UNLV

THE GRADUATE PROGRAM IN ELECTRICAL ENGINEERING

ELECTRICAL ENGINEERING GRADUATE PROGRAM DOCUMENT[1]

Nothing in this handbook/document supersedes any NSHE, UNLV, or Graduate College policy.

THE UNIVERSITY OF NEVADA, LAS VEGAS
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
4505 MARYLAND PARKWAY, BOX 454026
LAS VEGAS, NV 89154-4026
PHONE: (702) 895-4183
DEPARTMENT OFFICE: TBE B-325

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Handbook Information Changes (Based On 5-9-2016 Version)

Last revised	Revised by	Changes summary
08-17-2021	Mei Yang	Updated the list of full professors, removed comprehensive exam related to doctoral students (including roadmap)
04-01-2024	Mei Yang	Updated the qualifying exam subjects, two new subareas (split from Computer Engineering), added new course in Solid State Electronics & Photonics field, rule of preliminary exam, fixed the formatting problem
07-23-2024	Venki	Formatting, Designation changes, etc.

1. Department of Electrical and Computer Engineering –General Information

Department Message

Electrical engineering is the basic and applied research of scientific and mathematical principles to investigate, invent, develop, design, manufacture, and control of machines, processes, phenomena, and/or systems. The work of electrical engineers has had and continues to have a direct and vital impact on people's lives in the fields of environment, energy, defense, homeland security, data security, medicine, space exploration, safety, communication, biology and extending to all types of industrial and manufacturing issues. For example, electrical engineers have been responsible for the creation of electric power and signals at all frequencies and pulse repetition rates, modern electronics, computers, electronic communication systems, modern flight controllers, automated manufacturing, medical diagnostic tools. An electrical engineering education continues to provide opportunities for solving problems of great social significance and for augmenting the quality of life. The Department of Electrical and Computer Engineering at UNLV has excellent facilities for graduate education and research in electrical engineering. In addition, the Electrical and Computer Engineering faculty is experienced and knowledgeable in many of the electrical engineering disciplines, including communications, control system theory, digital design and computer systems, electromagnetics and optics, electronics, intelligent systems and robotics, power systems, signal processing, and solid-state devices. At UNLV, students have the opportunity to interact effectively with faculty and personnel so that programs and research theses and dissertations can be tailored to their interests.

Purpose

The purpose of this handbook (ECE Graduate Document) is to provide recently updated program specific information that may not be found in the UNLV Graduate Catalog. Students are responsible for understanding and following the policies and procedures delineated in this document and the UNLV Graduate Catalog, as well as the NSHE Code, UNLV Bylaws, and the UNLV Student Conduct Code. Questions about policies should be directed to the Graduate College: valarie.burke@unlv.edu or gradassociatedean@unlv.edu. **Nothing in this handbook/document supersedes any NSHE, UNLV, or Graduate College policy.**

The Faculty

A current listing of the graduate faculty can be found in the UNLV Graduate Catalog. Faculty must hold appropriately approved privileges of graduate faculty status to be involved in graduate education at UNLV. For up-to-date information regarding graduate faculty status in your department, visit the Graduate Faculty status web page.

Department Website: Department of Electrical and Computer Engineering

Chair:

Prof. Mei Yang
Office: TBE 324; Phone: (702) 895-2530
Email: mei.yang@unlv.edu

Graduate Coordinator:

Prof. Venki Muthukumar
Office: AEB-271 Phone: (702) 774-3421
Email: venki.muthu@unlv.edu

Electrical and Computer Engineering Main Office:

Jennifer Reff, Department Secretary
Office: TBE B325
Phone: (702) 895-4183
Fax: (702) 895-4075

Faculty information can be found: ECE Faculty

Annual Mandatory Individual Development Plan and Procedures

Each winter break and early spring term, graduate students are required to complete the Graduate Student Individual Development Plan (IDP) form. The review covers the prior calendar year and assesses student progress, and it establishes reasonable goals for the year ahead. Reported student data is shared with students' graduate coordinators and advisors to foster opportunities for discussion about students' strengths and weaknesses, accomplishments and next requirements, and mentoring plans so that students know what they need to do to progress successfully through their programs in a timely manner. Students who are graduating are also required to complete the form in order to record their achievements since the data is also used to track metrics related to the annual productivity of all students.

Discipline Resources

Department Facilities

The Department of Electrical and Computer Engineering offers a wide array of high technology computing and research facilities. Throughout the Department, as well as the College, graduate students have access to a large network of personal computers and scientific workstations. Available software includes layout tools, logic synthesis tools, processing and demo modeling tools, signal and image processing tools and microwave design tools. The Department's high-technology research equipment includes: vacuum technology, C-V profiler, three gun sputtering system, Hall mobility measurement system, diffusion furnace, vacuum evaporative system, semiconductor parameter analyzers, class 1,000 clean rooms, various metallization systems, unique custom prototyping equipment for prototyping of nanoscale devices and circuits, photolithography facility, bonding and packaging capability, ultra- high resolution scanning electron microscope, atomic force microscope, IR to UV optical characterization, high resolution Raman spectroscopy, ultrahigh field magnetic characterization facility, cryogenic characterization, and various electronic characterization facility in the *Solid State and Nanotechnology fields*; tunable femtosecond lasers and optical parametric amplifiers, high energy Q-switched lasers, semiconductor lasers, terahertz systems, nano- second high-energy pulsed and CW lasers, optical benches and diagnostics, vacuum technology and components, radio-frequency shielding room, world class 700 MHz to 40 GHz EM anechoic chamber with antenna pattern measurement, radar, and electromagnetic compatibility instrumentation, a 1 MV, 15.6 kJ, 7 □ pulsed power device (*Nevada Shocker*), 20 kV, 15 kJ non-equilibrium plasma pinch (NEPP) also known as a dense plasma focus (DPF), DC high voltage equipment, novel Secondary Electron Emission (SEE) test stand with 4 ^{o}K cryostat, microwave, visible, UV and soft x-ray spectrometers, 2-18 GHz 1 kW, pulsed (6% duty cycle) TWT amplifiers and source drivers, and various state of the art instrumentation including real time oscilloscopes, vector network analyzers, and conventional and real time spectrum analyzers and modeling software in the *Electromagnetics and Optics field*s; precision power analyzer, battery test equipment, smart grid test bench in the *Power field*; and twelve ALDEC donated student workstations with FPGA/LDA hardware and HDL software, Agilent oscilloscope/multichannel logic analyzer/spectrum analyzer, 8-blade server with one dual-core processor on each blade, High-end TI DSP board and Multicore CUDA TESLA board, Xilinx, Altera simulation synthesis tools, development boards, NI Labview and MATLAB FP9A development software and hardware boards, CUDA GPU boards, and the GPU servers (configured with 2x Intel CPUs, 512GB memory and 4 TESLA K80 GPUs (each with 24GB GPU RAM) in the *Digital Design and Computer Systems field*.

Useful ECE Department and Graduate College Document Links

During your graduate experience in the Electrical and Computer Engineering Graduate Program, students have found the following forms and documents useful. All the Graduate College forms (Graduate College Forms) are available via the Grad Rebel Gateway. Excluding the column titles, all entries that are bold faced are linked directly to the document or form described in this handbook. The forms in red are typically required to be completed.

Form or Document Description	Student
Transfer Credit	All Students
Appointment of Advisory Committee	MS Thesis/Doctoral Students
Appointment of Faculty Advisor	MS Course-Only Student
Change of Advisory Committee Form	All Students
Appointment of Advisory Committee Approval Form	All Students
Plan of Study Part I	All Students
Plan of Study Part II	All Students

Form or Document Description	Student
Prospectus Approval Form	MS Thesis Students
Advance to Doctoral Candidacy Form	Doctoral Students
Culminating Experience Results	All Students
Graduate College Appeal Form	All Students
Application for Graduation (in MyUNLV)	All Students
Independent Study (ECE Dept. Office)	All Students
Thesis/Prelim/Dissertation Assessment Form (ECE Dept. Office)	MS Thesis/Doctoral Students

Sample Degree Timeline

Steps	Student Degree	Deadlines & Notes
Find Advisor, Declare Transfer Credits, Declare Program Track (Degree Program)	**All Students**	**Within the first semester of enrollment; Degree Audit Requirement** • **Declare Program Track** • **Major and Minor fields (PhD)** • **Transfer credit level (includes Integrated BS-PhDs)**
Select Examination Committee	**All Students**	**No later than the last day of instruction of the first semester of enrollment and before established degree program**
Qualifying Exam (Two Sittings Max.)	• **Doctoral**	• **Must be passed within the first two semesters upon admission to the Doctoral Program.**
Submit Prospectus Approval to Graduate College	• **Master** • **Doctoral**	• **Submitted the semester before taking thesis credit** • **Submitted the semester before taking dissertation credit. Students may enroll in thesis/dissertation credits only after successfully defending their thesis/dissertation proposals.**
Comprehensive Exam (Two Sittings Max.)	• **Master (course only)**	• **Prior to the end of the first week of classes in the student's last two semesters, announce to the ECE Graduate Coordinator student's intention of taking the exam and the completed major field to be examined**
Preliminary Exam & *Assessment* (Generally Two Sittings Max.)	**Doctoral**	**After completing all coursework except for 18 credits of ECG 799 and passing the Qualifying Exam. May not be taken more than once per semester.**
Advance to Candidacy	**Doctoral**	**After all coursework is completed, the Prospectus approved by Graduate Dean, pass the Preliminary Exam. Students will only be eligible to enroll in ECG 799 AFTER advanced to candidacy**
Apply for Graduation	**All Students**	**The exact deadline is announced each semester in the UNLV Schedule of Classes**
Submit Thesis/ Dissertation for Initial Format Check	**All Students**	**Around the 8th week of the semester that graduation is anticipated or earlier**
Submit Thesis/ Dissertation Draft to ECE AA for Dissemination to Review Committee	**All Students**	**At least twelve business days prior to Graduate College's deadline**
Thesis/Dissertation Defense & Assessment	**All Students**	**Deadline set by Graduate College**
Submit Final Copies of the Thesis/Dissertation to Graduate College	**All Students**	**Deadline set by Graduate College**

Steps	Student Degree	Deadlines & Notes
Submit Final Exam for Advanced Degree Results to Graduate College	**All Students**	**Immediately following the official posting of Final Examination for Advanced Degree results. May be submitted at the same time final copies of thesis/ dissertation are submitted to the Graduate College.**

University Resources

The Graduate Academy: Innovative Leadership, Professional, and Career Development
The goal of the Graduate Academy is to serve as a virtual resource providing support and many professional opportunities to UNLV graduate students. The Academy offers information about events and services such as graduate certificate programs, workshops, training sessions and career services. You can follow Academy activities via social media or look for regular updates on the website.

Alumni Engagement
With an alumni base 150,000+ strong, the UNLV Alumni Engagement offers a variety of services and opportunities in support of alumni and their families. UNLV alumni are encouraged to support the values of higher learning through advocacy, involvement, and giving.

Commencement Office
Located in the UNLV Office of the Registrar, the commencement office is the last step in the graduation process. Please check with the commencement office for information on the commencement ceremony and your diploma; for all other information about graduate student degree completion and graduation, including thesis/dissertation requirements and doctoral hooding, please contact the Graduate College. It is the students' responsibility to ensure they apply for graduation on time and submit all required forms to the Graduate College. Questions regarding thesis/dissertation should be directed to the Graduate College Student Services Team and questions regarding required forms should be directed to the Graduate College RPC Team.

Office of Diversity Initiatives
The vision of the Office of Diversity Initiatives is to advocate, promote, and support the advancement of equity, inclusiveness, and empowerment of a continuously changing collegiate and global community. The mission of the Office of Diversity Initiatives is to provide leadership and support for UNLV's diversity mission: *to nurture equity, diversity, and inclusiveness that promotes respect, support, and empowerment*. This Office also handles UNLV Title IX questions, inquiries, and reporting.

Disability Resource Center (DRC)
The DRC is committed to supporting students with disabilities at UNLV through the appropriate use of advocacy, accommodations, and supportive services to ensure access to campus courses, services, and activities. The DRC is the university-designated office that determines and facilitates reasonable accommodations in compliance with the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act of 1973. Graduate students with disabilities must disclose to the DRC in order to receive appropriate accommodations.

Office of International Student and Scholars Services
International Students and Scholars (ISSS) ensures compliance with both SEVIS (Student and Exchange Visitor Information System) and federal law, so that the university can continue to be authorized by the U.S. federal government to enroll international students; host and hire international scholars; assist and advise employment eligibility and authorization relating to international students and scholars, and visa, travel, and immigration issues; provide critical and specialized services to the international students and scholars of the UNLV community; and facilitate their transition to the campus and the U.S.

The Care Center
The Care Center is committed to creating a supportive and inclusive environment for all genders through programming, services, and advocacy for the UNLV community. The Women's Center has informational resources, brochures, and flyers for a variety of on and off campus organizations to help empower and protect yourself, and learn about your options. They also provide free tampons, pads, and condoms.

The Intersection

The Intersection is a one-stop resource for UNLV's highly diverse student body — a comprehensive multicultural center grounded in the academic life of our students. As an intersecting campus resource, the Intersection helps ensure students, particularly first-generation and students of color, successfully navigate their academic careers. Here, all members of campus can discuss their differences, discover their similarities, and build a shared sense of belonging.

UNLV Libraries
UNLV Libraries has always been more than books; they are about encouraging students and creating quality programs that elevate growth and learning. Please visit their website for important information about the services they offer to graduate students.

Graduate & Professional Student Association (GPSA)
The Graduate & Professional Student Association serves all currently enrolled University of Nevada, Las Vegas graduate and professional students. The GPSA maintains the Graduate Student Commons located in the Lied Library room 2141 and Gateway Building PDAC Room. The facility a working office equipped with a copier, fax, flatbed scanners, color laser printer, office supplies, and computers with printers and a small kitchen area. The GPSA is the graduate student governance body at UNLV; the GPSA Council consists of one graduate student representative from each graduate department, and they meet monthly. The GPSA also provides volunteer opportunities, sponsors social events, and supports graduate student research through the graduate research and travel grants program.

Office of Student Rights and Responsibilities
The Office of Student Rights & Responsibilities is a student-centered, service-oriented office located within the Division of Student Affairs. The Office of Student Rights & Responsibilities collaborates with the UNLV community to provide an inclusive system through enforcement of the *UNLV Student Code of Conduct* by:

- Promoting awareness of student rights and responsibilities;
- Establishing accountability for student choices;
- Creating opportunities for involvement in the process; and
- Striving to uphold the values and ethics that advance the common good.

Military and Veteran Services Center
The Military and Veteran Service Center is staffed with veterans and veteran education benefits-experienced staff to assist more than 1,800 veterans, dependents, active duty service members, National Guard members, and reservists attending UNLV. Their mission is to develop a welcoming, veteran-friendly campus environment that fosters academic and personal success.

The Financial Aid & Scholarships Office
The Financial Aid & Scholarships Office supports higher-education access and persistence by providing financial aid to eligible students. The office partners with student organizations, the UNLV Foundation, the Graduate College, and other external constituents to provide financial aid learning opportunities and scholarship support for graduate students.

Writing Center
This is a free service to UNLV students to help you with any writing project, from papers to creative writing, to resumes, and we can work with you at any stage of the writing process. The center can help you brainstorm, make an outline, work on your drafts, or just be a soundboard for your ideas. The center staff can assist you in person, or via the Online Writing Lab (OWL) page.

University Policies and Procedures

Graduate students are responsible for knowing and acting in accordance with UNLV Policies and Procedures. To view the most commonly referenced campus policies and procedures, you can refer to the following websites:

- Academic Integrity
- Activation for Military Service
- Change of Address
- FERPA/Privacy Rights

- Health Insurance - Mandatory
- Jean Clery Campus Safety and Security Report
- Proof of Immunization
- Policies and Procedures on the Protection of Research Subjects
- Rebelmail Policy
- Student Conduct Code
- Student Computer Use Policy
- Title IX

UNLV does not discriminate in its employment practices or in its educational programs or activities, including admissions, on the basis of sex/gender pursuant to Title IX, or on the basis of any other legally protected category as is set forth in NSHE Handbook Title 4, Chapter 8, Section 13. Reports of discriminatory misconduct, questions regarding Title IX, and/or concerns about noncompliance with Title IX or any other anti-discrimination laws or policies should be directed to UNLV's Title IX Coordinator Michelle Sposito.

The Title IX Coordinator can be reached through the online reporting form, by email at titleixcoordinator@unlv.edu, by phone at (702) 895-4055, by mail at 4505 S. Maryland Parkway, Box 451062, Las Vegas, NV, 89154-1062, or in person at Frank and Estella Beam Hall (BEH), Room 555.

To ensure compliance with Graduate College policies and procedures, please review the relevant sections of the Graduate Catalog:

- Academic Calendar
- Academic Policies
- Admission and Registration Information
- Degree Progression Policies & Procedures

In addition, the Graduate College website contains additional information regarding policies and procedures.

Nothing in this handbook supersedes any NSHE, UNLV, or Graduate College policy.

1. Overall and Specific Degree Program Objectives, Outcomes, and Assessments

Overall Electrical Engineering Graduate Program Objectives

The Department of Electrical and Computer Engineering offers graduate programs which culminate in M.S. and Ph.D. degrees in Electrical Engineering. *Throughout this document, the Master of Science in Electrical Engineering and Doctor of Philosophy in Electrical Engineering are abbreviated as MSEE (M.S.E.E.) and PhD (Ph.D.) respectively.* These programs strive to provide a learning centered environment where accomplished faculty share their experience and knowledge with students so that graduates of the program can

1. Demonstrate strong technical knowledge in their field of study with the potential to lead and direct engineering and scientific teams.
2. Demonstrate the ability to learn independently and generate new knowledge in their chosen field of study.
3. Reach the highest academic level with the potential to become a leader and an authority in Electrical and Computer Engineering.

MSEE Program – Course Only Option

(All Corresponding Tracks) (Official Degree requirements are found in the Graduate Catalog)

Objective:

The M.S. in Electrical Engineering non-thesis program strives to provide a learning centered environment where accomplished faculty share their experience and knowledge with students so that graduates of the program can

1. Demonstrate strong technical knowledge in their field of study with the potential to lead and direct engineering and scientific teams.

Outcome:

Graduates of the program will

1. Demonstrate a strong technical knowledge in chosen electrical engineering field by passing a comprehensive exam in the student's major area of study near the completion of the degree program.

Assessment:

1. Comprehensive exam
2. Exit interview

MSEE Program – Thesis Option (All Corresponding Tracks)

Objective:

The M.S. in Electrical Engineering thesis program strives to provide a learning centered environment where accomplished faculty share their experience and knowledge with students so that graduates of the program can

1. Demonstrate strong technical knowledge in their field of study with the potential to lead and direct engineering and scientific teams.
2. Demonstrate the ability to learn independently.

Outcome:

Graduates of the program will

1. Demonstrate strong technical knowledge in electrical engineering field by successfully completing course work and integrating knowledge learned in their course work into a thesis.
2. Demonstrate the ability to learn independently by completing a creative or research project and reporting on this activity in a thesis which should include
   - A hypothesis (or hypotheses)
   - A motivation

- A set of objectives and goals
- A critical literature review
- A theoretical, experimental and/or modeling study
- A conclusion

3. Demonstrate the ability to communicate technical information orally and in writing at an acceptable level of proficiency.

Assessment:

1. Thesis defense (oral exam)
2. MS thesis
3. Exit interview

Please see the Graduate Catalog for official program requirements.

Ph.D. Program (All Track Options)

Objective:

The Ph.D. in Electrical Engineering program strives to provide a learning centered environment where accomplished faculty share their experience and knowledge with students so that graduates of the program can

1. Demonstrate strong scientific and technical knowledge in their field of study capable to lead and direct engineering and scientific teams.
2. Demonstrate the ability to learn independently and generate new knowledge in their chosen field of study.
3. Reach the highest academic level with the potential to become a leader and an authority in Electrical Engineering.

Outcome:

Graduates of the program will

1. Demonstrate strong technical knowledge in electrical engineering field by successfully completing course work, by passing a qualifying exam, and by integrating knowledge learned in this course work into a dissertation.
2. Demonstrate the ability to learn independently and generate new knowledge by completing creative novel work and reporting on this work in a dissertation which should include
   - A hypothesis (or hypotheses)
   - A motivation
   - A set of objectives and goals
   - A critical literature review
   - A theoretical, experimental and/or modeling study
   - A conclusion
3. Demonstrate the ability to communicate technical information both orally and in writing at an acceptable level of proficiency by completing a well written dissertation and presenting the work in their dissertations during an oral dissertation exam.

Assessment:

1. Qualifying Exam
2. Preliminary Exam
3. Final Exam (Oral Defense)
4. Ph.D. Dissertation
5. Exit interview

2. Department Regulations

Advisors

Each graduate student must have a faculty advisor. All entering graduate students are temporarily assigned the graduate coordinator as a faculty advisor. Graduate students should select a faculty advisor in their particular field of interest before completing their first semester. The faculty advisor assists in planning a graduate study program tailored to the particular interests of the student and satisfies the program degree requirements. The faculty helps the student select an advisory committee. Typically, the faculty advisor supervises the graduate student throughout the Master's thesis or Ph.D. dissertation experience.

Transfer Credit

Consideration may be given for transferring graduate credit granted by another *regionally accredited* [*Graduate Student Handbook*] institution or university. The Electrical and Computer Engineering Graduate Committee and the Graduate College *must approve all transfer credits.* At the time of filing for admission or no later than the first semester of classes, the student must petition to the Graduate College and the ECE Graduate Committee those credits earned from a different university to be transferred to their graduate program. The Graduate Committee can only approve up to 6 credits from a different university to be transferred towards a Master's degree program or up to 9 credits from a different university to be transferred towards a PhD program. Credits being transferred cannot be used towards any other earned degree. Under no circumstances will the Graduate Committee transfer more than 6 credits from a different university into a Master's degree program or 9 credits from a different university into a Ph.D. degree program. Typically, the time duration of a degree program is six years starting from the semester of the first class counted towards that degree to the culmination of the degree. See Graduate Catalog for transfer credit information. For estimation purposes only, a MS degree will take about 2 years and a PhD degree will take about 4 years both plus or minus a year. In the Master of Science in Electrical Engineering (MSEE or, equivalently, M.S.E.E.) thesis option program, at most three ECE transfer credits may be applied to the 18 minimum required ECE credits. In the MSEE course only program, none of the transfer credits may be applied to the 21 minimum required ECE credits. Of the nine credits in the Ph.D. program, up to three credits may be applied towards the ECE major field of study and/or the ECE minor field (primary minor field). Up to nine credits may be transferred in the second minor (secondary minor). All courses being transferred must have a grade of B or higher and have not been applied to a degree received or in the process of receiving.

Non-degree Seeking Student Credits

A non-degree seeking student may apply up to 15 UNLV ECE credits towards a degree seeking program in ECE. The credits must have been taken within *four* years from the time upon entering the degree program to be applied towards the program. All UNLV courses being applied to the degree program must have a grade of B or higher [*Graduate Student Handbook*]. Students entering a degree program in ECE with both UNLV credits and credits from another university will only be able to apply up to a total of 15 credits to the degree program [*Graduate Student Handbook*]. Informal courses [For definition, refer to Sect. 3.6.] such as ECG 791 Graduate Independent Study and seminar taken as a non-degree seeking student cannot be applied towards a program degree in ECE. Students can count ECG 695/795 Graduate Special Topics towards the program degree as long as they adhere to the conditions of the particular program option regarding informal course credits.

Graduate Teaching Assistantships (GTA) [Graduate Student Handbook]

The Department of Electrical and Computer Engineering has a limited number of teaching assistantships also commonly referred to as graduate assistantships that are awarded to superior students. To be considered for a teaching assistantship, a student must submit Graduate Record Examination (GRE) scores [scaled score and percentile in quantitative, verbal reasoning, and analytical writing] to the Department of Electrical and Computer Engineering. Prospective candidates should contact the Department's Graduate Coordinator for additional information and refer to Section 3.10 as well as the Graduate Catalog for application submission deadlines (**February 1st** for the fall semester of the same year and **October 1st** for the spring semester of the subsequent year) and requirements. [**Admission Deadlines**]

A Teaching Assistant is contracted to work on average of 20 hours per week on teaching related service (grading, lab

monitoring, lab instructor, office hours, exam proctor, course instructor, etc.) and is also required to complete a minimum of six graduate credit hours per semester. Teaching Assistants who are also working towards the M.S.E.E. degree must take the Thesis Option. The contract period begins on the Monday prior to the first week of class and terminates on Monday following exam week with all required grades and materials appropriately submitted. Teaching Assistants that are not able to meet the contract period obligation must have secured signed and dated letters from the ECE Laboratory Director (for laboratory assistants and laboratory monitors), individual course instructors (for graders), and/or the Graduate Coordinator (especially regarding the first contract week) in this regard. Letters must be submitted to the Graduate Coordinator at least one month in advance prior to the beginning or end of the contracted semester. Teaching assistantship duties are typically assigned by the ECE Laboratory Director (or ECE Department Chair) the first week prior to the beginning of each semester. The ECE Laboratory Director must be notified ***in advance*** by email regarding any requested changes to scheduled duties whether permanent or temporary (illness).
Appropriately, ***contract termination, contract non-renewal, and/or proration of pay*** may result when Teaching Assistants do not adhere to these requirements, do not perform their assigned duties satisfactorily, or do not maintain the minimum GPA (grade point average) requirements specified by their degree programs. The Electrical and Computer Engineering Graduate Committee in conjunction with the Graduate College will determine the terms of the student‘s probation or contractual relationship.

Additional Employment [*Graduate Student Handbook*]**:** Additional employment on or off campus is prohibited unless approved by the Department Chair and Dean of the Graduate College. Such employment **can never exceed 10 hours per week** and must be limited in nature. Failure to request prior approval of secondary employment may result in the assistantship being rescinded. **International students (on F-1 visas) are limited to the 20-hour GA work week during the academic year.**

International Graduate Assistants (GAs) are required to pass the Test of Spoken English (TSE) **[***Graduate Student Handbook* **]** (typically better than 48 out of 60 points) or to take English as a Second Language at UNLV prior to assuming any type of instructional duties.

Academic Integrity [Graduate Student Handbook]

All members of the UNLV community are dedicated to learning. The University and the Graduate College expect nothing less than a high level of scholarly integrity and academic honesty on the part of students, faculty, staff, and administrators. See Graduate Catalog for official policies.

Quality academic work requires honesty. The UNLV faculty and administration regard any attempt by a student to present as his or her own work that which he or she has not solely produced as a serious offense. Students are considered to have cheated, for example, if they copy the work of another; use unauthorized notes or other aids during an examination; turn in a paper or an assignment written, in whole or in part, by someone else as their own. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging the sources, or if they paraphrase ideas from such sources without acknowledging them. Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, examination, or other scholarly endeavor may receive a grade of _F‘ for the course involved and may be suspended or removed from the program. Additionally, UNLV has established policies regarding research misconduct among students, faculty and staff. Research misconduct pertains to commission of any of the following acts: falsification of data, improper assignment of authorship, claiming another person‘s work as one‘s own, unprofessional manipulation of experiments or of research procedures, or misappropriation of research funds.

If a student is deemed by a faculty member to be guilty of academic dishonesty, where applicable, the student may be assigned a failing grade for the corresponding segment of the course or for the entire course. The faculty member or administrator also may initiate disciplinary review under procedures described in the Graduate Catalog and/or UNLV Office of Student Conduct.

Disciplinary sanction options described therein include warning, probation, suspension, and expulsion or revocation of a degree if a degree has been previously awarded. In all cases the faculty member is responsible for recording the circumstances, notifying the student in writing, and for giving the student an opportunity to reply. Appeals go to the chair of the student‘s academic department, academic dean and Graduate Dean.

If a graduate student fails to maintain the standards of academic or professional integrity expected as defined in writing by their discipline or program, the student‘s admission status in his or her program will be terminated. If any member of the university community is deemed guilty of academic dishonesty, action may be brought under the Graduate Catalog. In addition, students who violate these standards will be subject to conduct sanctions, in accordance with the **UNLV Student**

Conduct Code and Policies, in order to promote their own personal development, to protect the university community, and to maintain order and stability on campus.

Sample Non-Regular Courses

ECG 791 Graduate Independent Study, ECG 793 Engineering Science Seminars, Graduate Seminar, and ECG 695/795 Graduate Special Topics

A combination of up to six credits of informal courses such as ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 695/795 Graduate Special Topics may be applied towards a degree program. These credits cannot replace formal, UNLV curriculum approved, ECE courses (or electives) required in the MSEE and PhD degree programs. Further, they cannot be applied to the major or either of the two minor fields in a PhD program. How these courses may be applied to a specific program is discussed below. Unless specifically stated, the terms MSEE and PhD refers to all programs and tracks specific options in a particular degree program. All credit-bearing courses must be approved courses by the Graduate Course Review Committee.

A student in coordination with his faculty advisor may enroll in ECG 791 Graduate Independent Study. No more than 10% of the content of an ECG 791 Graduate Independent Study may include material similar to any other UNLV course. Also, an ECG 791 Graduate Independent Study cannot be substituted for any required or elective UNLV course, especially, one that the student has failed. An ECG 791 Graduate Independent Study in combination with ECG 793 Engineering Science Seminar, and graduate seminar may be taken repeatedly, but no more than a total of three credits of these combined courses can be applied towards a particular degree program. In the MSEE thesis option program, ECG 791 (individually or in combination with graduate seminar and ECG 793 Engineering Science Seminars) cannot be applied to the 18 minimum required ECE credits. In the MSEE course only option program, ECG 791 (individually or in combination with graduate seminar and ECG 793 Engineering Science Seminars) cannot be applied to the 21 minimum required ECE credits. In the PhD program, ECG 791 (individually or in combination with graduate seminar and ECG 793 Engineering Science Seminars) cannot be applied to the candidate‘s major and two minor areas. Further, in the PhD program, ECG 791 (individually or in combination with graduate seminar and ECG 793 Engineering Science Seminars) cannot be applied towards the 15 credits of formal 700 level courses.

Before enrolling in ECG 791 Graduate Independent Study, a student must in coordination with his/her faculty advisor AND independent study course instructor, prepare a proposal to succinctly define the course syllabus, including course content, the type and number of assignments that must be submitted, and the grading method that will be employed with expectations clearly delineated for each grade level; have the course syllabus approved by both the student‘s faculty advisor, independent study course instructor, and the graduate coordinator (or graduate committee). A student cannot apply an ECG 791 Graduate Independent Study towards a degree program if a proposal is not submitted and approved prior to the beginning of the semester that the student enrolls in ECG 791. *Currently, graduate seminar credits are treated as independent study credits. In the advent that a graduate seminar course number is formally approved, all seminar requirements will be treated in the same fashion as the graduate independent study requirements. In combination, no more than a total of three credits of graduate seminar, ECG 793 Engineering Science Seminars, and Graduate Independent Study may be applied towards a degree program.*

A student in coordination with the student‘s faculty advisor may enroll in an ECG 695/795 Graduate Special Topics course approved by the Electrical and Computer Engineering Department. Graduate special topics and advanced graduate special topics courses typically cover experimental and/or theoretical topics which may be of current interest in modern electrical engineering. No more than 10% of the special topics course content can overlap an existing course at UNLV. *If Graduate Independent Study (ECG 791) and seminar credits have not been taken, then at most six credits of special topics may be counted towards a degree. If any total three-credit combination of Graduate Independent Study (ECG 791), Engineering Science Seminars (ECG 793), and graduate seminar has been counted towards a degree, then at most three credits of special topics may be counted towards a degree.* In the MSEE thesis option program, ECG 695/795 cannot be applied to the 18 minimum required ECE credits. In the MSEE course only option program, ECG 695/795 cannot be applied to the 21 minimum required ECE credits. In the PhD program, ECG 695/795 cannot be applied to the candidate‘s major and two minor areas. Further, in the PhD program, ECG 695/795 cannot be applied towards the 15 credits of formal 700 level courses. At the risk of the student, one exception will be allowed. If an ECG 695/795 Special Topics course becomes a Graduate College approved course with a unique course number prior to the final thesis defense (MSEE thesis option), or the comprehensive exam (MSEE course only option), then the ECG 695/795 Graduate Special Topics course equivalent to the newly approved course may be applied to the MSEE or PhD degree program as if it were a formal course.

Some elective graduate courses taken prior to being formally admitted into an ECE graduate degree program cannot be applied to the graduate degree program. Refer to Section 3.3 for non-degree seeking graduate students, Sections 4.1 and 5.1 for program admission requirements, and Sections 4.1.2 and 5.1.1 for students pursuing the Integrated BS-PhD options.

Appeals

Information about appeals may be found in the Graduate Catalog and accessed via the Graduate Rebel Gateway.

Counting 600 Level Classes in a Master or Ph.D. Degree Program

If a student has taken a UNLV 400 level class that has a UNLV 600 level equivalent listing (where equivalent implies that the class is dual listed as a 400/600 level class) and applied this class to a Bachelor's degree program, then the student cannot apply the UNLV 600 level class towards a Master or Ph.D. degree program. For clarity, the student cannot retake the same class under the 600 level designation and count the course towards the MS or PhD degree programs. Only graduate level courses may be considered as part of graduate programs.

Provisional and Conditional Status [Graduate Student Handbook]

Please see the Catalog for information about provisional and conditional admission status.

Admission and Graduate Assistant Application Deadlines [Admission Deadlines]

Potential candidates seeking a Graduate Teaching Assistantship (GTA) must complete BOTH an Admission Application to a post graduate degree program (MS or PhD) in Electrical and Computer Engineering AND a Graduate Assistantship Application by **February 1st** for admission in the fall of the same calendar year or by **October 1st** for admission in the spring of the subsequent calendar year. ***All existing students*** currently in an Electrical and Computer Engineering post graduate degree program seeking a GTA must complete only the Graduate Assistantship Application by **February 1st** for admission in the fall of the same calendar year and **October 1st** for admission in the spring of the subsequent calendar year.

Potential candidates seeking a Graduate Research Assistantship (GRA) must complete BOTH an Admission Application to a post graduate degree program (MS or PhD) in Electrical and Computer Engineering AND a Graduate Assistant Application by **May 1st** for admission in the fall of the same calendar year or by **October 1st** for admission in the spring of the subsequent calendar year. ***All existing students*** currently in an Electrical and Computer Engineering post graduate degree program seeking a GRA may complete a Graduate Assistantship Application at any time.

Potential candidates not seeking an assistantship must complete an Admission Application to a post graduate degree program (MS or PhD) in Electrical and Computer Engineering by **May 1st** for admission in the fall of the same calendar year or by **October 1st** for admission in the spring of the subsequent calendar year.

3. Master of Science Program Options in Electrical Engineering

Please see the **Graduate Catalog for official program requirements**.

[Graduate Catalog – MSEE Program] [Graduate Catalog – Dual Degree]

The Department of Electrical and Computer Engineering at UNLV offers several program degree options leading to the Master of Science in Electrical Engineering (M.S.E.E. or, equivalently, MSEE). Specific areas of study that are currently available include Communications, Control System Theory, Digital Design and Computer Systems, Electromagnetics and Optics, Electronics, Intelligent Systems and Robotics, Power Systems, Signal Processing, and Solid State Materials and Devices. The following degree options are available: MSEE with thesis option, MSEE with course only option, MSEE Integrated BS-MS option, and MSEE dual degree option. The MSEE thesis option culminates with a thesis which prepares the student for a PhD experience if higher education is desired. The course only option is a final advanced professional degree option culminating with a comprehensive exam that must be passed in the student‘s specialty area. The Integrated BS-MS option is for UNLV graduates who excel in their ECE UNLV undergraduate programs wanting to attain a MSEE or PhD degree at UNLV in ECE with the thesis option. The dual degree program allows the student to complete a MSEE degree and a Master’s of Science in Mathematics (MS MAT) degree jointly. The program prepares graduate students with complementing educational components covering electrical engineering and mathematics, which is the basis of all engineering.

Admission Requirements may be found in the Graduate Catalog
General Admission Requirements can be found in the Catalog

Graduate College Admission Requirements

1. ***Completed application in the Application Portal and non-refundable application fee.***
2. ***Bachelor's Degree – You must hold a four-year baccalaureate from a regionally accredited institution or an approved equivalent.***
3. ***Grade Point Average – You must have a minimum overall grade point average of 2.75 (4.00=A) for the bachelor's degree or a minimum 3.00 (4.00=A) for the last two years (60 semester credits).***
4. ***All applicants are required to submit an unofficial transcript from each postsecondary institution attended, showing all degrees and coursework, the dates awarded, and grades received. Official transcripts required upon admission.***
5. ***Credentials not in English must be accompanied by an English translation certified as true by a university official, an official representative of a United States embassy or consulate, the United States Information Service, the United States Education Foundation, or an approved professional translating service. Notarized copies of originals or translations are not considered official.***

Admission Requirements for the Integrated BS-MSM.S.E.E. Program Option.

Official Information may be found in the Graduate Catalog

The Integrated BS-PhD program allows select UNLV undergraduates to pursue the Electrical Engineering M.S.E. degree at UNLV. The program provides an opportunity for those undergraduates who have taken either 9, 6, or 3 graduate-level electrical and computer engineering courses toward their undergraduate electrical/computer engineering degrees, to complete the respectively corresponding M.S. in Engineering with a total of either 21, 24, or 27 as opposed to the 30 credits required for Thesis Track. Students admitted to the Integrated BS-MS program are required to write a thesis. To be considered for admission to the Integrated BS-MS M.S.E.E. Program Option, an applicant must have completed a B.S. degree in the electrical engineering and/or computer engineering program at UNLV:

1. Have a minimum overall grade point average (GPA) of 3.5 (A = 4.00) for their B.S. degree; and
2. Have completed up to a maximum of 9 credits of formal Graduate College curriculum approved 600/700 level courses (which excludes informal courses such as ECG 791 Graduate Independent Study, ECG 793 Engineering Science Seminars, graduate seminar, and ECG 659/795 Special Topics) which were applied towards the student’s

B.S. degree (Refer to Section 3.6)). Each graduate level course must have been completed with a minimum grade of B (3.0).

Additional Admission Requirements for International Applicants
[Please see the Graduate Catalog for official information].

For international applicants to be considered for admission, the Graduate College requires that they take the Test of English as a Foreign Language (TOEFL) and obtain a minimum score of 550 or 85 on the Michigan Test. Students whose first language is not English may be required to take and pass (typically 48 out of 60 points) the English as a Second Language Placement Test upon arrival at UNLV. If necessary, they will be required to take English as a Second Language (ESL) courses at UNLV. These courses will not count towards their graduate degree. Those awarded a teaching assistant must satisfy the requirements of in Section 3.4.

M.S.E.E. Official Degree Requirements can be found in the Graduate Catalog

All graduate students must select a faculty advisor in their first semester. In coordination with the faculty advisor, student's taking the thesis option must also form a thesis advisory committee. A thesis advisory committee is composed of at least four members of the UNLV Graduate Faculty. Three of this faculty must be from the Department of Electrical and Computer Engineering. The fourth faculty member must from a relevant supporting field outside of the department having *appropriately approved Graduate Faculty Status to serve as the Graduate College Representative* as recognized by the Graduate College. At the time of admission or no later than the first semester, the MS candidate must formally petition BOTH the graduate college and the ECE graduate committee to accept transfer credits and credits taken as a non-degree seeking graduate student to be applied to the MSEE program. By the end of the second semester, the MS candidate must submit an approved program form and thesis prospectus to the graduate coordinator. The student's advisor, advisory committee, and the graduate coordinator must approve this program prior to submission to Graduate College. All MSEE students must show satisfactory progress towards completion of their degree by completing at least six graduate credits of their approved program per calendar year (more specifically ―within three rolling semesters‖ which includes the summer semester). If progress towards their degree program is not satisfactory, students will be placed on probation an may be consequently dismissed from the program.
Specific requirements for the M.S.E.E. degree are:

2. Satisfy the M.S.E.E. degree program admission requirements (refer to Sect. 3.10 for application deadlines) and be admitted to the M.S.E.E. program with full graduate status.

3. All M.S.E.E. candidates must maintain graduate level standing and an overall minimum grade point average (GPA) of 3.0, a minimum GPA of 3.0 each semester, and must complete all graduate level courses that apply towards their degree with a minimum GPA of 2.70 (B-). Courses with grades below B- cannot be applied towards the M.S.E.E. degree and must be repeated or replaced. A class grade below C (2.0) is grounds for initiating a program separation recommendation to the Graduate College. MSEE candidates who do not maintain an overall minimum GPA of 3.0 and a minimum GPA of 3.0 each semester or who earn more than one grade below B- will be placed on academic probation via the Graduate college process. The Electrical and Computer Engineering Graduate Committee in conjunction with the Graduate College will determine the terms of the student's probation based upon the student's academic record and in accordance with the rules of the Graduate College

4. Select a program option. No more than three credits of ECG 791 Graduate Independent Study (which cumulatively includes graduate seminar and ECG 793 Engineering Science Seminars) and no more than a total of six credits of courses (independent study, topics or seminars) such as the combination of ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 695/795 Graduate Special Topics may be applied towards the MSEE degree program. These credits cannot be used towards the *required* 18 (for Thesis Option) and 21 (for Course Only Option) credits of ECE courses. Refer to Roadmap and flow chart of the MSEE Programs at the end of this document.

Thesis Option: Students who select the Thesis Option must complete a minimum of 30 credits. Of the 30 required credits, a minimum of 18 credits must be in formal electrical engineering courses, a minimum of 15 credits must be in formal 700-level electrical engineering courses excluding ECG 797 Electrical Engineering Thesis. Informal courses (such as ECG 695/795 Special Topics, ECG 793 Engineering Science Seminars, graduate seminar, and ECG 791 Graduate Independent Study) cannot be applied to these 18 credits. (Refer to Section 3.6) Students must complete at least six credits of ECG 797 Electrical Engineering Thesis which culminates in the successful completion of a thesis

oral exam and the submission of an approved thesis. Although ECG 797 Electrical Engineering Thesis can be taken repeatedly, no more than 6 credits can be applied towards the 30 credits required for the M.S.E.E. degree. Students can only enroll in thesis credits after successfully defending their thesis proposals.

Course Only Option: Students who select the Course Only Option must complete a minimum of 30 credits. Of the 30 required credits, a minimum of 21 credits must be in 700-level electrical engineering courses excluding informal courses (such as ECG 791 Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 695/795 Special Topics). (Refer to Section 3.6) The Course Only Option is a final advanced professional degree option in that students who complete the Course Only Option will not be considered for admission into any of the department's Ph.D. program options. Students in the course only option are required to pass a comprehensive examine in one area of choice. A degree is not awarded until the comprehensive exam is passed and all coursework is successfully completed within the constraints of this option. The comprehensive exam is the culminating experience for the MSEE course only option. The culminating experience is typically taken in the graduating semester and it's incumbent upon students to work with their advisors to progress through degree completion appropriately.

Integrated BS-MS M.S.E.E. Program Option: Students who have been admitted into the Integrated BS-MS M.S.E.E. Program Option must complete a minimum of 21, 24, or 27 credits in the Integrated BS-MS program respectively corresponding to 9, 6, or 3 credits respectively of *formally approved* graduate level courses (Refer to Section 3.6 and 4.1.2) applied toward the B.S. degree yielding a total of 30 course credits. Of the 30 course credits, a minimum of 18 credits must be in *formally approved* electrical engineering courses excluding the required six credits of ECG 797 Electrical Engineering Thesis. Fifteen (15) of these 18 credits are 700 level courses. For clarity, such courses as ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 695/795 Special Topics are *not formally approved* courses and are termed informal courses in this document. Potentially, six credits of informal courses may be fitted into the Integrated BS-MS MSEE Program Option. (Refer to Section 3.6.) A minimum of 15 of the 18 credits must be in formal 700-level electrical engineering courses. Students must complete at least six credits of ECG 797 Electrical Engineering Thesis which culminates in the successful completion of a thesis oral exam and the submission of an approved thesis. Although ECG 797 Electrical Engineering Thesis can be taken repeatedly, no more than 6 credits can be applied towards the 21, 24, or 27 credits required for the M.S.E.E. degree. Students can only enroll in thesis credits after successfully defending their thesis proposals

M.S. MAT Program: Students who are also pursuing an M.S. MAT degree can apply up to 6 credits of courses to both their M.S. MAT degree and their M.S.E.E. degree. Non-ECG courses must be applied towards non-ECG credits in the electrical engineering degree program pursued.

5. Successfully complete a minimum of three credits in at least three of the following areas [Graduate Catalog – MSEE Program] [Graduate Catalog – Dual Degree]:

    a) Communications
    b) Control Systems
    c) Digital Design and Computer Systems
    d) Electromagnetics and Optics
    e) Electronics
    f) Intelligent Systems and Robotics
    g) Power Systems
    h) Signal Processing
    i) Solid State Electronics and Photonics

6. Thesis Requirements.

Students fulfilling the Thesis Option requirements or the Integrated BS-MS M.S.E.E. Program Option requirements must complete a thesis. Before beginning a thesis, students must have their thesis topic approved by their advisor, the advisory committee, and the ECE graduate coordinator. The necessary paper work must be filed with the Graduate College by the end of the second semester. The thesis prospectus describes the thesis topic and must include an introductory set of sentences, a well formed hypothesis or hypotheses (specifically italicized in the prospectus) accompanied by a motivation, objectives with major and alternative approaches to the studies, and conjectures of possible outcomes. **Students are NOT allowed to take thesis credits until their thesis prospectus is approved. Credits taken before the approval date will NOT count towards the degree program.** The student must complete a thesis containing original research and publicly defend it before his/her advisory committee at the Thesis Exam. Although the student may take as many credits of ECG 797 Electrical Engineering Thesis as necessary to complete the research effort, only 6 credits will be counted towards the MSEE degree. Students who

plan to continue their studies beyond the M.S.E.E. degree program at UNLV are required to select this option.

The Prospectus: The prospectus describes the thesis/dissertation topic and must include an introductory set of sentences with a referenced literature search, a well formed hypothesis or hypotheses (*specifically italicized in the prospectus*) accompanied by one or more motivations, objectives with major and alternative approaches to the studies, and conjectures of possible outcomes. Typically, the prospectus is 1 to 3 pages in length. The hypothesis or hypotheses represent the kernel about which a thesis or dissertation is built upon and around. It may be expressed in the form of a statement or a question. The hypothesis is a scientific educational guess that has of yet not been proved. Paraphrased from Wikipedia, "A **hypothesis** is a *proposed* explanation for a phenomenon that cannot satisfactorily be explained with the available scientific theories. The hypothesis is a proposed explanation of a phenomenon which still has to be rigorously tested." ***Italicize the hypothesis (hypotheses) in the prospectus.*** One way of stating the hypothesis is –It is hypothesized that *performing this task or cause*‘ will *yield this effect or result*. ‘‖ The why question of the hypothesis is to be addressed in the motivation. The motivation is the gut feeling or spark of intuition or ingenious that drives, ignites, and/or guides the formulation of the hypothesis. The motivation is usually based on complete or partial scientific evidence or lack of evidence in experiment, theory, or archived literature. Objectives serve as a goal of a course of action based on observable phenomena. The objectives drive major and alternative approaches to study phenomena supporting or disproving the scientific hypothesis. **In your prospectus, bullet and bold-face the objectives.** To conjecture is to infer from inconclusive evidence possible outcomes. In effect, one is guessing based on a partial evidence and motivation which drives the hypothesis. Conjectures act as a guide driving your objectives. Conjectures are required to support the objectives of your prospectus. A polished prospectus must contain each of the above components. Examples are available upon request.

Thesis Exam: A student must submit a complete copy of his/her thesis to each member of his/her advisory committee at least two weeks prior to the date of the thesis exam. The student must also notify each member of his advisory committee of the date, time, and location of the oral defense of his/her thesis exam at least two weeks in advance. During the thesis exam, the student will publicly present and defend the thesis. After the thesis exam, the student‘s advisory committee will meet and determine if the student‘s presentation and defense of the thesis was satisfactory. To pass the Thesis Exam, the MSEE candidate‘s advisory committee must ***unanimously*** approve the MSEE candidate‘s Thesis [**Graduate College Policy**]. If the committee votes unanimously to fail the student or the vote is not unanimous to pass, the student, will be placed on probation via the Graduate College. Additionally, in consultation with his/ her advisor, the student may request the committee to administer a second examination [Graduate College Policy]. The student must wait at least three months before taking the second examination [**Graduate College Policy**]. To complete the thesis requirement, the student must submit his/her approved, properly formatted hard-copy thesis to the Graduate College, and submit the approved electronic version to ProQuest by the posted deadline

Comprehensive Exam in the Course Only Option. To complete this requirement the student must pass a closed book three hour exam on graduate coursework in one area of choice composed of at least two formal graduate level courses which includes all prerequisite material whether graduate or undergraduate in nature. A degree will not be awarded until the comprehensive exam is passed. The exam may be taken in the last two semesters of the student‘s MSEE program. The student may not take the exam until all course work pertaining to the exam is completed. For clarity, students enrolled in courses pertaining to the comprehensive exam cannot take the comprehensive exam. Within the six-year limit, the exam may be repeated until passed but cannot be taken more than once per semester. Prior to the end of the first week of classes in the student‘s last two semesters, the student must announce to the ECE Graduate Coordinator his/her intention of taking the exam, the major field to be examined, and at least two courses taken in that field.

Time Limits

The Department of Electrical and Computer Engineering requires that the M.S.E.E. degree be finished within a period of six years. Courses taken more than six years prior to graduation cannot be applied toward the M.S.E.E. degree without special permission from the Department and the Graduate College.

No Risk Pass/Fail Ph.D. Pre-Qualifying Exams

A *full graduate standing* Master Degree candidate who is interested in pursuing a Ph.D. Degree may be allowed to take the Ph.D. Qualifying exam during his/her period in the Master of Science degree program (thesis option) without penalty. The exam may be taken as many times as desired but no more than once a semester at the time the exam is typically offered. *The MSEE candidate must **PASS four areas** of choice in a **single sitting** to satisfy the Qualifying Exam requirement.* Refer to Section 5.3 for more information. If the student successfully completes the Qualifying

Exam requirement while pursuing the MSEE degree with a thesis option in the Electrical and Computer Engineering department at UNLV, the student will have automatically fulfilled the Qualifying Exam requirement upon admission to the PhD program in the Electrical and Computer Engineering program at UNLV. Once the student receives an M.S. degree in Electrical Engineering, the student must abide by the requirements outlined in the Ph. D. program upon entering in this program. This option is not available to non-degree seekingstudents.

4. Ph.D. Program Options in Electrical Engineering

Please see the Catalog for official programs requirements.

[Graduate Catalog – PhD] [Graduate Catalog – Dual Degree]

The culminating experience in the Ph.D. program in the Department of Electrical and Computer Engineering is centered about developing new knowledge focused on a specific theme embodied in the form a well-written and orally defended dissertation. The Department of Electrical and Computer Engineering at UNLV offers a number of program options leading to the Ph.D. degree in the Field of Electrical Engineering. Specific major areas of study currently available include: Communications, Control System Theory, Digital Design and Computer Systems, Electromagnetics and Optics, Electronics, Intelligent Systems and Robotics, Power Systems, Signal Processing, and Solid-State Materials and Devices. Applicants may be admitted to the Electrical Engineering Ph. D Program through one of the following three options: the Conventional Ph. D Program Option, the Direct Ph. D Program Option, or the Integrated BS-PhD Program Option. The Conventional Program Option requires the student to have completed a M.S. Degree in Electrical Engineering, Computer Engineering, or a closely related field with thesis before entering the program. The Direct Ph.D. Program Option allows undergraduates with outstanding undergraduate backgrounds to enter the Ph.D. program without having to complete a M.S. Degree in Electrical or Computer Engineering. The Integrated BS-PhD Program Option allows UNLV undergraduate students who applied up to 9 credits of UNLV electrical engineering or computer engineering graduate courses towards their UNLV B.S. in Electrical Engineering or Computer Engineering degree to complete their Ph.D. in engineering with up to 9 fewer credits than students in the Direct Ph.D. Option. All requirements leading to a Ph.D. are still required beyond the B.S. Degree in Electrical and Computer Engineering excluding the completion of a Master‘s thesis. In conjunction with these options, a dual degree option does exist for candidates simultaneously working towards a PhD degree in Electrical Engineering and a Master of Science degree in Mathematics. This program prepares graduate students with complementing educational components covering electrical engineering and mathematics, which is the basis of all engineering.

Admission Requirements are found in the [Graduate Catalog – PhD]

Students admitted on provisional and/or conditional status are not allowed to take the qualifying exam until they have completed their provisional and, if appropriate, conditional status requirements. Students taking the exam while on provisional or conditional status will be required to retake the exam regardless if one or all areas of the exam have been passed. Provisional and conditional status students must complete all required supplementary work within one calendar year from the time of admission into the program with a grade of B (3.0) or better in each course. (Refer to Section 3.9.) If such work cannot be completed in this time, then the student must make special arrangements with the Graduate Coordinator regarding his/her situation. ***These arrangements must be placed in writing and signed by the student, graduate coordinator, and the ECE department chair.*** It is important to note that the completion of supplementary work *is more important* than the completion of PhD degree requirements.
*Students not completing supplementary work within a calendar year or has not received grades of B (3.0) or better in each course within the specified period, unless otherwise stated, will be removed from the degree program [**Graduate College Policy**]. A student may only be admitted as a Graduate Provisional student once [**Graduate College Policy**].*

General Admission Requirements are found in the Graduate Catalog.

Graduate College Admission Requirements

1. Completed application in the Application Portal and non-refundable application fee.
2. Bachelor's Degree – You must hold a four-year baccalaureate from a regionally accredited institution or an approved equivalent.
3. Post-Master's tracks and Advanced Certificates require a regionally accredited Master's degree.
4. Grade Point Average – You must have a minimum overall grade point average of 2.75 (4.00=A) for the bachelor's degree or a minimum 3.00 (4.00=A) for the last two years (60 semester credits).
5. All applicants are required to submit an unofficial transcript from each postsecondary institution attended, showing all degrees and coursework, the dates awarded, and grades received. Official transcripts required upon admission.
6. Credentials not in English must be accompanied by an English translation certified as true by a university official, an official representative of a United States embassy or consulate, the United States Information Service, the United States Education Foundation, or an approved professional translating service. Notarized

copies of originals or translations are not considered official.

Admission Requirements for International Applicants [Graduate College Policy – International Applicants] are found in the Graduate Catalog

Ph.D. Degree Requirements are found the [Graduate Catalog – PhD]

All graduate students must select a faculty advisor in their first semester. At the time of admission or no later than the first semester, the PhD candidate must formally petition BOTH the graduate college and the ECE graduate committee to accept transfer credits and credits taken as a non-degree seeking graduate student to be applied to the PhD program. By the end of the second semester (not including summer), the full standing Ph.D/ graduate student must pass the qualifying exam. By the end of the third semester, the PhD candidate must submit an approved program form and dissertation prospectus to the graduate coordinator. The student's advisor and the graduate coordinator must approve this program prior to submission to the Graduate College. All graduate students must show satisfactory progress towards completion of their degree by completing at least six graduate credits of their approved program per calendar year (more specifically ―within three rolling semesters‖ which includes the summer semester). If their progress towards their degree program is not satisfactory, students will either be placed on probation or expelled from the program.

The sequential but overlapping order of specific requirements for all Ph.D. Program Options is:

1) Satisfy the Ph.D. degree program admission requirements (refer to Sect. 3.10 for application deadlines) and be admitted to the Ph.D. program with a full graduate standing status.

2) Pass the Qualifying Exam within the first two semesters upon being admitted to the Ph.D. program with full graduate standing status. The Qualifying Exam is offered once every fall semester and once every spring semester. This exam cannot be taken more than twice. The Qualifying Exam is described in Section 5.3 of this manual. Students admitted on provisional and/or conditional status are not allowed to take the qualifying exam until they have completed their provisional and, if appropriate, conditional status requirements.

3) During the student's first semester, student must select a faculty advisor. The faculty advisor does not have to be the one to whom the student was assigned upon entering the Ph.D. program. In coordination with the faculty advisor, the student must also form a doctoral advisory committee. A doctoral advisory committee is composed of at least four members of the UNLV Graduate Faculty. Three of this faculty must be from the Department of Electrical and Computer Engineering. The fourth faculty member must from a relevant supporting field outside of the department having *Full Graduate Faculty Status* as recognized by the Graduate College.

4) All Ph.D. candidates must maintain an overall minimum grade point average (GPA) of 3.2, must maintain a minimum GPA of 3.2 each semester, and must complete all graduate level courses that apply towards their degree with a minimum GPA of 2.70 (B-) in each course. Grades below B- cannot be applied towards the Ph.D. degree and must be repeated or replaced. A class grade below C (2.0) is grounds for initiating a program probation and subsequent separation recommendation to the Graduate College. Ph.D. candidates who do not maintain an overall minimum GPA of 3.2, who do not maintain a minimum GPA of 3.2 each semester, or who earn more than one grade below B- will either be placed on academic probation via the Graduate College process. The Electrical and Computer Engineering Graduate Committee in conjunction with the Graduate College will determine the terms of the student's probation based upon the student's academic record and in accordance with the rules of the Graduate College. Students may be separated if they have not fulfilled the terms of the probation.

5) Choose a program option. In all options of the PhD program, no more than three credits of ECG 791 Graduate Independent Study in combination with graduate seminar and no more than a total of six credits of the combination of ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 695/795 Graduate Special Topics may be applied towards a PhD degree program option excluding the Direct PhD Option as indicated below. These credits including those taken in the MSEE degree program *cannot* be applied towards course credit requirements in the major field and the two minor fields. Refer to Section 3.6 regarding informal courses. Further, refer to the Roadmap and flow chart of the PhD Program at the end of this document to determine visually how these classes may fit into your program.

Conventional Ph.D. Program Option

Students who have been admitted into the Conventional Ph.D. Program Option must complete a minimum of 27 credits beyond their M.S. degree. Of the 27 required credits, a minimum of 18 credits must be in 700-level courses.

Fifteen (15) of these eighteen (18) 700-level credits must be from formal courses. No more than 3 credits may be from ECG 791 Graduate Independent Study together with Seminar and ECG 793 Engineering Science Seminars. Not more than six credits of a combination of informal courses such as ECG 791 Graduate Independent Study, ECG 659/795 Special Topics, ECG 793 Engineering Science Seminars, and graduate seminar may be applied to the degree program. These informal courses (ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 659/795 Special Topics) cannot be applied to the ECE Major, ECE Minor 1 (primary minor) and the Open Minor 2 (secondary minor) fields. The student's doctoral advisory committee may add more requirements in accordance with the individual's background and field of study. Clear documentation of meeting equitable competencies of all students must be made apparent by the program faculty. Official degree requirements are listed in the Catalog.

Direct Ph.D. Program Option

Students who have been admitted into the Direct Ph.D. Program Option must complete a minimum of 51 credits (24 M.S.E.E. credits + 27 Conventional Ph.D. Program Option credits). Of the 51 required credits, a minimum of 33 credits must be in 700-level courses. Thirty (30) of these thirty-three (33) 700- level credits must be from formal courses. (Refer to Section 3.6.) No more than 6 credits of ECG 791 Graduate Independent Study, ECG 793 Engineering Science Seminars, and graduate seminar cumulatively may be applied to the degree program. Also, no more than twelve credits of informal courses such as ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 659/795 Special Topics may be cumulatively applied to the degree program. Informal courses (ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 659/795 Graduate Special Topics) cannot be applied to the ECE Major, ECE Minor 1 (primary minor), or Open Minor 2 (secondary minor) fields. The student's doctoral advisory committee may add more requirements in accordance with the individual's background and field of study. Clear documentation of meeting equitable competencies of all students must be made apparent by the program faculty. Official degree requirements are listed in the Catalog. Students on academic probation may opt to be transferred to the M.S.E.E. Program depending on the student's academic record. In such a case, the MSEE Program requirements must be satisfied. For example, only six credits of the informal courses may be applied to the MSEE degree program with the further constraint that up to three credits total of ECG 791 in combination with graduate seminar may be in the six credits.

Integrated BS-PhD Program Option

Students who have been admitted into the Integrated BS-PhD Program Option must complete a minimum of 42, 45, or 48 credits in the Integrated BS-PhD program and the 9, 6, or 3 credits respectively of *formally approved* graduate level courses (Refer to Section 3.6 and 5.1.1) applied toward the B.S. degree yielding a total of 51 course credits. Of the 51 course credits, a minimum of 33 credits must be in 700- level courses. Thirty (30) of these 33 700-level credits must be from formal courses. For clarity, such courses as ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 695/795 Special Topics are *not formally approved* courses and are termed informal courses in this document. (Refer to Section 3.6.) No more than a total of 6 credits can be cumulatively from ECG 791 Graduate Independent Study, ECG 793 Engineering Science Seminars, and graduate seminar. Not more than twelve credits of the combination of ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 659/795 Special Topics may be applied to the degree program. Informal courses (e.g, ECG 791 Graduate Independent Study, graduate seminar, ECG 793 Engineering Science Seminars, and ECG 659/795 Graduate Special Topics) cannot be applied to the ECE Major, ECE Minor 1 (primary minor) and Open Minor 2 (secondary minor) fields. The student's doctoral advisory committee may add more requirements in accordance with the individual's background and field of study. Clear documentation of meeting equitable competencies of all students must be made apparent by the program faculty. Official degree requirements are listed in the Catalog. Students on academic probation may opt to be transferred to the M.S.E.E. Program depending on the student's academic record.

M.S. MAT Program

Students who are also pursuing an M.S. MAT degree can apply up to 6 credits of courses to both their M.S. MAT degree and their Ph.D. in Engineering degree. Non-ECG courses must be applied towards non-ECG credit in the program.

6) Beyond the Bachelor degree, a Ph.D. student must complete a minimum of 15 credits in an approved ECE major field in a single area of Electrical and Computer Engineering, 9 credits an approved ECE minor (primary minor) fields in a single area of Electrical and Computer Engineering, and 9 credits in a second approved minor (secondary minor) field. Of the 15 credits required in the ECE major field, a minimum of 9 credits must be completed in 700-level courses. A minimum GPA of 3.33 (B+=3.30) must be attained in the major field. *Further, in the Conventional PhD Program Option, a minimum of 6 credits of the 15 credits in the major field must come from course credits applied to the PhD program.* Of the 9 required credits in each minor field, a minimum of 6 credits must be in 700-level courses. A minimum GPA of 3.33 (B+=3.30) must be attained in each of the minor fields. *Further, in the Conventional PhD*

Program Option, a minimum of 3 credits for each minor field (yielding a total of six credits) must come from course credits applied to the PhD program. Approved major and minor fields are described in detail in Section 5.8 of this manual.

7) All full graduate standing graduate students must file an approved program before the completion of their third semester. Students admitted on provisional and/or conditional status must file an approved program no later than one semester following the successful completion of the Qualifying exam. This program must be approved by the student's advisor and the graduate coordinator. All graduate students must show satisfactory progress towards completion of their degree by completing at least six graduate credits of their approved program per calendar year. If their progress towards their degree program is not satisfactory, students will be put on probation and subsequent possible separation from the program.

8) Before beginning a dissertation, students must have their dissertation topic approved by their advisor, the advisory committee, and the ECE graduate coordinator. The necessary paper work including a dissertation prospectus must be filed with the Graduate College by the end of the third semester. *The **dissertation prospectus** describes the dissertation topic and must include an introductory set of sentences, a well formed hypothesis or hypotheses (specifically italicized in the prospectus) accompanied by a motivation, objectives with major and alternative approaches to the studies, and conjectures of possible outcomes.* **Students are NOT allowed to take dissertation credits until their prospectus is approved and have advanced to candidacy. Credits taken before the approval date will NOT count towards the degree program.**

The Dissertation Prospectus: The dissertation prospectus describes the thesis/dissertation topic and must include an introductory set of sentences with a referenced literature search, a well formed hypothesis or hypotheses (*specifically italicized in the prospectus*) accompanied by one or more motivations, objectives with major and alternative approaches to the studies, and conjectures of possible outcomes. Typically, the prospectus is 1 to 3 pages in length. The hypothesis or hypotheses represent the kernel about which a thesis or dissertation is built upon and around. It may be expressed in the form of a statement or a question. The hypothesis is a scientific educational guess that has of yet not been proved. Paraphrased from Wikipedia, "A **hypothesis** is a *proposed* explanation for a phenomenon that cannot satisfactorily be explained with the available scientific theories. The hypothesis is a proposed explanation of a phenomenon which still has to be rigorously tested." ***Italicize the hypothesis (hypotheses) in the prospectus.*** One way of stating the hypothesis is –It is hypothesized that *_performing this task or cause*' will *_yield this effect or result*. '‖ The why question of the hypothesis is to be addressed in the motivation. The motivation is the gut feeling or spark of intuition or ingenious that drives, ignites, and/or guides the formulation of the hypothesis. The motivation is usually based on complete or partial scientific evidence or lack of evidence in experiment, theory, or archived literature. Objectives serve as a goal of a course of action based on observable phenomena. The objectives drive major and alternative approaches to study phenomena supporting or disproving the scientific hypothesis. **In your prospectus, bullet and bold-face the objectives.** To conjecture is to infer from inconclusive evidence possible outcomes. In effect, one is guessing based on a partial evidence and motivation which drives the hypothesis. Conjectures act as a guide driving your objectives. Conjectures are required to support the objectives of your prospectus. A polished prospectus must contain each of the above components. Examples are available upon request.

Only after successfully completing all required course work and passing the qualifying exam, the candidate is eligible to take the Preliminary Exam. The Preliminary Exam cannot be taken more than once per semester where semester is delineated as spring, summer, and fall. The time interval between any two consecutive preliminary exams must exceed three months [*Graduate Student Handbook*]. Generally, the preliminary exam may be taken only twice. Two failures of the preliminary exam may lead to separating the student from the program for failure to progress. [*Graduate Student Handbook*]The Preliminary Exam is described in detail in Section 5.5 of this manual. Students are only eligible to enroll in dissertation credits after they have advanced to candidacy.

9) Complete a minimum of 18 credits of ECG 799 Dissertation and complete a dissertation containing original research. Upon completion, the student must pass the Final Exam in which the student defends his/her dissertation. The Final Exam cannot be taken more than once per every three months but may be repeated until passed. The Final Exam is the culminating experience of the PhD program and is described in detail in Section 5.6 of this manual. Please see the Graduate Catalog for the number of attempts in defending dissertations.

Qualifying Exam

The Qualifying Exam tests the student's general undergraduate knowledge of electrical and computer engineering. Before a student is eligible to register for the Qualifying Exam, the student must have satisfied the Ph.D. degree program admission

requirements and have been admitted to the Ph.D. program with full graduate standing status. To register for the Qualifying Exam, eligible students must notify the graduate coordinator no later than one month prior to the examination date. All students must pass the Qualifying Exam within the first two semesters (excluding the summer semester) upon being admitted in their Ph.D. program with full graduate standing status. The Qualifying Exam is offered once every fall semester and once every spring semester. This exam cannot be taken more than twice. If a student is required to take the qualifying exam and is not present to sit the exam, an automatic FAIL is assigned. Candidates who have not completed all requirements for the Qualifying Exam in their first semester (excluding the summer semester) upon being admitted in their Ph.D. program with full graduate standing status will automatically be placed on academic probation consistent with Graduate College policy. Students who have not passed the Qualifying Exam within this time frame will be terminated from the Ph.D. program. Students who have not passed the Qualifying Exam following their second attempt will be terminated from the Ph.D. program. Students in the Direct Ph.D. program who fail the Qualifying Exam on their second attempt within the two-semester time frame may elect to pursue a MSEE degree by transferring to that degree and completing all the requirements listed in Section 4. Master of Science Program Options in Electrical Engineering of this document.

Students admitted on provisional and/or conditional status in the PhD program are not allowed to take the qualifying exam (Q-exam) until they have completed their provisional and, if appropriate, conditional status requirements. Students taking the Q-exam while on provisional status will be required to retake the exam regardless if one or all areas of the exam have been passed. Refer to Section 5.1. Students who passed the Q-exam while in the MSEE degree program are not required to take the exam as a PhD candidate. Refer to Section 4.3 for more information.

The Qualifying Exam is a four and one-half hour exam testing knowledge of topics in the following undergraduate electrical and computer engineering fields/areas:

1. Communications EE 460
2. Control System Theory EE 370
3. Electromagnetics and Optics EE 330
4. Electronics EE 320
5. Power EE 340
6. Signal Processing EE 480
7. Solid State EE 450
8. Digital Logic Design – CpE 302 [Questions are not related to a specific HDL (programming language) or a specific FPGA (hardware)]
9. Computer Architectures and Organization – CpE 300
10. Embedded Systems – CpE 301 and CpE 403 [Questions are not related to a specific microcontroller]
11. Computer Communication Networks – CpE 400

The test material for each field will be relevant to topics covered in the class(es) listed with the field and their prerequisites. For example, the undergraduate field of Computer Architectures and Organization is covered in CpE 300 and has a CpE 200 course prerequisite. Exam questions may be directed to either course. Students are required to know material in both CpE 300 and its prerequisite CpE 200. Recommended readings for the field exams are listed in Section 5.8.1. A collection of problems representing the material being tested may be available in each area. Consult the Graduate Coordinator or the ECE Graduate Secretary for more details. To pass the qualifying exam requirement, the student must successfully complete any four of the eleven areas with a grade of PASS to complete the qualifying exam requirement within two sittings. If the student passes less than four areas on the first attempt, the student will receive a PASS for those individual areas successfully completed and will not be required to retake these areas on the second attempt. The exam is a closed note, closed book exam.

Candidates are allowed to bring a pencil, eraser, ruler (or straight edge) and/or pen to the exam. There should be no special markings on these tools. Cell phones, ipods, computers, electronic devices, scratch or regular paper, calculators, notes, slide rulers, and books will not be allowed in the exam room. The department will supply scientific calculators for the exam. Students wishing to become familiar with the calculator before the exam may contact ECE Department Secretary. This is a closed book, closed notes exam. No exceptions are allowed. The exams are self-contained. Students found cheating will be dismissed from the exam and will receive a FAIL on all areas attempted during that sitting. Further, other disciplinary measures will be pursued within the limits set by UNLV.

The graduate coordinator or a member of the graduate committee will administer and proctor the Qualifying Exam. The faculty member who administers the exam will provide each student with an identification code that will be used to identify each student‘s exam. Students will not put their names, initials or any other identifying marks besides their identification code on their exams. Faculty grading their portion of the exam must provide a pass or fail result for their portion of the exam within 15 calendar days of the exam to the graduate coordinator. The graduate committee may review the exams to

verify grading but cannot alter grades. If the graduate committee suspects a grading problem with a field/area exam, the graduate committee will submit that entire exam to the appropriate field subcommittee for re-grading. After all of the exams have been graded, the graduate committee will notify student of the results of the exam.

Appeals

Any student may appeal the results of the Qualifying Exam. To appeal, a student must submit a letter of appeal to his/her faculty advisor within 21 calendar days of receiving the exam results. The letter must indicate the field in which the student is appealing the result and the reasons for which the student is appealing. The student‘s advisor will forward the appeal letter to the Graduate Committee. The Graduate Committee and the corresponding field subcommittee(s) will consider the appeal and reevaluate the student‘s results. A student cannot appeal the results of the Qualifying Exam more than once. If the student would like to appeal their case, the student may submit a Graduate College appeal form via the Grad Rebel Gateway.

Preliminary Exam

The Preliminary Exam evaluates the caliber of a student‘s dissertation topic. The Preliminary Exam cannot be taken more than once per semester and, generally, may only be repeated once. Two failures for the preliminary exam lead to probation and consequently separation from the program for failure to progress. [Graduate College Policy]. If the student fails the first attempt, the student will be placed on probation via the Graduate College process (which the Graduate Coordinator initiates). To be eligible for the Preliminary Exam, a student must have successfully completed all required course work except for the 18 credits of ECG 799 Dissertation.

Before the Preliminary Exam, a student must prepare a 10 to 20-page prospectus of his/her research. A copy of this prospectus must be submitted to the Graduate Committee and each member of the Ph.D. candidate‘s advisory committee at least two weeks prior to the Preliminary Exam. The student must also notify the Graduate Committee and each member of their advisory committee of the date, time, and location of their Preliminary Exam. This must be done at least two weeks prior to the Preliminary Exam.

During the Preliminary Exam, the student will present his/her prospectus to his advisory committee. To pass the Preliminary Exam, the student‘s advisory committee must ***unanimously*** approve the student‘s prospectus [*Graduate Student Handbook*]. If the committee votes unanimously to fail the student or the vote is not unanimous to pass, the student, in consultation with his/ her advisor, may request the committee to administer another examination [*Graduate Student Handbook*]. The Preliminary Exam cannot be taken more than once per semester where semester is delineated as spring, summer, and fall. The time interval between any two consecutive preliminary exams must exceed three months [*Graduate Student Handbook*]. Generally, the preliminary exam may be taken only twice. Two failures of the preliminary exam may lead to separating the student from the program for failure to progress. [*Graduate Student Handbook*]

Students who pass the Preliminary Exam are advanced in candidacy in the Ph. D program.

Final Exam (Dissertation Defense)

The Final Exam evaluates the Ph.D. candidate‘s dissertation. The Final Exam cannot be taken more than once per every three months and, generally, may only be repeated once. First failure lead to being placed on probation vi the Grad College process (in which the Graduate Coordinator initiates). Two failures for the final exam may lead to consequently separation from the program for failure to progress. [*Graduate Student Handbook*] If the student fails the first attempt, the student will be placed on probation via the Graduate College process. To be eligible for the Final Exam, a Ph.D. candidate must have passed the Preliminary Exam, and have successfully completed all required course work including a minimum of 18 credits of ECG 799 Dissertation. Students are only eligible for enrolling in ECG 799 Dissertation after they have advanced to candidacy and successfully completed of the Preliminary Exam. A copy of the Ph. D candidate‘s dissertation must be submitted to the Graduate Committee and each member of the Ph.D. candidate‘s advisory committee at least two weeks prior to the Final Exam. The dissertation guidelines can be found in Graduate Student Handbook. The Ph.D. candidate must also notify the Graduate Committee and each member of his/her advisory committee of the date, time, and location of his/her Final Exam at least two weeks prior to the Final Exam. During the Final Exam, the Ph.D. candidate will publicly defend the dissertation to the advisory committee. After the exam, the advisory committee will privately discuss the student‘s accomplishments.. To pass the Final Exam, the Ph.D. candidate‘s advisory committee must ***unanimously*** approve the Ph.D. candidate‘s dissertation [*Graduate Student Handbook*]. If the committee votes unanimously to fail the student or the vote is not unanimous to pass, the student, in consultation with his/ her advisor, will be placed on probation

via the Graduate College. The student may request the committee to administer a second examination [*Graduate Student Handbook*]. The Final Exam cannot be taken more than once per every three months [*Graduate Student Handbook*] but may be repeated until passed. To complete the final exam, the student must submit his/her approved, properly formatted hard-copy dissertation to the Graduate College, and submit the approved electronic version to ProQuest by the posted deadline.

Time Limits

The Department of Electrical and Computer Engineering requires that the Ph.D. degree be completed within a period of six years from the time the candidate is fully admitted to the Ph.D. program. Students exceeding this time limit must formally write a letter requesting permission from both the Graduate Committee and the Graduate College to stay in the Ph.D. program. The formal letter must explain the circumstances of why the degree was not completed within the allotted timeframe and indicate the extended period of time needed to complete the degree.

Ph.D. Major and Minor Fields.

Official Program requirements are described in the Graduate Catalog

Beyond the bachelor's degree, a Ph.D. student must complete a minimum of 15 credits in a ECE major field in a single area in electrical and computer engineering and 9 credits in a primary minor field (ECE Minor 1 Field) in a single but different area in electrical and computer engineering, and another 9 credits in an approved secondary minor field (Minor 2 Field). Currently, the Department of Electrical and Computer Engineering at UNLV offers Communications, Control System Theory, Digital Design and Computer Systems, Electronics, Electromagnetics and Optics, Electronics, Intelligent Systems and Robotics, Power Systems, Signal Processing, and Solid State Materials and Devices as major fields. Specific courses that can be applied to specific fields are listed Section 5.9.2.

Of the 15 credits in the ECE major field, a minimum of 9 credits must be completed in 700-level courses. To complete the ECE major field requirement, the Ph.D. candidate must attain a minimum overall GPA of 3.33 (B+=3.30) in the 15 credits of course work applied to the ECE major field. *In the Conventional PhD Program Option, a minimum of 6 credits of the 15 credits in the major field must come from course credits applied to the PhD program.*

Each student must complete two minor fields with one exclusively in a single Electrical and Computer Engineering. To complete a minor field, the student must complete a minimum of 9 credits in a minor field ***and*** have an overall minimum GPA of 3.33 (B+=3.30) for the 9 minor field credits. Of the 9 required credits in each minor field, a minimum of 6 credits (in each minor field) must be in 700-level courses. *In the Conventional PhD Program Option, a minimum of 3 credits for each minor field (yielding a total of six credits) must come from course credits applied to the PhD program*.

Courses that can be applied to specific minor fields are listed Section 5.9.2. Some courses may be listed under two or more different fields. These courses may be applied to any designated field but may only be counted once. With the written approval of the major advisor and the student's advisory committee, the secondary minor may be a mixed minor field that complements the student's PhD program. A mixed minor field may be formed with courses inside and/or outside of the Electrical Engineering Department's approved fields (e.g., mixed minor in mathematics and physics, a mixed minor in computer engineering and computer science, a physics minor, a mechanical engineering minor, solid state and electromagnetics mixed minor, and etc.). A mixed minor cannot be composed of courses in the Electrical Engineering Department that satisfy coursework in the ECE major and the ECE primary minor fields. The only exception is when a course may be used in more than one field. In this case, the course cannot be counted twice but may be used for either minor area. However, the student must complete at least one minor field (primary minor field or ECE Minor 1 Field) in Electrical Engineering in a single area.

Subfield Listings for MSEE and PhD Programs

This section contains a list of recommended undergraduate reading for the Qualifying exam in the Department of Electrical and Computer Engineering (ECE). The reading list has been divided into the eleven ECE recognized subfields/areas. Further, the ECE recognized sub-area fields for a MSEE and PhD degree in electrical and computer engineering has also been supplied. In that section, approved major and minor course listings have been delineated and a general category listing has been provided.

Recommended Reading for Qualifying Exam - Summarized

1. **Communications - EE 460**
   Recommended reading:
   - Jerry D. Gibson, Principles of Analog and Digital Communications, 2nd edition, New York, Macmillan Publishing Company, 1989. Ch. 1-6,8.
   - E. Ziemer and W. H. Tranter, Principles of Communications, 4th edition, Houghton Mifflin Company, 1995. Ch. 1-3.
   - P. Lathi, Modern Digital and Analog Communication Systems, 2nd edition, Holt, Rinehart and Winston Inc., 1989. Ch. 1-4.

2. **Control Systems - EE 370**
   Recommended reading:
   - Dorf and R. Bishop, Modern Control Systems, 7th Ed., Addison Wesley. Ch. 1-10.
   - Kuo, Automatic Control Systems, Prentice Hall.
   - Hostetter, C. Savant Jr., R. Stefani, Design of Feedback Control Systems, Saunders College Publishing.
   - D'Azzo and C. Houpis, Linear Control System: Analysis and Design: Conventional and Modern, McGraw Hill.
   - DiStefano, A. Stubberud and I Williams, Schaum's Outline of Theory and Problems of Feedback and Control, 2nd Ed.,1990.

3. **Electromagnetics and Optics - EE 330**
   Recommended reading:
   - Sadiku, Elements of Electromagnetics, 6nd, Oxford University Press, 2015, Chapts. 1-10.
   - Zahn, Electromagnetic Field Theory: A Problem Solving Approach, repr. 1987, Robert E. Krieger Co., Florida (Wiley copyright 1979).
   - Seshadri, Fundamentals of Transmission Lines and Electromagnetic Fields, Addison-Wesley, Pub., 1971.
   - Hayt, Jr., Engineering Electromagnetics, McGraw Hill, 1989
   - Edminister, Theory and Problems of Electromagnetics, Schaum's Outline Series, McGraw Hill, 1979.
   - C. Johnk, Engineering Electromagnetic Fields and Waves, 2nd Ed., Wiley, New York, 1988.

4. **Electronics - EE 320**
   Recommended reading:
   - Schilling and Belove, Electronic Circuits, Discrete and Integrated, 3rd Ed., 1989.
   - Millman and Grabel, Microelectronics, 2nd Ed., 1987.
   - Soclof, Application of Analog Integrated Circuits, 1985.
   - Neamen, Electronic Circuit Analysis and Design, 1996.

5. **Power - EE 340**
   Recommended reading:
   - Shultz and R. Smith, Introduction to Electric Power Engineering, Wiley, 1988.
   - Chapman, Electric Machinery Fundamentals, McGraw Hill, 1985.

6. **Signal Processing - EE 480**
   Recommended Reading:
   - Oppenheim and R. Schafer, Discrete-Time Signal Processing, Prentice Hall, 1989. Chapters 1 to 5, 8, 9
   - Proakis and D. Manolakis, Introduction to Digital Signal Processing, 3rd edition, MacMillan, 1988. Chapters 1 to 6, 8.

7. **Solid State - EE 450**
   Recommended reading:
   - Modular Series on Solid State Devices, Vol. I, Pierret, 1983
   - Modular Series on Solid State Devices, Vol. II, Neudeck, 1989
   - Modular Series on Solid State Devices, Vol. III, Neudeck, 1989
   - Modular Series on Solid State Devices, Vol. IV, Pierret, 1983
   - Navon, Semiconductor Microdevices and Materials, 1986
   - Sze, Semiconductor Devices, 1985
   - Sze, High Speed Semiconductor Devices, 1990

8. **Digital Logic Design – CpE 302** (Previously CpE 410) **[Questions are not related to a specific HDL (programming language) or a specific FPGA (hardware)]**

Recommended reading:

- C. H. Roth, *Fundamentals of Logic Design*, 5th edition, Thomson Corp., Division Brooks/Cole, 2004, Ch. 1-9, 11-15.

9. **Computer Architectures and Organization – CpE 300**
   Recommended reading:
   - V. Heuring and H. Jordan, *Computer Systems Design and Architecture*, Addison Wesley, 1997.
10. **Embedded Systems – CpE 301 and CpE 403 [Questions are not related to a specific microcontroller]**
    Recommended reading:
    - Muhammad Ali Mazidi, Sarmad Naimi, and Sepehr Naimi. 2010. AVR Microcontroller and Embedded Systems: Using Assembly and C (1st. ed.). Prentice Hall Press, USA.
    - Alexander G. Dean. 2017. Embedded Systems Fundamentals with ARM Cortex-M based Microcontrollers: A Practical Approach. ARM Education Media UK.
11. **Computer Communication Networks – CpE 400**
    Recommended reading:
    - W. Stallings, *Data and Computer Communications*, 8th or 7th edition, Pearson Prentice Hall, 2007.
    - Tanenbaum, *Computer Networks*, 4th edition, Pearson education, Inc., 2004.

NOTE 1: Undergraduate course descriptions may be found online at ece.unlv.edu in the Undergraduate Program EE and CPE links. Once in either link, click the Engineering Program packet (pdf format) link. Also, ABET-Style Course Syllabi may be found at ece.unlv.edu by activating the two consecutive links "ABET" then "ABET-Style Course Syllabi". More descriptive information is found in the ABET Style Course Syllabi.

MSEE and PhD Field/Area Disciplines in ECE with Delineated Course Listings [Graduate Catalog – PhD] [Graduate Catalog – Dual Degree]

Official Program and Degree requirements are found in the Graduate Catalog. Below are sample course listings.

Communications

General Electrical Engineering Area

Applied Mathematics

Approved Major Field Courses for Communications

ECG 662	Digital Communication Systems
ECG 666	Wireless and Mobile Communications
ECG 704	Coding with Applications in Computers and Communication
Media ECG 706	Analysis of Telecommunication and Data Networks
ECG 760	Random Processes in Engineering
Problems ECG 762	Detection and Estimation of Signals in
Noise ECG 763	Advanced Digital Communication
Systems	

Approved Minor Courses for Communications

ECG 662	Digital Communication Systems
ECG 666	Wireless and Mobile Communications
ECG 760	Random Processes in Engineering
Problems ECG 762	Detection and Estimation of Signals in
Noise ECG 763	Advanced Digital Communication
Systems	

Area Coordinators: Saberinia

Recommended Reading for Communications Qualifying Exam

1. Jerry D. Gibson, Principles of Analog and Digital Communications, 2nd edition, New York, Macmillan Publishing Company, 1989. Ch. 1-6,8.
2. E. Ziemer and W. H. Tranter, Principles of Communications, 4th edition, Houghton Mifflin Company, 1995. Ch.1-3.
3. P. Lathi, Modern Digital and Analog Communication Systems, 2nd edition, Holt, Rinehart and Winston Inc., 1989. Ch. 1-4.

Control System Theory

General Electrical Engineering Area

Applied Mathematics

Approved Major Field Courses for Control System Theory

ECG 672	Digital Control Systems
ECG 770	Linear Systems
ECG 771	Optimal and Modern
Controls ECG 772	Nonlinear Systems
ECG 774	Stochastic Control
ECG 776	Adaptive Control

Approved Minor Courses for Control System Theory

ECG 770	Linear Systems
ECG 771	Optimal and Modern
Controls ECG 772	Nonlinear Systems
ECG 774	Stochastic Control
ECG 776	Adaptive Control

Area Coordinators: Singh and Kachroo

Recommended Reading for Control System Theory Qualifying Exam

1. Dorf and R. Bishop, Modern Control Systems, 7th Ed., Addison Wesley. Ch. 1-10.
2. Kuo, Automatic Control Systems, Prentice Hall.
3. Hostetter, C. Savant Jr., R. Stefani, Design of Feedback Control Systems, Saunders College Publishing.
4. D'Azzo and C. Houpis, Linear Control System: Analysis and Design: Conventional and Modern, McGraw Hill.
5. DiStefano, A. Stubberud and I Williams, Schaum's Outline of Theory and Problems of Feedback and Control, 2nd Ed.,1990.

Digital Design and Computer Systems

General Computer Engineering Area

Applied Mathematics

Approved Major Field Courses for Digital Design and Computer Systems

ECG 600	Computer Communication Networks
ECG 603	Advanced Embedded System
ECG 604	Modern Processor Architecture
ECG 605	Data Compression Systems
ECG 608	Digital Design Verification and Testing
ECG 609	Embedded Digital Signal Processing
ECG 618	Cloud Computing in Engineering
ECG 620	Analog Integrated Circuit Design
ECG 621	Digital Integrated Circuit Design
ECG 700	Advanced Computer System Architecture
ECG 701	Reliable Design of Digital Systems
ECG 702	Interconnection Networks for Parallel Processing Applications
ECG 704	Coding with Applications in Computers and Communication Media
ECG 706	Analysis of Telecommunication and Data Networks
ECG 707	Logic Synthesis Engineering
ECG 709	Synthesis and Optimization of Digital Systems

Approved Minor Courses for Digital Design and Computer Systems

All major field courses.

Area Coordinators: Harris, Latifi, Selvaraj, Muthukumar, Regentova, Jiang, and Yang

Recommended Reading for Digital Design and Computer Systems Qualifying Exam
Refer to items 8-11 listed in ***Section 5.8.1 Recommended Reading for Qualifying Exam – Summarized.***

Electromagnetics and Optics

General Electrical Engineering Area

Applied Physics

Approved Major Field Courses for Electromagnetics and Optics

ECG 630	Transmission Lines
ECG 631	Engineering Optics
ECG 632	Antenna Engineering
ECG 633	Active and Passive Microwave
Engineering ECG 730	Advanced Engineering
Electromagnetics I ECG 731	Theoretical Techniques
in Electromagnetics ECG 732	Advanced Engineering
Electromagnetics II ECG 733	Plasma I

Approved Minor Courses for Electromagnetics and Optics

All major field courses.

Area Coordinators: Schill

Recommended Reading for Electromagnetics and Optics Qualifying Exam

1. Sadiku, Elements of Electromagnetics, 6nd, Oxford University Press, 2015, Chapts. 1-10.
2. Zahn, Electromagnetic Field Theory: A Problem Solving Approach, repr. 1987, Robert E. Krieger Co., Florida (Wiley copyright 1979).
3. Seshadri, Fundamentals of Transmission Lines and Electromagnetic Fields, Addison-Wesley, Pub., 1971.
4. Hayt, Jr., Engineering Electromagnetics, McGrawHill, 1989
5. Edminister, Theory and Problems of Electromagnetics, Schaum's Outline Series, McGraw Hill, 1979.
6. C. Johnk, Engineering Electromagnetic Fields and Waves, 2nd Ed., Wiley, New York, 1988.

Electronics

General Electrical Engineering Area

Applied Physics

Approved Major Field Courses for Electronics

ECG 620	Analog Integrated Circuit
Design ECG 621	Digital Integrated Circuit
Design ECG 720	Advanced Analog IC Design
ECG 721	Memory Circuit Design
ECG 722	Mixed-Signal Circuit Design

Approved Minor Courses for Electronics

All major field courses.

Area Coordinators: Baker

Recommended Reading for Electronics Qualifying Exam

1. Sedra and Smith, Microelectronics.
2. Jaeger, Microelectronic Circuit Design
3. Baker, CMOS Circuit Design, Layout, and Simulation

Intelligent Systems and Robotics

Interdisciplinary Area

Applied Mathematics

Approved Major Field Courses for Intelligent Systems and Robotics

ECG 607	Biometrics
ECG 617	Internet of Things Systems
ECG 676	Mobile Robotics
ECG 677	Embedded Security and Machine Learning
ECG 682	Digital Signal Processing Applications
ECG 703	Machine Learning and Applications
ECG 710	Real-Time Embedded Systems
ECG 711	Embedded Systems for Automation
ECG 782	Multidimensional Digital Signal Processing
ECG 783	Adaptive Signal Processing with Neural Networks
CS 682	Artificial Intelligence
CS 688	Big Data Analysis
CS 722	Advanced Machine Learning

Approved Minor Courses for Intelligent Systems and Robotics

All major field courses.

Area Coordinators: Harris, Latifi, Morris, Muthukumar, Regentova, Jiang, and Yang

Recommended Reading for Intelligent Systems and Robotics Qualifying Exam

Refer to items 8-11 listed in ***Section 5.8.1 Recommended Reading for Qualifying Exam – Summarized.***

Power Engineering

General Electrical Engineering Area

Applied Physics

Approved Major Field Courses for Power Engineering

ECG 642 Power Electronics
ECG 646 Photovoltaic Devices and Systems
ECG 740 Computer Analysis Methods for Power Systems ECG 741 Electric Power Distribution System Engineering ECG 742 Power System Stability and Control
ECG 743 Smart Electrical Power Grid

Approved Minor Courses for Power Engineering

All major field courses.

Area Coordinators: Baghzouz

Recommended Reading for Power Qualifying

Exam

1. Shultz and R. Smith, Introduction to Electric Power Engineering, Wiley, 1988.
2. Chapman, Electric Machinery Fundamentals, McGraw Hill, 1985.

Signal Processing

General Electrical Engineering Area

Applied Mathematics

Approved Major Field Courses for Signal Processing

ECG 680	Discrete-Time Signal Processing
ECG 682	Digital Signal Processing Applications
ECG 703	Machine Learning and Applications
ECG 760	Random Processes in Engineering
Problems ECG 762	Detection and Estimation of Signals in Noise ECG 781 Digital Filters
ECG 782	Multidimensional Digital Signal Processing
ECG 783	Adaptive Signal Processing with Neural Networks

Approved Minor Courses for Signal Processing

All major field courses.

Area Coordinators: Stubberud, Morris, and Kachroo

Recommended Reading for Signal Processing Qualifying Exam

1. Oppenheim and R. Schafer, Discrete-Time Signal Processing, Prentice Hall, 1989. Chapters 1 to 5, 8, 9
2. Proakis and D. Manolakis, Introduction to Digital Signal Processing, 3rd edition, MacMillan, 1988. Chapters 1 to 6, 8.

Solid State Electronics and Photonics

General Electrical Engineering Area

Applied Physics

Approved Major Field Courses for Solid State Electronics and Photonics

ECG 611	Introduction to Quantum Space Science
ECG 611 L	Introduction to Quantum Space Science Laboratory
ECG 614	Quantum Communication
ECG 615	Spacecraft and Payload Engineering
ECG 615 L	Spacecraft and Payload Engineering Laboratory
ECG 616	Space Sensors and Instruments
ECG 624	Biomedical Instrumentation
ECG 651	Electronic and Magnetic Materials and
Devices ECG 652	Optoelectronics
ECG 653	Introduction to
Nanotechnology	
ECG 712	Optical Materials and Devices
ECG 715	Biomedical Photonics
ECG 716	Space Systems
ECG 750	Photonics
ECG 752	Physical Electronics
ECG 753	Advanced Topics in Semiconductor
Devices I ECG 755	Monolithic Integrated Circuit Fabrication
ECG 756	Advanced Topics in Semiconductor
Devices II	
ECG 757	Electron Transport Phenomena in Solid State
Devices ECG 758R	Optical Sensing

Approved Minor Courses for Solid State Electronics

All major field courses.

Area Coordinators: Venkat, Das, Sun, Zhai

Recommended Reading for Solid State Electronics and Photonics Qualifying Exam

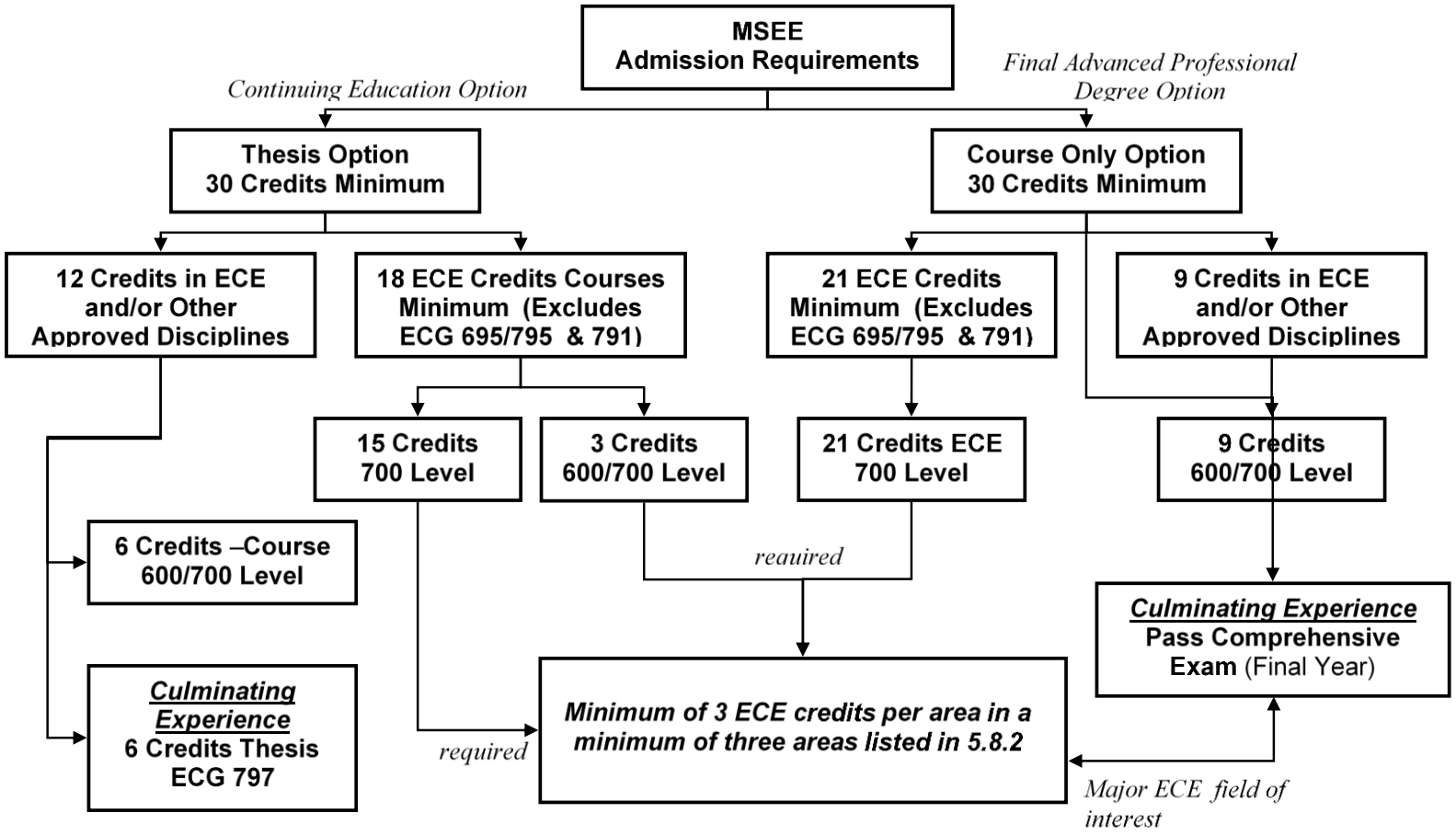
1. Modular Series on Solid State Devices, Vol. I, Pierret, 1983
2. Modular Series on Solid State Devices, Vol. II, Neudeck, 1989
3. Modular Series on Solid State Devices, Vol. III, Neudeck, 1989
4. Modular Series on Solid State Devices, Vol. IV, Pierret, 1983
5. Navon, Semiconductor Microdevices and Materials, 1986
6. Sze, Semiconductor Devices, 1985
7. Sze, High Speed Semiconductor Devices, 1990

5. Electrical Engineering Graduate Courses

Please refer to the Graduate Catalog regarding graduate level Electrical and Computer Engineering course offerings. [Graduate Catalog - Courses]

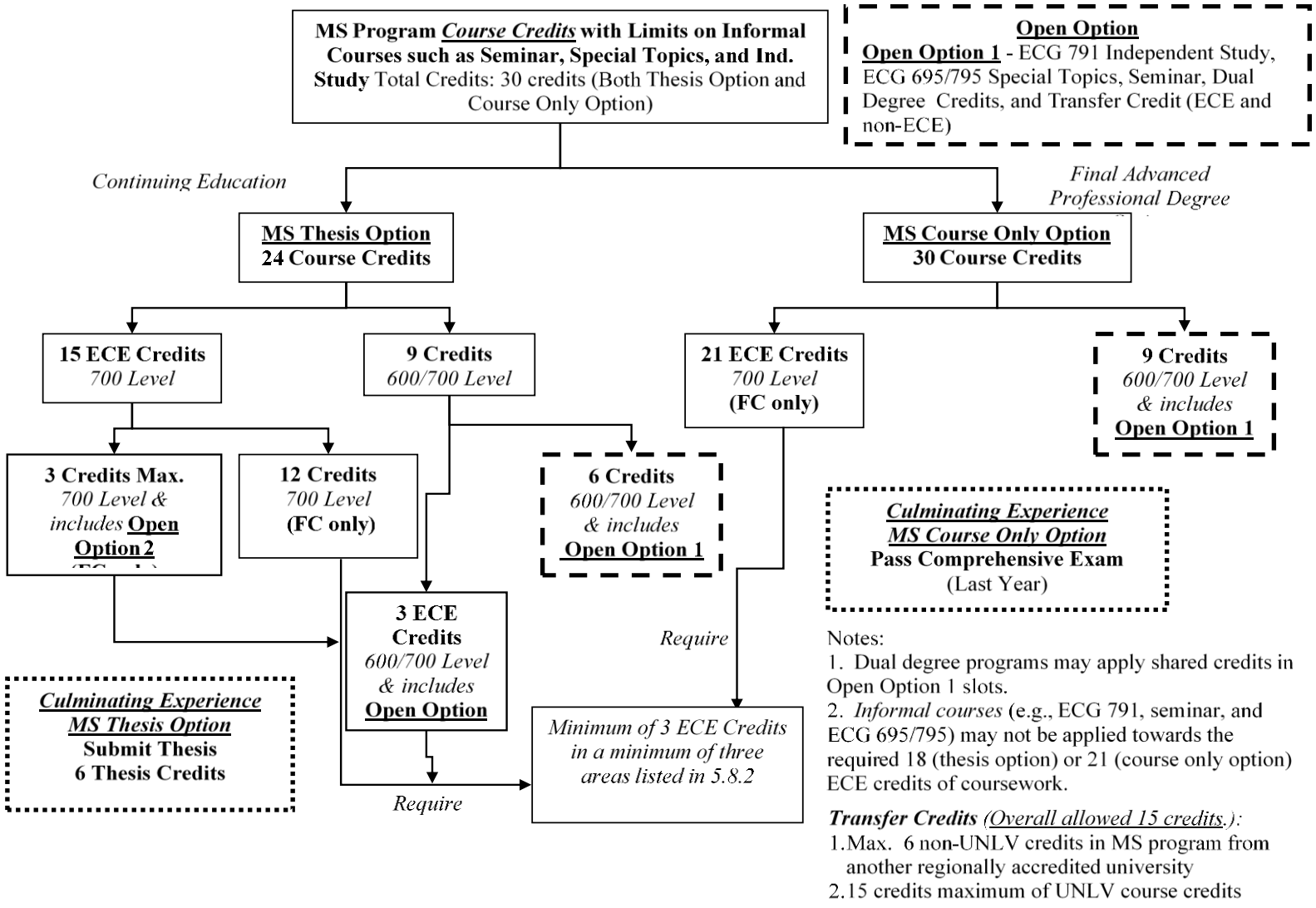
6. **Sample Degree Program**

Roadmap MSEE Program

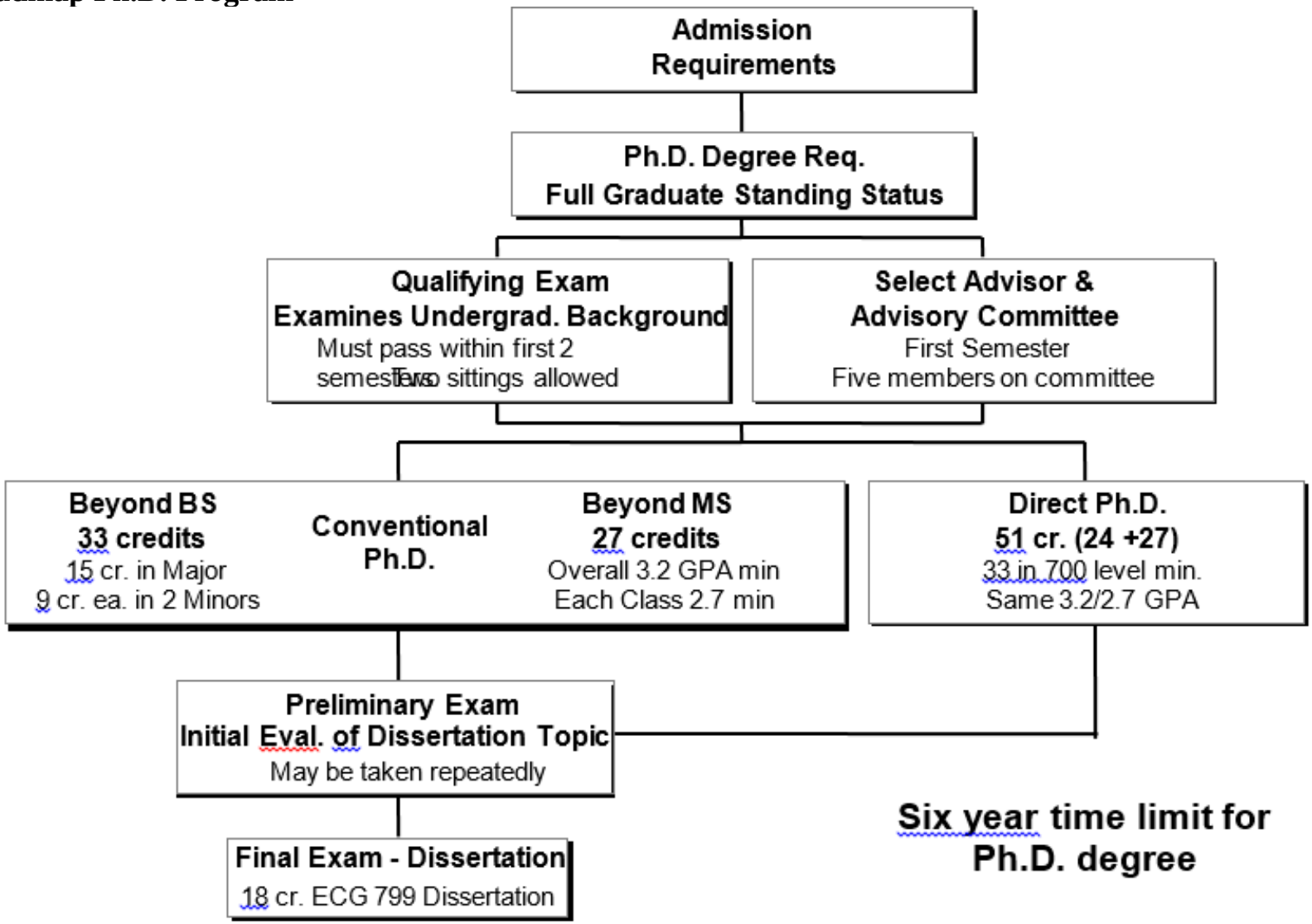


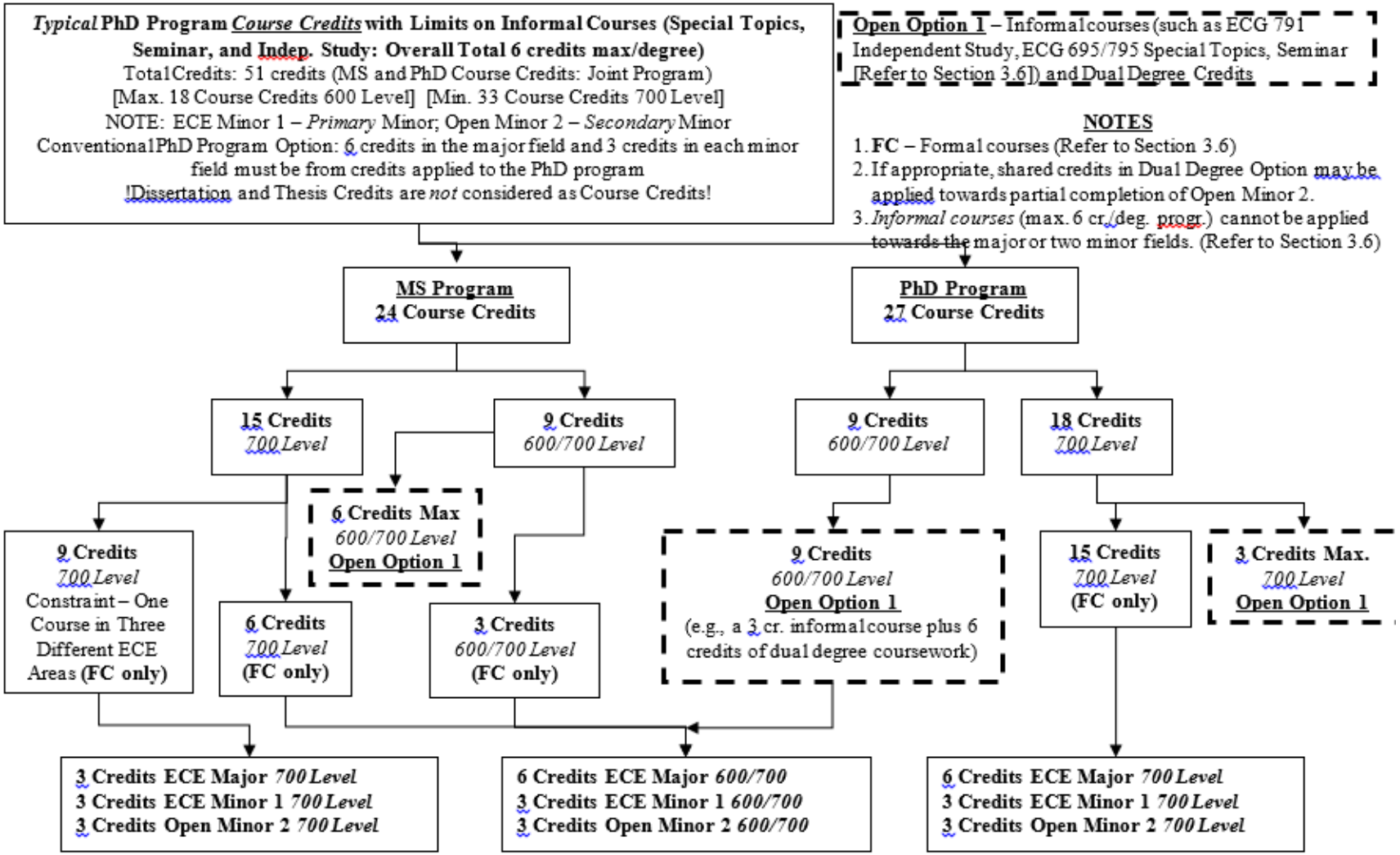
Six year time limit for MS degree

7. MSEE Flowchart



8. Roadmap Ph.D. Program





Course Level	ECE Major	ECE Electives Major & Elective – 3.33 GPA each		
700 Level	9 Credits	9 Credits	= 18 Credits	~2/3 Course Credits
600/700	3 Credits	6 Credits	= 9 Credits	~1/3 Course Credits
Total	*12 Credits*	*15 Credits*	= 27 Credits	

Note: The 15-credit electives must have at least 9 ECG credits. Others can be CoE credits.

Transfer Credits (Overall allowed 15 cr.):

1. Max. 6 credits in MS prog. and Max. 9 credits to electives in PhD prog. from another regionally accredited university;
2. 15 cr. Max of UNLV course credits