination is that students taking the former must solve five problems in their major area only. Three of these problems must be from the “basic” courses and two must be from the “advanced” courses designated for each area. Another difference is that students will be exempt from problems on basic courses for which they received A or higher, and problems on advanced courses for which they received A- or higher. Students who did not pass all five problems at the Ph.D. level in their first trial will be given a second chance within one month of their first attempt. In the second attempt, they will be required to solve problems only from the courses they did not pass at the Ph.D. level in their first attempt (regardless of how many they cleared in the first trial).

The normative time for taking the preliminary exam is by the end of the student’s third quarter. Plan II M.S. candidates who took the combined M.S. comprehensive and Ph.D. preliminary examination and successfully passed at the Ph.D. level are given credit for having passed the Ph.D. preliminary examination for those courses in their major area.

Please refer to Section III.A for the list of basic and advanced courses in each area.

2. Ph.D. Qualifying Examination

After passing the preliminary examination, the students are expected to demonstrate that they have a thorough understanding of their research field, and have potential for doing cutting-edge research. For that purpose, each student must choose a research topic under the guidance of his/her faculty advisor and orally present to the Ph.D. Qualifying Committee the state-of-the-art in that topic as well as the new research directions he/she intends to take. The oral presentation is given to the Ph.D. Qualifying Committee members, and is not open to the general public.

The oral presentation must be accompanied by a written report, which is written in proper technical English and in the style of a typical Electrical Engineering conference or journal publication. The report must be delivered to the committee members at least a week prior to the oral presentation.

The Ph.D. Qualifying Examination must be taken within one year after entering the program. Typically, this will correspond to prior to the start of the Fall quarter after the Preliminary Examination is passed. Based on the written report and the oral presentation, a recommendation will be made by the Ph.D. Qualifying Committee that the student either 1) be advanced to Ph.D. candidacy, 2) be asked to modify and enhance the report and/or the presentation, or 3) be requested to withdraw from the Ph.D. program. If the
student is asked to modify and enhance, the student is entitled to one more attempt in passing the Qualifying Examination.

3. Ph.D. Qualifying Committee

By Academic Senate Regulation and Graduate Council policy, the Qualifying Committee is comprised of five members, a majority of whom, but not all, are affiliated with the program. The Chair of the Qualifying Committee is normally the student's Ph.D. Advisor, who must be a voting member of the Academic Senate. (All committee members should normally be voting members of the UC Academic Senate.) Any exceptions must hold Ph.D.s, be qualified for a UC faculty appointment and must be supported by a memo of justification from the Graduate Advisor. A memo need not be written for those holding Adjunct faculty positions.

One member of the Qualifying Committee, designated the “outside member,” must be a voting member of the UC Academic Senate who does not hold an appointment in the EE department. This person represents the faculty at large and acts most importantly, as a "third party ensuring fairness." Special expertise in the area of the student's dissertation is not expected; this member's academic field may be unrelated to the field of study of the student and the other committee members, and this member is expected to be unaffiliated with the department. The “outside member” cannot be an EE Cooperating Faculty.

The student and his/her Advisor nominate the Committee with the concurrence of the Department Chair or Graduate Advisor. After review of the nominations, the Graduate Dean appoints the Committee. This Committee, once approved by the Graduate Dean, becomes responsible for the student's academic guidance and evaluation until advanced to candidacy.

The proposed Qualifying Committee and the date set for the exam must be submitted to the Graduate Division Office on the Ph.D. Form 2 (Nomination for Qualifying Examination for the Degree of Doctor of Philosophy) at least two weeks (preferably one month) prior to the date of the final qualifying examination date. If any nominee is not a member of the University of California Academic Senate, a curriculum vitae and a memo justifying the appointment from the Graduate Advisor or Department Chair should be submitted with the Form 2.

Once the committee has been formally appointed, the date and time of the oral presentation will be scheduled. Any changes in the exam date or in the composition of the Committee must be communicated in writing to the Graduate Division not less than twenty-four (24) hours before the oral examination is held.

The recommendation of the committee must be reported to the Graduate Council within forty-eight (48) hours on Ph.D. Form 3 (Report on Qualifying Examination and Nomination of Dissertation Committee) which is provided by the Graduate Division to departments on request. Each committee member must sign the form. No one can sign for them.

The Graduate Dean will accept a unanimous committee report for or against approval for the Graduate Council. If a student has failed the qualifying examination, the committee is required make a recommendation for or against a second examination, ordinarily not to be given until at least three months have elapsed. The date of the second oral examination shall be communicated to the Graduate Division in writing at least two weeks prior to its occurrence. A third examination is not permitted. The student will be notified of the results immediately following the exam when a unanimous vote is reached.

If there is an initial divided vote, the committee will make every effort to arrive at unanimity. Failing unanimity, a committee reports which contains only one negative vote will be deemed a pass, and committee’s report containing two (or more) negative votes will be considered a failure. When the vote is
split, the committee or any member of the committee can petition (in writing) the Graduate Council to consider a reversal of the judgment. In that event, the Administrative Committee of the Graduate Council will make the final determination as to whether the student has passed. In such cases no statement is made to the student regarding his/her passing or failure until the final determination has been made. The student shall be informed within forty-eight (48) hours that the vote is split and the final determination will be made by the Graduate Council.

When the Committee meets to conduct the oral Qualifying Examination, it must report the vote and/or action to the Graduate Council via the Graduate Dean. If the Committee decides to reexamine the student at a later date or does not pass the student for any reason, this must be reported. Once a committee convenes an examination, that committee must report either a pass or fail. All committee members must sign the Form 3 at the time the qualifying examination is concluded, and submitted even if the examination was failed.

4. Advancement to Candidacy

After successful completion of the qualifying examinations and completion of all University and departmental requirements, the student is eligible for formal advancement to candidacy. At that time, the EE department submits the "Report of Departmental Requirements for Ph.D. Degree" to the Graduate Division to conduct a degree check. The student will be billed the Candidacy Fee after the degree check has been completed. After a successful degree check, the student and EE department are notified of the formal advancement to candidacy.

All students who are considered nonresidents for tuition purposes and are advanced to candidacy for the Ph.D. receive a reduction of 100 percent of the non-resident tuition. Each student is eligible for a maximum of three calendar years of non-resident tuition reduction. Time spent not registered (withdrawn, on leave, or on filing fee status) will count toward the three-year total unless the Graduate Dean grants an exception. A student must be advanced by the first day of the academic term to qualify for that quarter.

Candidacy for the Ph.D. will normally lapse if the student loses graduate standing by academic disqualification or failure to comply with the University policy on continuous registration. A readmitted student who was a candidate for the Ph.D. may be required to again advance to candidacy and thereafter enroll as a candidate for at least one academic quarter before the Ph.D. will be conferred. If less than three years has passed since the student withdrew, the candidacy will normally remain in effect. If three or more years have passed since Advancement to Candidacy, candidacy status will be determined by consultation between the Graduate Dean and the department.

5. The Ph.D. Dissertation Committee

Following advancement to candidacy, a Ph.D. student formally begins his/her dissertation research, and upon recommendation of the Graduate Advisor or the EE Chair, has a Ph.D. Dissertation Committee appointed by the Graduate Council through the Graduate Dean. The committee will consist of at least three Academic Senate faculty members with at least two members from the Electrical Engineering department. These criteria assume that any nominated person will be affiliated with this campus throughout the time that the student is working on the dissertation. For any nominee who does not fit the above criteria (other than Adjunct faculty), the Graduate Division requires supporting justification from the Department for review and consideration. All committee members must have a doctoral degree.

At this stage, the Dissertation Committee becomes responsible for the student's academic guidance and evaluation for the remainder of their degree studies. It is recommended that Ph.D. candidates interact frequently with members of their dissertation committee to insure that dissertation progress is acceptable.
If the Chairperson of the dissertation committee leaves the campus, he or she leaves the department as well as the Academic Senate. If the student has already completed a major portion of the dissertation research under this chairperson, the outgoing faculty member may remain on the student's committee in the capacity of Co-Chairperson, serving with a member of the student's department who does meet the above criteria appointed as Co-Chairperson. Of course, the outgoing faculty member would need to be willing to continue serving on this committee.

If a committee member other than the Chairperson leaves the campus, a faculty member meeting the above stated criteria normally replaces the outgoing member. Exceptions to this practice have been made when the student has already completed a substantial portion of the dissertation research, and the departing member is willing to continue to serve on the committee. As a safeguard for the student, the appointment of a minimum of three UCR Academic Senate members to dissertation committees is normally required.


The normative time for the Ph.D. Dissertation Proposal Evaluation is by the end of the third year. It must be taken at least six months prior to the Dissertation Defense.

To go through this evaluation, the student must prepare a written dissertation proposal that clearly indicates the proposed problem under study, demonstrate substantial knowledge of the topic and related issues, state the progress made towards a solution, and indicate the work remaining to be done. The new approaches and methods to be used in the research should be discussed. An extensive bibliography for the problem under study should also be attached to the proposal. The proposal should promise an original and substantial contribution to knowledge in the student’s major field. The student must demonstrate his/her ability to carry out a program of independent advanced research and to report the results in accordance with standards observed in recognized scientific journals.

The Dissertation Proposal Evaluation will be administered by the Ph.D. Dissertation Committee, and will consist of an oral presentation of the dissertation proposal by the student, followed by an evaluation of the appropriateness of the research topic and the feasibility of the research plan. A realistic timeline for the completion of the dissertation will also be established.

7. Ph.D. Dissertation Defense and Degree Conferral

After completion of the dissertation research, a written copy of the dissertation must be submitted to and approved for defense by the student's Ph.D. Dissertation Committee. Once a draft has been approved for defense, an oral defense of the dissertation will be scheduled. This defense consists of a seminar open to the entire academic community, followed by a question/answer period conducted by the Ph.D. Dissertation Committee.

Under unusual circumstances, the exam may be waived with the unanimous consent of the committee and the approval of the Graduate Dean. The final examination may be given either just prior to the completion of the dissertation and while the student is in residence during a regular academic session or after the acceptance of the dissertation, and will be open to all members of the academic community.

Upon completion or waiver of the final examination and approval of the dissertation, the Doctoral Committee recommends, by submission of Ph.D. Form 5 (Report of Final Examination), that the Ph.D. be conferred. All members of the committee must sign the form. They may not have anyone else sign for them. Also, two copies of the dissertation must be submitted to the Graduate Division. (See Instructions for the Preparation and Submission of Theses and Dissertations for complete information about UCR dissertation requirements.)
Ph.D. degrees are conferred, subject to the final approval of the Graduate Council, as of the last day of the regular academic quarter in which all requirements have been satisfied (the last day of the quarter), including the final positive recommendation of the Doctoral Committee, and the acceptance of the approved dissertation by the Graduate Division on behalf of the University. A graduate student must be registered or on Filing Fee status the quarter in which the dissertation is submitted and the degree is to be conferred. No fee for filing the manuscript itself is required.

Unless payment of a Filing Fee or a Leave of Absence is approved, all graduate students must register each regular academic quarter (excluding Summer Session) until all degree requirements are completed - otherwise, student status and candidacy for the Ph.D. will normally lapse. Once status lapses, the degree can be conferred only after readmission of the student, followed by at least one quarter of registration or Filing Fee status and possibly re-advancement to candidacy. Students are advised by mail of formal degree conferral at the end of the quarter in which the degree is completed. As soon as all degree requirements are completed, the student may request a formal letter of certification of completion bearing the Graduate Dean's signature from the Division office. A formal certification of completion is the equivalent of formal degree conferral for faculty and postdoctoral appointments and other employment and career advancement purposes.

Once the diploma is ready, the Registrar will notify the student by postcard that they may pick-up their diploma at that office. If they want it mailed to them they must pay the Registrar for postage. They should make these arrangements with the Registrar's Office.
III. MAJOR AREA COURSES

This section presents the list of courses in each of the five areas. Recall that M.S. Plan II students must choose a major area and two minor areas, and answer 3 questions from their major area, and 1 question from each of the two minor areas (these could be either basic or advanced courses). Ph.D. students will answer five question from one major area only, but answer 3 questions from the basic courses and 2 from the advanced courses in the chosen major area.

Please refer to the UCR General Catalog (http://www.catalog.ucr.edu/) for descriptions of the courses.

**Nano-materials, devices, and circuits**

**BASIC COURSES**

- EE 201 Applied Quantum Mechanics
- EE 202 Fundamentals of Semiconductors and Nanostructures
- EE 203 Solid State Devices
- EE 205 Optoelectronics and Photonic Devices
- EE 206 Nanoscale Characterization Techniques
- EE 215 Stochastic Processes

**ADVANCED COURSES**

- EE 204 Advanced Electromagnetics
- EE 207 Noise in Electronic Devices
- EE 208 Semiconductor Electron, Phonon, and Optical Properties
- EE 209 Semiclassical Electron Transport
- EE 212 Quantum Electron Transport
- EE 214 Quantum Computing
- EE 216 Nanoscale Phonon Engineering
- EE 219 Advanced CMOS Technology
- EE 220 Applied Ferromagnetism
- EE 223 Numerical Analysis of Electromagnetic Devices
- EE 230 Mathematical Methods for Electrical Engineering

**PHYS 221A,B** Quantum Mechanics
- PHYS 234 Physics of Nanoscale Systems
- PHYS 235 Spintronics and Nanoscale Magnetism

**PHYS 240A,B,C** Condensed Matter Physics
- PHYS 242 Physics at Surfaces and Interfaces

**CHEM 202** Advanced Instrument Design
- CHEM 203 Nanoscience and Nanotechnology
- ME 272 Nanoscale Science and Engineering
- BIEN 245 Optical Methods in Biology, Chemistry, and Engineering
- MSE 210 Crystal Structure and Bonding
- MSE 220 Materials Characterization Techniques
Control and Robotics

BASIC COURSES

EE 215  Stochastic Processes
EE 230  Mathematical Methods for Electrical Engineering
EE 235  Linear System Theory
EE 236  State and Parameter Estimation Theory

ADVANCED COURSES

EE 210  Advanced Digital Signal Processing
EE 211  Adaptive Signal Processing
EE 237  Nonlinear Systems and Control
EE 238  Linear Multivariable Control
EE 239  Optimal Control
EE 240  Pattern Recognition
EE 241  Advanced Digital Image Processing
EE 242  Intelligent Systems
EE 243  Advanced Computer Vision
EE 244  Computational Learning
EE 245  Advanced Robotics
EE 246  Intelligent Transportation Systems

Intelligent Systems

BASIC COURSES

EE 215  Stochastic Processes
EE 230  Mathematical Methods for Electrical Engineering
EE 235  Linear System Theory
EE 236  State and Parameter Estimation Theory
EE 240  Pattern Recognition
EE 242  Intelligent Systems

ADVANCED COURSES

EE 210  Advanced Digital Signal Processing
EE 211  Adaptive Signal Processing
EE 229  Video Processing and Communication
EE 239  Optimal Control
EE 241  Advanced Digital Image Processing
EE 243  Advanced Computer Vision
EE 244  Computational Learning
EE 245  Advanced Robotics
EE 246  Intelligent Transportation Systems
EE 247  Current Topics in Computer Vision and Pattern Recognition
EE 250  Information Theory
Communications and Signal Processing

**BASIC COURSES**

EE 210  Advanced Digital Signal Processing  
EE 215  Stochastic Processes  
EE 224  Digital Communication Theory and Systems  
EE 230  Mathematical Methods for Electrical Engineering  
EE 235  Linear System Theory  
EE 236  State and Parameter Estimation Theory

**ADVANCED COURSES**

EE 211  Adaptive Signal Processing  
EE 225  Error-Correcting Codes  
EE 226  Wireless Communications  
EE 227  Spread Spectrum Communications  
EE 228  Fundamentals of Data Compression  
EE 229  Video Processing and Communication  
EE 240  Pattern Recognition  
EE 241  Advanced Digital Image Processing  
EE 250  Information Theory  
EE 251  Algorithmic and Combinatorial Coding Theory

**Integrated Circuits and VLSI System Design**

**BASIC COURSES**

EE 203  Solid State Devices  
EE 213  Computer-Aided Electronic Circuit Simulation  
EE 217  GPU Architecture and Parallel Programming  
EE 221  Radio-Frequency Integrated Circuit Design  
EE 222  Advanced Radio-Frequency Integrated Circuit Design  
EE 235  Linear System Theory  
CS 203A  Advanced Computer Architecture  
CS 218  Design and Analysis of Algorithms

**ADVANCED COURSES**

EE 201  Applied Quantum Mechanics  
EE 202  Fundamentals of Semiconductors and Nanostructures  
EE 215  Stochastic Processes  
EE 219  Advanced CMOS Technology  
EE 230  Mathematical Methods for Electrical Engineering  
EE 248  Computer-Aided Logic Synthesis for Digital Systems  
CS 203B  Advanced Computer Architecture  
CS 213  Parallel Processing Architectures  
CS 220  Synthesis of Digital Systems  
CS 223  Reconfigurable Computing  
CS 269  Software and Hardware Engineering of Embedded Systems
IV. FACULTY PROFILES

This section presents information concerning the EE graduate faculty and their research interests, office numbers, phone numbers, and e-mail addresses.

A. EE DEPARTMENTAL FACULTY

**Alexander Balandin**, Professor  
Ph.D., 1997, University of Notre Dame  
Room 435 – WCH  
827-2351  
balandin@ee.ucr.edu

Electronic materials and devices, nanostructures and nanotechnology, nanoelectronic and quantum computer architecture, optoelectronics, noise in electronic devices, electromagnetics and antennas.

**Matthew Barth**, Professor  
Ph.D., 1990, University of California, Santa Barbara  
Room 342 – WCH  
827-5782  
barth@ee.ucr.edu

Transportation and emissions modeling, intelligent transportation systems, vehicle activity analysis, intelligent electric vehicles, intelligent sensing and control, mobile robot navigation, active computer vision, panoramic sensing techniques, mobile robot navigation.

**Bir Bhanu**, Professor  
Ph.D., 1981, University of Southern California  
Room 216 – WCH  
827-3954  
bhanu@ee.ucr.edu

Computer vision, image processing, pattern recognition, machine learning, artificial intelligence, robotics, multi-media databases, computer graphics and visualization, digital systems.

**Jie Chen**, Professor  
Ph.D., 1990, University of Michigan  
Room 428 – WCH  
827-3688  
jchen@ee.ucr.edu

Systems and control, system identification, robust control, linear multivariable systems theory, acoustic control.

**Ilya Dumer**, Professor  
Ph.D., 1981, Russian Academy of Sciences, Russia  
Room 427 – WCH  
827-2924  
dumer@ee.ucr.edu

Error-correcting codes, information theory, decoding algorithms.

**Jay Farrell**, Professor and Chair  
Ph.D., 1989, University of Notre Dame  
Room 341 – WCH  
827-2159  
farrell@ee.ucr.edu

Adaptive and learning control, intelligent control, navigation, stability theory, autonomous systems.

**Elaine Haberer**, Assistant Professor  
Ph.D., 2005, University of California, Santa Barbara  
Room 418 – WCH  
827-7174  
haberer@ee.ucr.edu

Bio-templated materials for electronic, optoelectronic, and energy applications; nano-structured hybrid materials; and novel top-down and bottom-up assembly techniques.
Susan Hackwood, Professor
Ph.D., 1979, DeMontford University, U.K.
Robotics, distributed sensing systems, color vision and integrated manufacturing.
Room 319 – WCH 827-5652 hackwood@ee.ucr.edu

Hamed Mohsenian-Rad, Assistant Professor
Ph.D., 2008, University of British Columbia, Canada
Smart power grid, cyber-physical systems, communication networks, optimization, and game theory
Room 436 – WCH 827-5652 hamed@ee.ucr.edu

Yingbo Hua, Professor
Ph.D., 1988, Syracuse University
Blind channel identification, wireless communications, spectral estimation, signal processing, estimation and detection.
Room 432 – WCH 827-2853 yhua@ee.ucr.edu

Alexander Korotkov, Professor
Ph.D., 1991, Moscow State University, Russia
Single-electron tunneling, electron transport in semiconductors, quantum measurements.
Room 434 – WCH 827-2345 korotkov@ee.ucr.edu

Roger Lake, Professor
Ph.D., 1992, Purdue University
Electron transport in nanostructures, modeling semiconductor devices, theoretical electronics and opto-electronics, ultra-scaled devices.
Room 437 – WCH 827-2122 rlake@ee.ucr.edu

Ping Liang, Associate Professor and Undergraduate Advisor
Ph.D., 1987, University of Pittsburgh
Image processing and analysis, medical image processing, pattern recognition, artificial neural networks, signal processing, pattern formation in distributed systems, decision support systems.
Room 323 – WCH 827-2261 liang@ee.ucr.edu

Jianlin Liu, Professor
Ph.D., 2003, University of California, Los Angeles
Material growth, nano-fabrication and characterization, and device fabrication and characterization.
Room 439 – WCH 827-7131 jianlin@ee.ucr.edu

Anastasios Mourikis, Assistant Professor
Ph.D., 2008, University of Minnesota
Autonomous vehicle localization, multi-robot systems, estimation in mobile sensor networks, vision-aided inertial navigation, simultaneous localization and mapping, structure from motion.
Room 306 – WCH 827-6051 mourikis@ee.ucr.edu

Mihri Ozkan, Professor
Ph.D., 2001, University of California, San Diego
Bio-micromechanical-systems (Bio-MEMS) and Bio-Photonics for applications in bioengineering.
Room 319 – MSE Building 827-2900 mihri@ee.ucr.edu
Wei Ren, Associate Professor
Ph.D., 2004, Brigham Young University
Multi-agent systems, cyber-physical systems, cooperative control, distributed control, networked control systems, autonomous vehicles, robotics.

Amit Roy Chowdhury, Associate Professor and ABET coordinator
Ph.D., 2002, University of Maryland
Computer vision and image processing, statistical pattern recognition, machine learning, video communication, imaging/non-imaging sensor networks, biological image processing

Sheldon Tan, Professor
Ph.D., 1999, University of Iowa
Computer-aided design for VLSI integrated circuits with emphasis on design automation for mixed-signal/analog/RF circuits, embedded system based on FPGA platforms and signal integrity issues in deep submicron and nanometer VLSI designs.

Ertem Tuncel, Associate Professor and Graduate Advisor
Ph.D., 2002, University of California, Santa Barbara
Network information theory, joint source-channel coding, data compression, content-based retrieval

Albert Wang, Professor
Ph.D., 1996, State University of New York, Buffalo
RF/Analog/Mixed-signal integrated circuits (IC), On-chip ESD protection for ICs, SoC (System-on-a-Chip), IC CAD and modeling.

Zhengyuan (Daniel) Xu, Professor
Ph.D., 1999, Stevens Institute of Technology
Blind system identification, spread spectrum communication, multiuser detection, and wireless communication networks.

Qi Zhu, Assistant Professor
Ph.D., 2008, University of California, Berkeley
Embedded systems, cyber-physical systems, computer-aided design for circuits.

B. ADJUNCT FACULTY MEMBERS

Gang Chen
Ph.D., 2004, Shanghai Institute of Optics and Fine Mechanics, China
Atmospheric ultraviolet communication system design, experimentation, and applications.
Hossny El Sherief  
Ph.D., 1979, McMaster University, Canada  
Digital signal processing, control systems, software engineering.  

Rabee Ikkawi  
Next generation memory devices, nanoscale device characterization and reliability.  

Aleksandr Khitun  
Ph.D., 1995, Moscow Institute of Physics and Technology  
Spintronics, magnonics, synthetic multiferroics, magnetic logic devices, cellular nonlinear networks, nanoarchitectonics  

Sakhrat Khizroev  
Ph.D., 1999, Carnegie Mellon University  
Nanomagnetic devices and systems, magnetic memory, data storage systems, spintronics, nano-magnetic resonance imaging (NMRI), and focused ion beam based nanofabrication  

Bahram Parvin  
Ph.D., 1991, University of Southern California  
Computational bioimaging and informatics.  

C. COOPERATING FACULTY MEMBERS  

Guillermo Aguilar  
Associate Professor, Mechanical Engineering  

Ludwig Bartels  
Professor, Chemistry  

Laxmi Bhuyan  
Professor, Computer Science and Engineering  

Philip Brisk  
Assistant Professor, Computer Science and Engineering  

Paulo Chagas  
Professor, Music  

Michalis Faloutsos  
Professor, Computer Science and Engineering  

Robert Haddon  
Distinguished Professor, Chemistry
Srikanth Krishnamurthy
Professor, Computer Science and Engineering

Keh-Shin Lii
Professor, Statistics

Julia Lyubovitsky
Assistant Professor, Bioengineering

Mart Molle
Professor, Computer Science and Engineering

Ashok Mulchandani
Professor, Chemical and Environmental Engineering

Walid Najjar
Professor, Computer Science and Engineering

Hyle Park
Assistant Professor, Bioengineering

Thomas Stahovich
Professor, Mechanical Engineering

Frank Vahid
Professor, Computer Science and Engineering
V. EE FACILITIES

A. ELECTRICAL ENGINEERING TEACHING & RESEARCH LABORATORIES

Electrical Engineering Teaching Laboratories include: Circuit and Electronics Lab, Dynamic Systems and Control Lab, Electrical Engineering Electronics Shop, Image Processing & Computer Vision Lab; Logic Design & Digital Systems Lab, Pentium and Sun Lab, Robotics & Design Projects Lab, and the Signals and Communication Lab.

Electrical Engineering Research Laboratories include: Distributed Robotics & Multimedia Lab, Communication Research Lab, Lab for Identification & Control, Laboratory for Terahertz and Terascale Electronics, Neural Networks & Pattern Recognition Lab, Nanostructure Materials and Device Research Lab, Robotics Research Lab, and the Visualization & Intelligent Systems Lab.

B. CENTER FOR RESEARCH IN INTELLIGENT SYSTEMS (CRIS)

The Center for Research in Intelligent Systems (CRIS) involves an interdisciplinary team of 18 UCR faculty members from seven departments, to promote research and development of autonomous/semiautonomous systems with sensing capabilities that are able to communicate and interact with other intelligent (biological and artificial) systems. These intelligent systems will be able to perform tasks that require understanding of the environment through knowledge, learning, reasoning and planning.

C. COLLEGE OF ENGINEERING - CENTER FOR ENVIRONMENTAL RESEARCH AND TECHNOLOGY

CE-CERT is a center for collaborative research by university, industry, and regulatory agencies on environmental problems. Founded in 1992, CE-CERT is housed in a 36,000 square-foot office and laboratory complex located two miles from the UCR campus in an industrial park. The laboratories at CE-CERT have been designed and developed to address air pollution and technology issues. Primary laboratories at CE-CERT include an atmospheric processes laboratory, vehicle emissions research laboratory, advanced vehicle engineering laboratory, environmental modeling laboratory, pollutant analysis laboratory, and stationary source evaluation laboratory. Each of these laboratories is a state-of-the-art test facility, and a number of the labs, especially the vehicle emissions research laboratory, contain equipment which is unique to a university research facility.
VI. MISCELLANEOUS INFORMATION

A. FACILITY ACCESS AND KEYS

EBU 2 uses card access for most of the doors in the building. The “key” is the student ID card, “UCR Connection Card,” students receive when first registered at UCR. Card key access to general EE graduate student areas is granted to students when they first apply for a computer and e-mail account during the graduate student orientation. This access will be continuous as long as a student is in good academic standing.

Access to research laboratories must be requested on a quarterly basis by the faculty member supervising the specific research laboratory. The Department Chair grants access to instructional laboratories to TAs on a quarterly basis. If regular keys are required for a specific door, a written request, approved by the student’s Advisor and Department Chair, must be submitted to the Department Manager. A $5 deposit is required for each key, which is refunded when the key is returned. Replacement of damaged or lost cards is the responsibility of the students. Lost keys should be reported immediately to the Department Manager.

B. OFFICE AND DESK SPACE

The Graduate Program Assistant assigns office and desk space, as available to full-time students. Preference is given to full-time students with teaching assistant appointments, full-time students with research assistant appointments, other full-time students, and finally part-time students, in that order. It may not be possible for every student to be assigned desk space.

C. MAIL

Incoming mail and intercampus notices may be picked up from mailboxes in the mailroom in Room 107 inside the EE TA Office in EBU2. Outgoing intercampus mail and official university mail can be deposited in the Departmental Administrative Suite in Room 343. Students should send and receive all personal mail (e.g., personal letters, bills, non-technical magazines) from their personal residences.

D. REMUNERATION AND DISBURSEMENT

Direct Deposit statements are available on-line; students employed by other departments should verify the disbursement location and time from the administrative office of the employing department. The Department of Electrical Engineering strongly encourages each employee to participate in the Direct Deposit program. Should you desire a traditional paycheck, you will need to request a waiver and the paycheck will be sent to your residence via U.S. Postal Service (USPS). It is incumbent upon the employee to ensure your local address is current in the Payroll/Personnel System (PPS).

E. TELEPHONE/FACSIMILE

Student offices and laboratories have telephone service, which is restricted either to the local calling area or to within UCR, although long distance calls can be received. If long distance calls of an official nature are required, they should be made through the Advisor’s phone and a charge slip completed.
Use of the facsimile (fax) machine is restricted to official university business only. Obtain your advisor’s consent and ask the department manager for permission to use the fax machine. You will need to complete the fax log upon completion of your transmittal.

F. PHOTOCOPYING

There is a photocopier in the Administrative Suite (343 EBU2) that is available during regular office hours. Only graduate students copying material associated with their duties as a research or teaching assistant may use the photocopier. The copying of copyrighted material must be accomplished through the Printing & Reprographics department. This ensures prevention of infringement of intellectual property rights; royalties, patents and other commercial protection authors of various printed works are entitled.

Research or teaching assistants should submit a request to the reception desk in Room 343 EBU2 for a copy access code. The request must first be approved by the student’s Advisor or TA faculty supervisor. Photocopy charges will be billed to the appropriate account.

PERSONAL PHOTOCOPYING, INCLUDING COPYING OF NOTES, HOMEWORK, EXAM SOLUTIONS, THESIS DRAFTS, TEXTBOOKS AND JOURNAL ARTICLES, NOT ASSOCIATED WITH RESEARCH OR TEACHING ASSISTANT DUTIES, IS NOT PERMITTED ON DEPARTMENTAL PHOTOCOPIERS. Commercial photocopy machines are located in the UCR Bookstore, Rivera Library, Science Library, and the Copy Service store in the Commons.

G. MACHINE SHOP

The machine shop facilities are located in the ground-floor of the laboratory wing of Bourns Hall, Room B155. Students may borrow equipment and use certain machine tools with supervision and prior approval of Paul Stovall, ME Principal Mechanician. Such use is limited to research and is not for personal work.

H. SAFETY

Safety precautions shall be exercised, observed and complied with at all times. NO EXCEPTIONS! All employees are required to attend General Safety Orientation and may be required to attend Laboratory Safety Orientation depending upon duties and tasks performed. In addition, lab specific or task specific training may be required depending upon requirements of the laboratory assigned or employed. Students must become acquainted with all safety rules and procedures before working in the machine shop or laboratories. Dan Giles, is the department safety coordinator and can be reached at 2-2220 or dgiles@ee.ucr.edu.

I. COMPUTERS

Computers and a printer available for use by graduate students are located in the EE Computer Labs. In addition, there are a number of computer labs distributed around the UCR campus, including the Science Library. Students should register for E-mail and network accounts on the EE server when they first enroll for graduate studies. Registration forms and submittals can be obtained from the EE Department Systems Administrator in Room 109 EBU2.
Please check your email frequently; this is the primary method of information dissemination regarding deadlines, seminars, etc.

J. THESES AND DISSERTATIONS

Typing and submittal of a thesis or dissertation to the specifications of the Graduate Division is the responsibility of the student. See the *Thesis & Dissertation Format Guide* from the Graduate Division for specific information.

K. UNIVERSITY LETTERHEAD

The use of University letterhead is for official business only. See your advisor should you feel the use of letterhead is warranted.

L. DEADLINES

It is the responsibility of the student to submit the proper forms, paperwork, etc. on time to both the Department and the Graduate Division, and in all other respects satisfy the requirements for a degree as specified by the Department and the Graduate Division.

M. TIMETABLE TO FILE APPROPRIATE FORMS

1. M.S. Degree
   - At the beginning of the quarter in which the student wants to graduate, the *Application for Candidacy for Master of Science in the Field of Electrical Engineering* form must be filled out and submitted to the Graduate Division. Due dates for this form are published in the quarterly Schedule of Classes. See appendix for form.
   - Student should schedule the final defense of the thesis if he/she opted for Plan I. (the date does not have to be reported to Graduate Division when scheduled).
   - Student should sign up to take the Comprehensive Exam if he/she opted for Plan II. If students had already taken the comprehensive exam at the time of advancement, results of the exam should be reported on the Application for Candidacy.
   - Student should report the result of thesis defense immediately following the event by using the *Report of Final Defense for Master’s Degree*. See appendix for form.
   - Students in Plan I - Thesis option should bring the draft of the thesis to Graduate Division for format review.
   - Student should file final copies of thesis with Graduate Division (on or before the last day of the quarter.)

2. Ph.D. Degree
   - Student must pass the Preliminary Examination to advance towards a Ph.D. degree.
Students should nominate Oral Exam Committee by completing and submitting the **Nomination for Qualifying Examination for the Degree of Doctor of Philosophy** (Form 2) to Graduate Division for Dean’s approval. See Appendix for form.

Student should take the Oral Exam and report the result to the Graduate Division for Dean’s approval. Student should also nominate the Dissertation Committee by completing the **Report on Qualifying Examination for the Degree of Philosophy & Nomination of Dissertation Committee** (Form 3). See appendix for form.

The **Report of Departmental Requirements for Ph.D. Degree** form should be filled out and sent to the Graduate Division for students to advance to candidacy (this form should be filed before or along with form 3.) See appendix for form.

Student should schedule the final Defense of Dissertation (date does not have to be reported to Grad Division when scheduled.)

Student should report the result of Final Defense to Graduate Division for Dean’s approval by submitting the **Report on Final Examination for the Degree of Doctor of Philosophy** (Form 5). See appendix for form.

Student should bring draft of dissertation to Graduate Division for format review.

Student should file final copies of dissertation with Graduate Division (on or before last day of the quarter.)