UNLV

THE GRADUATE PROGRAM
IN
ELECTRICAL ENGINEERING

ELECTRICAL ENGINEERING
GRADUATE PROGRAM DOCUMENT

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
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LAS VEGAS, NV 89154-4026
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DEPARTMENT OFFICE: TBE B-325

1 Updated: January 16, 2015.
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Table of Contents

1. Department of Electrical and Computer Engineering-General Information______2
   1.1 Department Message ____________________________________________________ 2
   1.2 Purpose________________________________________________________________2
   1.3 The Faculty ___________________________________________________________ 2
   1.4 Annual Review Procedures ______________________________________________ 5
   1.5 Discipline Resources _____________________________________________________5
      1.5.1 Department Facilities __________________________________________________5
      1.5.2 Useful ECE Department and Graduate College Document Links____________________6
      1.5.3 Typical Degree Timeline ________________________________________________7
      1.5.4 University Resources ____________________________________________________8
   1.6 University Policies and Procedures ________________________________________9

2. Overall and Specific Degree Program Objectives, Outcomes, and Assessments___11
   2.1 Overall Electrical Engineering Graduate Program Objectives ________________ 11
   2.2 MSEE Program-Course Only Option ______________________________________11
   2.3 MSEE Program-Thesis Option ___________________________________________ 11
   2.4 Ph.D. Program _________________________________________________________ 12

3. Department Regulations ______________________________________________14
   3.1 Advisors _____________________________________________________________ 14
   3.2 Transfer Credit _______________________________________________________ 14
   3.3 Non-degree Seeking Student Credits _____________________________________ 14
   3.4 Teaching Assistantships (Graduate Assistantships) _________________________ 14
   3.5 Academic Integrity ____________________________________________________ 15
   3.6 Informal Courses _____________________________________________________ 16
   3.7 Waivers _____________________________________________________________ 17
   3.8 Counting 600 Level Classes in a Master or Ph.D. Degree Program ____________ 17
   3.9 Provisional and Conditional Status ______________________________________ 17
   3.10 Admission Application Deadlines ________________________________________ 18

4. Master of Science Program Options in Electrical Engineering _______________19
   4.1 Admission Requirements _______________________________________________ 19
      4.1.1 General Admission Requirements ________________________________________ 19
      4.1.2 Admission Requirements for the Fast Track M.S.E.E. Program Option ________ 21
      4.1.3 Additional Admission Requirements for International Applicants _____________ 21
   4.2 M.S.E.E. Degree Requirements __________________________________________ 21
      4.2.1 Time Limits __________________________________________________________ 24
   4.3 No Risk Pass/Fail Ph.D. Pre-Qualifying Exams______________________________ 24
5. **Ph.D. Program Options in Electrical Engineering**

5.1 **Admission Requirements**

5.1.1 General Admission Requirements

5.1.2 Additional Admission Requirements for International Applicants

5.2 **Ph.D. Degree Requirements**

5.3 **Qualifying Exam**

5.3.1 Appeals

5.4 **Comprehensive Exam**

5.4.1 Appeals

5.5 **Preliminary Exam**

5.6 **Final Exam**

5.7 **Time Limits**

5.8 **Ph.D. Major and Minor Fields**

5.9 **Subfield Listings for MSEE and PhD Programs**

5.9.1 Recommended Reading for Qualifying Exam

5.9.2 MSEE and PhD Field/Area Disciplines

6. **Electrical Engineering Graduate Courses**

Program Flow Charts and Road Maps are at the End of the Document

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

**Handbook Information**

<table>
<thead>
<tr>
<th>Last revised</th>
<th>Revised by</th>
<th>Changes summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Department of Electrical and Computer Engineering – General Information

1.1 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, computer engineering, control system theory, electromagnetics and optics, electronics, 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.

1.2 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 kendall.hartley@unlv.edu. Nothing in this handbook/document supersedes any NSHE, UNLV, or Graduate College policy.

1.3 The Faculty

A current listing of the graduate faculty can be found in the UNLV Graduate Catalog. Faculty must hold either associate or full 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.

Chair:
Peter Stubberud
Ph.D. University of California Los Angeles (1990)
Office: TBE B324; Phone: (702) 895-0869
Email: peter.stubberud@unlv.edu

Graduate Coordinator:
Robert A. Schill, Jr.
Ph.D. University of Wisconsin-Madison (1986)
Office: TBE B334; Phone: (702) 895-1526
Email: Robert.Schill@unlv.edu

Electrical and Computer Engineering Main Office:
Department Secretary
Office: TBE B325
Address: Box 545026, 4505 S Maryland Parkway, Las Vegas, Nevada 89154-4026
Professors:

Yahia Baghzouz
Ph.D. Louisiana State University (1987)
Office: SEB 2167; Phone: (702) 895-0887
Email: yahia.baghzouz@unlv.edu
Research Interests: Power system harmonics/power quality; computer-aided analysis of electric power systems; solar photovoltaic systems; renewable energy integration with the utility grid.

R. Jacob Baker
Ph.D. University of Nevada, Reno (1993)
Office: TBE B328; Phone: (702) 895-4152
Email: r.jacob.baker@unlv.edu
Research Interests: Integrated circuit design

Biswajit Das
Ph.D. Purdue University (1989)
Office: SEB 1172; Phone: (702) 895-2530
Email: dasb@unlv.nevada.edu
Research Interests: Nanotechnology, Nanoscale device fabrication and characterization, Biomedical applications of nanotechnology, Sensors and sensor networks, RF Circuit Design.

Yingtao Jiang
Ph.D. University of Texas at Dallas (2001)
Office: SEB 4218; Phone: (702) 895-2533
Email: yingtao.jiang@unlv.edu
Research Interests: Algorithms, VLSI architectures, and circuit level techniques for the design of DSP, networking and telecommunications systems; computer architectures; computer aided designs; biomedical signal processing, instrumentation, and medical informatics; BioMEMS/BioNEMS; wireless communications and security.

Pushkin Kachroo
Ph.D. University of California at Berkeley (1993)
Office: SEB 3218; Phone: (702) 895-4926
Email: pushkin@unlv.edu
Research Interests: Nonlinear and hybrid control systems, intelligent transportation systems, mechatronics, robotics, distributed parameter systems, differential geometric methods, feedback control in e-marketing, and education and learning, bio-dynamics and control, nano-bio transport control and robotics.

Shahram Latifi
Ph.D. Louisiana State University (1989)
Office: TBE B316; Phone: (702) 895-4016
Email: shahram.latifi@unlv.edu
Research Interests: Computer networks, parallel processing, fault-tolerant computing, data compression.

Robert A. Schill, Jr.
Ph.D. University of Wisconsin-Madison (1986)
Office: TBE B334; Phone: (702) 895-1526
Email: Robert.Schill@unlv.edu
Research Interests: Charged particle beams; microwave theory; fiber, traditional and modern optics; plasma physics; electromagnetic fields and material interactions; linear and nonlinear waves; pulsed power; biomedical and environmental applications of electromagnetics and pulse power.
Henry Selvaraj
Ph.D. Warsaw University of Technology (1994)
Office: TBE B336; Phone: (702) 895-4184
Email: henry.selvaraj@unlv.edu
Research Interests: Digital circuit design; programmable logic devices; logic synthesis; application of logic synthesis techniques in machine learning; data compression and data mining, functional decomposition; PLAs; and FPGAs; multiple valued functions and applications; artificial intelligence and multimedia; microprocessor architecture; and DSP.

Sahjendra Singh
Ph.D. The Johns Hopkins University (1972)
Office: TBE B326; Phone: (702) 895-3417
Email: sajendra.singh@unlv.edu

Peter Stubberud
Ph.D. University of California Los Angeles (1990)
Office: TBE B324; Phone: (702) 895-0869
Email: peter.stubberud@unlv.edu
Research Interests: Digital Signal Processing, multidimensional digital signal processing, adaptive signal processing, neural networks, mixed signal VLSI design, data converters.

Ke-Xun Sun
Ph.D. Massachusetts Institute of Technology (Physics 1993)
Office: SEB 2172; Phone: (702) 774-1486
Email: ke-xun.sun@unlv.edu
Research Interests: Security science and engineering, radiation hard III-V semiconductor and devices, micro and nano technology, radiation detection and measurement, ultrafast electronics, optics and nonlinear optical devices, HEDP diagnostics systems, space flight and payload instruments, scientific computing, and image analysis.

Rama Venkat
Ph.D. Purdue University (1988)
Office: TBE A111; Phone: (702) 895-1094
Email: rama.venkat@unlv.edu

Associate Professors:

Sarah L. Harris
Ph.D. Stanford University (2005)
Office: TBE B314; Phone: (702) 895-4518
Email: sarah.harris@unlv.edu
Research Interests: Digital design, computer architecture, embedded systems, informatics.

Venkatesan Muthukumar
Ph.D. Monash University Australia (2001)
Office: TBE B330; Phone: (702) 895-3566
Email: venkatesan.muthukumar@unlv.edu
Research Interests: Embedded systems, high performance computation on FPGAs, network and system on chips, multi-core and microprocessor systems.

Emma Regentova
Ph.D. Polytechnic of Yerevan (now, State Engineering University of Armenia) (1989)
Office: TBE B320; Phone: (702) 895-3187
Email: emma.regentova@unlv.edu
Research Interests: Classical and applied image processing, image analysis, coding and compression, pattern recognition; Advanced Computer Architectures; Computer Networks.

Ebrahim Saberinia
Ph.D. University of Minnesota (2004)
Office: TBE B318; Phone: (702) 895-3169
Email: ebrahim.saberinia@unlv.edu
Research Interests: Communications; Wireless communication systems and networks; Wireless local, personal and sensor area networks.

Mei Yang
Ph.D. University of Texas at Dallas (2003)
Office: SEB 4216; Phone: (702) 895-2364
Email: mei.yang@unlv.edu
Research Interests: Computer architectures, computer networks, wireless sensor networks, and embedded systems.

Assistant Professors:

Brendan Morris
University of California, San Diego (2010)
Office: SEB 3217; Phone: (702) 774-1480
Email: brendan.morris@unlv.edu
Research Interests: Intelligent systems, computer vision, pattern recognition, machine learning, intelligent transportation systems, and intelligent vehicles.

Emeritus Professors:

William Brogan
Ph.D. University of California Los Angeles (1965)
Office: ; Phone:

Eugene McGaugh
Ph.D. University of Kansas (1982)
Office: TBE B120; Phone: (702) 895-1341
Research Interests: Speaker recognition and laryngeal pathology detection.

1.4 Annual Review Procedures
Each spring term, graduate students are required to complete the Graduate Student Annual Review survey. This survey will be sent by the Graduate College to the student’s Rebelmail account. The review covers the prior calendar year and assesses student progress while setting goals for the year ahead.

1.5 Discipline Resources

1.5.1 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, nanosecond 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 Ω pulsed power device (Nevada Shock), 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 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 fields; 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, and CUDA GPU boards in the Computer Engineering field.

1.5.2 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. Excluding the column titles, all entries that are bold faced are linked directly to the document or form described. The forms in red are typically required to be completed.

<table>
<thead>
<tr>
<th>Form or Document Description</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Engineering M.S.E. Deg. Requirement Declaration (63)</td>
<td>MS Students</td>
</tr>
<tr>
<td>Electrical Engineering Ph.D. Deg. Requirement Declaration (63)</td>
<td>Doctoral Students</td>
</tr>
<tr>
<td>Transfer Credit (07)</td>
<td>All Students</td>
</tr>
<tr>
<td>Appointment of Advisory Committee Approval Form (14)</td>
<td>All Students</td>
</tr>
<tr>
<td>Proposed Masters &amp; Specialist Degree Program Part 1 (28)</td>
<td>MS Students</td>
</tr>
<tr>
<td>* Proposed Masters &amp; Specialist Degree Program Part 2</td>
<td>MS Students</td>
</tr>
<tr>
<td>Proposed Doctoral Degree Program Part 1 (30)</td>
<td>Doctoral Students</td>
</tr>
<tr>
<td>* Proposed Doctoral Degree Program Part 2 [Conventional PhD] [Direct PhD]</td>
<td>Doctoral Students</td>
</tr>
<tr>
<td>Prospectus Approval Form (34)</td>
<td>Thes./Diss. Students</td>
</tr>
<tr>
<td>Advance to Doctoral Candidacy Application (35)</td>
<td>Doctoral Students</td>
</tr>
<tr>
<td>Culminating Experience Results (58)</td>
<td>All Students</td>
</tr>
<tr>
<td>Change in Proposed Degree Program (32)</td>
<td>All Students</td>
</tr>
<tr>
<td>Notification of Oral or Written Examination (ECE Office)</td>
<td>All Students</td>
</tr>
<tr>
<td>Application for Graduation (in MyUNLV)</td>
<td>All Students</td>
</tr>
<tr>
<td>Independent Study (ECE Dept. Office)</td>
<td>All Students</td>
</tr>
<tr>
<td>Change of Advisory Committee Form (15)</td>
<td>All Students</td>
</tr>
<tr>
<td>Authorization for Overload (16)</td>
<td>All Students</td>
</tr>
<tr>
<td>Six-Year/Eight-Year Course Limit Extension Request (33)</td>
<td>All Students</td>
</tr>
<tr>
<td>Dissertation Approval Form (Grad. College Form)</td>
<td>Dissertation. Students</td>
</tr>
<tr>
<td>Thesis Approval Form (Grad. College Form)</td>
<td>Thesis Students</td>
</tr>
<tr>
<td>Thesis/Dissertation Submittal Form (Grad. College Form)</td>
<td>Thes./Diss. Students</td>
</tr>
<tr>
<td>Thesis/Prelim/Dissertation Assessment Form (ECE Office)</td>
<td>Thes./Diss. Students</td>
</tr>
<tr>
<td>Graduate College Appeals Form</td>
<td>All Students</td>
</tr>
<tr>
<td>ECE Graduate Student Orientation Power Point Presentation</td>
<td>All Students</td>
</tr>
<tr>
<td>Minimum Criteria for Syllabi – Spring 2015(Provost Memo – Provost Office)</td>
<td>Course GTAs</td>
</tr>
<tr>
<td>Syllabi Content, Minimum Criteria (Provost Office Webpage - Forms)</td>
<td>Course GTAs</td>
</tr>
</tbody>
</table>
1.5.3 Typical Degree Timeline

<table>
<thead>
<tr>
<th>Steps</th>
<th>Student Degree</th>
<th>Deadlines &amp; Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find Advisor, Declare Transfer Credits,</td>
<td>All Students</td>
<td>Within the first semester of enrollment; Degree Audit Requirement</td>
</tr>
<tr>
<td>Declare Program Track (Degree Program)</td>
<td></td>
<td>- Declare Program Track</td>
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<tr>
<td></td>
<td></td>
<td>- Major and Minor fields (PhD)</td>
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<tr>
<td></td>
<td></td>
<td>- Transfer credit level (includes fast tracks)</td>
</tr>
<tr>
<td>Select Examination Committee</td>
<td>All Students</td>
<td>No later than the last day of instruction of the first semester of enrollment and before established degree program</td>
</tr>
<tr>
<td>Qualifying Exam (Two Sittings Max.)</td>
<td>- Doctoral</td>
<td>• Must be passed within the first two semesters upon admission to the Doctoral Program.</td>
</tr>
<tr>
<td></td>
<td>- Master</td>
<td>• Submitted the semester before taking thesis credit</td>
</tr>
<tr>
<td></td>
<td>- Doctoral</td>
<td>• Submitted the semester before taking dissertation credit</td>
</tr>
<tr>
<td>Comprehensive Exam (Two Sittings Max.)</td>
<td>- Master</td>
<td>• 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</td>
</tr>
<tr>
<td></td>
<td>(course only)</td>
<td>• Must be passed within two semesters after completing all required coursework and the Qualifying Exam except for 18 credits of EEG 799</td>
</tr>
<tr>
<td></td>
<td>- Doctoral</td>
<td></td>
</tr>
<tr>
<td>Preliminary Exam &amp; Assessment (Generally</td>
<td>Doctoral</td>
<td>After completing all coursework except for 18 credits of ECG 799 and passing the Comprehensive Exam. May not be taken more than once per semester.</td>
</tr>
<tr>
<td>Two Sittings Max.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advance to Candidacy</td>
<td>Doctoral</td>
<td>After all coursework is completed, the Comprehensive Exam passed, the Prospectus approved by Graduate Dean, pass Prelim Exam</td>
</tr>
<tr>
<td>Apply for Graduation</td>
<td>All Students</td>
<td>The exact deadline is announced each semester in the UNLV Schedule of Classes</td>
</tr>
<tr>
<td>Submit Thesis/ Dissertation for Initial</td>
<td>All Students</td>
<td>Around the 8th week of the semester that graduation is anticipated or earlier</td>
</tr>
<tr>
<td>Format Check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit Thesis/ Dissertation Draft to ECE</td>
<td>All Students</td>
<td>At least twelve business days prior to Graduate College’s deadline</td>
</tr>
<tr>
<td>Grad. Secretary for Dissemination to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review Committee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thesis/Dissertation Defense &amp; Assessment</td>
<td>All Students</td>
<td>Deadline set by Graduate College</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit Final Copies of the Thesis/Dissertation to Graduate College</td>
<td>All Students</td>
<td>Deadline set by Graduate College</td>
</tr>
<tr>
<td>Submit Final Exam for Advanced Degree</td>
<td>All Students</td>
<td>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.</td>
</tr>
<tr>
<td>Results to Graduate College</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.5.4 University Resources

- **Academic Success Center**
  The goal of the Academic Success Center is to help students do well academically and complete their studies on time. They offer or will refer you to such programs and resources as tutoring, advising, skills testing, career exploration and more. They guide students every step of the way to the many established resources created to ensure they complete their educational goals. Learn more about the programs and services the center currently offers.

- **Alumni Association**
  With an alumni base 90,000 strong, the UNLV Alumni Association 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 Registrar’s Office, 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.

- **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**
  International Students and Scholars (ISS) 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.

- **Jean Nidetch Women's Center**
  The Jean Nidetch Women’s 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.

- **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. 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 Conduct**
The Office of Student Conduct is a student-centered, service-oriented office located within the Division of Student Affairs. The Office of Student Conduct 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.

• **Office of Veteran Services**
The UNLV Office of Veteran Services is staffed with veterans and GI Bill-experienced staff to assist more than 1,000 veterans, dependents, active duty service members, National Guard members, and reservists. 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.

### 1.6 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
- Jeanne 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

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/document supersedes any NSHE, UNLV, or Graduate College policy.*
2. Overall and Specific Degree Program Objectives, Outcomes, and Assessments

2.1 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.

2.2 MSEE Program – Course Only Option (All Corresponding Tracks)
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

2.3 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
   2.1. A hypothesis (or hypotheses)
   2.2. A motivation
   2.3. A set of objectives and goals
   2.4. A critical literature review
   2.5. A theoretical, experimental and/or modeling study
   2.6. 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

### 2.4 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 a comprehensive 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
   2.1 A hypothesis (or hypotheses)
   2.2 A motivation
   2.3 A set of objectives and goals
   2.4 A critical literature review
   2.5 A theoretical, experimental and/or modeling study
   2.6 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. Comprehensive Exam
3. Preliminary Exam
4. Final Exam (Oral Defense)
5. Ph.D. Dissertation
6. Exit interview
3. **Department Regulations**

3.1 **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.

3.2 **Transfer Credit**

Consideration may be given for transferring graduate credit granted by another regionally accredited [Graduate College Policy] 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. It is the Graduate College’s prerogative to accept transfer credits that fall outside of this time period. 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) being tested in the Comprehensive Exam. Up to nine credits may be transferred in the second minor (secondary minor) not being tested. 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.

3.3 **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 College Policy]. 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 College Policy]. 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.

3.4 **Teaching Assistantships (Graduate Assistantships)**

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 the Graduate Catalog for submission deadlines (which are typically February 1st for the fall semester and October 1st for the spring semester). [Graduate Catalog – Admission Deadlines]

A Teaching Assistant is contracted to work 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 College Policy]: 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 Teaching Assistants are required to pass the Test of Spoken English (TSE) (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.

### 3.5 Academic Integrity [Academic Integrity Policy]

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.

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 Nevada System of Higher Education document Rules and Disciplinary Procedures for Members of the University Community.

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 Rules and Disciplinary Procedures for Members of the University Community. 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.

3.6 Informal Courses (non Graduate College Curriculum Approved Courses): ECG 791 Graduate Independent Study, Graduate Seminar, and ECG 695/795 Graduate Special Topics

Informal graduate courses are defined as those courses whose curriculums have not been formally approved by the Graduate College. Formally approved courses have a well defined set of course topics, syllabus, assessment means, etc. that have been reviewed by the ECE Department and the Graduate College and are embodied in the UNLV catalog with a unique course number. The course content of a formally approved course is unique relative to those listed in all remaining courses offered by UNLV. The course catalog is the binding contract between student and professor on what is to be offered in a particular course when the course is taught. Formal graduate courses are defined as those courses whose curriculums have been formally approved by the Graduate College.

A combination of up to six credits of informal courses such as ECG 791 Graduate Independent Study, graduate seminar, 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.

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 may be taken repeatedly, but no more than three credits can be applied towards a particular degree program. In the MSEE thesis option program, ECG 791 (in combination with graduate seminar) cannot be applied to the 18 minimum required ECE credits. In the MSEE course only option program, ECG 791 (in combination with graduate seminar) cannot be applied to the 21 minimum required ECE credits. In the PhD program, ECG 791 cannot be applied to the candidate’s major and two minor areas. Further, in the PhD program, ECG 791 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 the combination of graduate seminar 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) 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 can not be applied to the 18 minimum required ECE credits. In the MSEE course only option program, ECG 695/795 can not 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 a 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 (PhD and 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 informal 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 fast track options.

3.7 Waivers

Under extraordinary circumstances, a student may be granted a waiver for a particular rule in this manual. To request a waiver, a student must submit a letter to the Graduate Committee specifying the rule for which he/she is requesting a waiver and the reason for the request. If the Graduate Committee deems the student’s circumstances to be sufficiently extraordinary, it may grant the student a waiver for a particular rule. If the waiver is granted, the Graduate Committee will send the student a letter explicitly stating the rule that has been waived and the terms of the waiver. A copy of the letter will be placed in the student’s department file. For the waiver to be valid, it must be signed by the entire Graduate Committee and the Department Chair. If students would like to request a waiver of Graduate College policy they may submit a Graduate College Appeals form: http://graduatecollege.unlv.edu/PDF_Docs/AppealGuide-2.pdf

3.8 Counting 600 Level Classes in an 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 Bachelors 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.

3.9 Provisional and Conditional Status [Graduate College Catalog]

Students whose previous academic records are not strong enough to merit Graduate Standing may be granted probationary admission and classified as Graduate Provisional. This classification does not apply to students with deficiencies or insufficient undergraduate credits in the chosen field of study. The Graduate College and the student’s department determine placement in this classification.
A provisional student must complete nine credit hours of graduate-level course work selected by the department and listed on the Letter of Admission. The student must complete this course work within one calendar year of admission, with grades of B or higher, (B- grades are unacceptable) before taking additional course work. Failure to complete the required course work in the specified period or a grade less than B (3.00) will automatically cancel the student’s admission.

When the Graduate College receives the grades covering the required course work, the student will be given Graduate Standing status. A student may only be admitted as a Graduate Provisional student once.

A Conditional Admission status may be granted when the applicant must submit additional material before finalizing admission, i.e., a final transcript of course work in progress while applying for admission. Full Graduate Standing or Graduate Provisional students may also be classified as Conditional Admission. This classification does apply to students with deficiencies or insufficient undergraduate credits in the chosen field of study. The Letter of Admission will specify which material must be submitted and the date by which the Graduate College or academic department must receive it. Failure to meet the condition(s) will automatically cancel the student’s admission and result in separation from the student’s graduate program.

3.10 Admission Application Deadlines [Graduate Catalog – Admission Deadlines]

The admission application deadline for applying to a degree program in electrical and computer engineering at UNLV is February 1st for admissions in the fall of the same calendar year and October 1st for admissions in the spring of the subsequent calendar year.
4. Master of Science Program Options in Electrical Engineering

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

The Department of Electrical and Computer Engineering at UNLV offers a number of 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, Computer Engineering, Control System Theory, Electromagnetics and Optics, Electronics, 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 fast track 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 fast track 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 Masters 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.

4.1 Admission Requirements

Applications are considered on an individual basis. Applicants may be admitted on a full graduate standing, conditional, or provisional status. Qualified applicants who are not admitted into the program can take graduate courses as a non-degree seeking graduate student. Up to 15 UNLV credits taken as a non-degree seeking graduate student at UNLV can be applied towards an M.S.E.E. degree. Potentially, six graduate credits taken at another regionally accredited university [Graduate College Policy] may be transferred into the MSEE degree program at UNLV. At most, only 15 credits of a combination of non-UNLV course credits and ECE UNLV course credits taken as a non-seeking graduate student may be applied to the MSEE program. Courses with a grade less than B (3.0) cannot be applied to the MSEE program. Further, the courses must not have been or will be applied to different degree program. Note that informal course credits (For definition, refer to Section 3.6.) will not be transferred into a MSEE degree program. Informal courses 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. Non-degree seeking 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. Refer to Sections 3.2, 3.3, and 3.6 for other conditions and constraints.

Provisional 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 can not 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, the 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 MSEE degree requirements. Students who have not completed supplementary work within a calendar year or have not received grades of B (3.0) or better in each course within the specified period, unless otherwise agreed upon, will be removed (separated) from the degree program [Graduate College Policy]. A student may only be admitted as a Graduate Provisional student once [Graduate College Policy].

4.1.1 General Admission Requirements

To be considered for admission to the M.S.E.E. program, an applicant must:

1. Have a Bachelor of Science (B.S.) degree in electrical engineering, computer engineering or a closely related discipline. (Applicants who possess a bachelor degree in a closely related discipline, such as physics or mathematics, may be admitted on conditional and/or provisional status. These students will be required to complete certain undergraduate and/or graduate courses before they can attain full graduate standing status.
The graduate committee determines these courses on an individual basis. Graduates with degrees in engineering technology ordinarily have an inadequate background to be admitted to the graduate program.

2. Have a minimum grade point average (GPA) of 3.00 (A = 4.00) for their Bachelor’s degree. (Applicants who have an overall GPA below 3.00 must submit Graduate Record Examination (GRE) scores to the Electrical and Computer Engineering Department, if appropriate, such applicants may be admitted subject to the discretion and possible further requirements of the Electrical and Computer Engineering Graduate Committee. Applicants who want to be considered for an teaching assistantship or who feel that their GRE scores will enhance their chances for admission are strongly encouraged to submit GRE scores [scaled score and percentile in quantitative, verbal reasoning, and analytical writing].)

3. Submit GRE scaled and percentile scores in quantitative, verbal reasoning, and analytical writing to the Department of Electrical and Computer Engineering if the applicant did not obtain his Bachelor degree from an ABET accredited institution, if the applicant is interested in a teaching assistantship, or if the applicant received a Bachelor’s Degree in Electrical and Computer Engineering more than five years prior to the first day of the first semester of the degree program applied for. Interpretation of the scores is at the discretion of the Electrical and Computer Engineering Graduate Committee. (An applicant possessing a Bachelor degree from an ABET accredited institution within the past five years is not required to submit GRE scores.) [NOTE: Five Year Limit - GRE scores will be considered valid if taken within five years prior to the date of admission AND is recognized by the GRE examination board (official scores must be obtained from GRE). If the applicant comes from a university that is not ABET accredited and the applicant’s GPA is below 3.00, then the applicant must satisfy the higher minimum requirements as listed in item (2.) above in order to be considered to the Masters program.]

4. Submit a completed application form and official transcripts of all college level work to the Graduate College. Submit an additional set of transcripts of all college-level work directly to the Department of Electrical and Computer Engineering.

5. In addition, submit a one page written statement of purpose indicating the applicant’s interests, motivations, and objectives. In the statement of purpose, the applicant must explicitly identify his/her areas of interest from the following list of areas offered at UNLV in the ECE Department: Communications, Computer Engineering, Control Systems, Electromagnetics and Optics, Electronics, Power Systems, Signal Processing, and Solid State Materials and Devices (which includes Nanotechnology). Applicants are required to account for all time beyond the Bachelor degree indicating how they have developed professionally. Applicants transferring from other graduate programs must justify why they are leaving that program to join our program. Applicants receiving grades less than B in a graduate course elsewhere may not be admitted to the graduate program without a well justified explanation. Poor performance in course work in the program that the student is transferring from may be a cause for denial of admission. It will be the graduate committee’s discretion whether to allow or deny admission.

6. Submit three letters of recommendation (signed [handwritten signature] and dated) concerning the applicant’s potential for succeeding in the graduate program directly to the Department of Electrical and Computer Engineering. Alternatively, the (signed [handwritten signature] and dated) letters of reference may be electronically uploaded in the online admissions application process. If the applicant has attended a university or is currently enrolled in a program beyond the bachelor degree, then the letters of recommendation should be solicited from that university or program. If the applicant has been out of school for an extended period of time, then letters should be solicited from the professional community that can comment on the applicant’s technical background and/or from the applicant’s most recent academic institution. Letters of recommendation written beyond a six-month period prior to applying for admission to our graduate program will not be accepted. Strong letters of recommendation illustrate technical talent and professional accomplishments beyond the grade point average or course grade. The graduate committee is interested in the applicant’s technical, conceptual, verbal, ethical, and social skills. The graduate committee is interested in the applicant’s ability to perform research with evidence to substantiate claims made. Note that letters from professors that casually know the applicant will not help in the admission process.

7. All domestic and international applicants must review and follow the Graduate College Admission and Registration Requirements.
4.1.2 Admission Requirements for the Fast Track M.S.E.E. Program Option

The Fast Track 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 Fast Track program are required to write a thesis. To be considered for admission to the Fast Track 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, 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).

4.1.3 Additional Admission Requirements for International Applicants

[Graduate College Policy – International Applicants]

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.

4.2 M.S.E.E. Degree Requirements

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 Full Graduate Faculty Status 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 either be placed on probation or expelled from the program.

Specific requirements for the M.S.E.E. degree are:

1) 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.

2) All M.S.E.E. candidates must maintain graduate status 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. 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.

3) Select a program option. No more than three credits of ECG 791 Graduate Independent Study (which cumulatively includes graduate seminar) and no more than a total of six credits of informal courses such as the combination of ECG 791 Graduate Independent Study, graduate seminar, 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, 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.

**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, 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.

**Fast Track M.S.E.E. Program Option:** Students who have been admitted into the Fast Track M.S.E.E. Program Option must complete a minimum of 21, 24, or 27 credits in the fast track 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, 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 Fast Track 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.

**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.
4) 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) Computer Engineering  
c) Control Systems  
d) Electromagnetics and Optics  
e) Electronics  
f) Power Systems  
g) Signal Processing  
h) Solid State Electronics, Materials and Devices

5) **Thesis Requirements.** Students fulfilling the Thesis Option requirements or the Fast Track 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 publically 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, 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 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 publically 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, in consultation with his/ her advisor, 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.

6) 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. The format of the exam complements the PhD Comprehensive Exam. Refer to Section 5.4.

4.2.1 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.

4.3 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 seeking students.
5. Ph.D. Program Options in Electrical Engineering

The culminating experience in the Ph.D. program in the Department of Electrical and Computer Engineering is centered about developing new knowledge focused around a specific theme embodied in the form of 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, Computer Engineering, Control System Theory, Electromagnetics and Optics, Electronics, 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 Fast Track Ph.D. 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 Fast Track Ph.D. 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.

5.1 Admission Requirements

Applicants are considered on an individual basis. Applicants may be admitted as a full graduate standing, conditional, or provisional status student. Qualified applicants who are not admitted can take graduate courses as a non-degree seeking graduate student. Up to 15 UNLV credits taken as a non-degree seeking graduate student at UNLV can be applied towards a PhD degree program in electrical and computer engineering. Potentially, nine graduate credits taken at another regionally accredited university may be transferred in the PhD degree program at UNLV. At most, only 15 credits of a combination of UNLV and non-UNLV course credits, within the constraints above, may be applied to the PhD program. Courses with a grade less than B (3.0) will not be applied to the PhD program. Further, the courses must not have been or will be applied to different degree program. Note that informal course [For definition, refer to Section 3.6.] credits will not be transferred into a PhD degree program. Informal courses 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. Non-degree seeking 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. Refer to Sections 3.2, 3.3, and 3.6 for other conditions and constraints.

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 can not 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].
5.1.1 General Admission Requirements
To be considered for admission to the Ph.D. program, an applicant must:

1) Meet the requirements for one of the following program options:

**Conventional Ph.D. Program Option:**
- Have a Master of Science (M.S.) degree in electrical engineering, computer engineering, or a closely related field with a Master thesis component. The Master thesis must be completed prior to admission. Potential candidates applying to the program based on a course only option or a project option will not be admitted. As evidence of completion, the thesis title, date of completion, location where completed, and thesis abstract are to be provided in the admission process. (Applicants who possess a bachelor degree in a closely related discipline, such as physics or mathematics, may be admitted on conditional and/or provisional status. These students will be required to complete certain undergraduate and/or graduate courses before they can attain full graduate standing status. The graduate committee determines these courses on an individual basis.)
- Have a minimum overall grade point average (GPA) of 3.20 (A = 4.00) for their M.S. degree and a 3.00 for their Bachelor of Science (B.S.) degree.

**Direct Ph.D. Program Option:**
- Have a Bachelor of Science (B.S.) degree in Electrical Engineering, Computer Engineering, or a closely related field. (Applicants who possess a bachelor degree in a closely related discipline, such as physics or mathematics, may be admitted on conditional and/or provisional status. These students will be required to complete certain undergraduate and/or graduate courses before they can attain full graduate standing status. The graduate committee determines these courses on an individual basis.)
- Have a minimum overall grade point average (GPA) of 3.50 (A = 4.00) for their B.S. degree in electrical, computer engineering, or the closely related field.

**Fast Track Direct Ph.D. Program Option:**
- Have obtained a Bachelor of Science (B.S.) degree in electrical engineering and/or computer engineering from UNLV.
- Have a minimum overall grade point average (GPA) of 3.5 (A = 4.0) for their B.S. degree in electrical engineering and/or computer engineering.
- Have up to a maximum of 9 credits (in increments of 3 credits; 3, 6, or 9 credits) of formally approved 600/700 level Graduate College courses which were applied towards the student’s B.S. degree. For clarity, such courses as ECG 791 Graduate Independent Study, graduate seminar, and ECG 695/795 Special Topics are not formally approved courses and are termed informal courses in this document. (Refer to Section 3.6.) The graduate level coursework must have been completed with a minimum grade of B (3.0) and an overall grade point average (GPA) of 3.2 (A = 4.0).

2) Submit GRE scaled and percentile scores in quantitative, verbal reasoning, and analytical writing to the Department of Electrical and Computer Engineering. Have achieved the following minimum percentile ranking:

<table>
<thead>
<tr>
<th>Section</th>
<th>% Below (Percentile)</th>
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<tbody>
<tr>
<td>Quantitative</td>
<td>75</td>
</tr>
<tr>
<td>Verbal Reasoning</td>
<td>20</td>
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<tr>
<td>Analytical Writing</td>
<td>20</td>
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</tbody>
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NOTE: Five Year Limit - GRE scores will be considered valid only if taken within five years prior to the date of admission AND is recognized by the GRE examination board. Official scores must be obtained from an official GRE provider.
GRE Waiver: The GRE entrance requirement will be waived for students entering the Ph.D. program if 
**ALL** of the following are satisfied:

1. The candidate received an MS degree (thesis option) in electrical and/or computer engineering from UNLV.
2. The candidate’s BS GPA equals or exceeds 3.0.
3. The candidate’s MS GPA equals or exceeds 3.6.
4. The candidate shows evidence that a paper pertaining to his/her research has been published in a refereed conference (minimum requirement). A published article in a refereed journal exceeds this minimum requirement. In all cases, the candidate must be the first author of the publication. Galley proofs along with a letter of acceptance may be used as minimum evidence that a paper will be published.
5. The candidate is not seeking a teaching assistantship.
6. One strong letter of recommendation from the major professor indicating the student’s ability for higher education.

3) Submit a completed application form and official transcripts of all college level work to the Graduate College. Submit an additional set of transcripts of all college-level work directly to the Department of Electrical and Computer Engineering.

4) Submit a **one page** written statement of purpose indicating the applicant’s interests, motivations, and objectives. In the statement of purpose, the applicant must explicitly identify his/her areas of interest from the following list of areas offered at UNLV in the ECE Department: Communications, Computer Engineering, Control Systems, Electromagnetics and Optics, Electronics, Power Systems, Signal Processing, and Solid State Materials and Devices *(which includes Nanotechnology)*. Applicants are required to account for all time beyond the Bachelor degree indicating how they have developed professionally. Applicants transferring from other graduate programs without obtaining a Master’s degree must justify why they are leaving that program to join our graduate program. Applicants receiving grades less than B in a graduate course elsewhere may not be admitted to the graduate program without a well justified explanation. Poor performance in course work in the program that the student is transferring from can be a cause for denial of admission. It will be the graduate committee’s discretion whether to allow or deny admission.

5) Submit three letters of recommendation *(signed [handwritten signature] and dated)* concerning the applicant’s potential for succeeding in the graduate program directly to the Department of Electrical and Computer Engineering. Alternatively, the *(signed [handwritten signature] and dated)* letters of reference may be uploaded in the online admission application process. If the student received a MS degree in electrical and/or computer engineering at UNLV, then only one letter of recommendation is required and it must come from the candidate’s ECE thesis advisor which should be the advisor committee chair. If the applicant has attended a university or is currently enrolled in a program beyond the Master degree, then at least one letter of recommendation should be solicited from that university or program and two letters requested from the university in which the Master degree was received. One of the three letters should be written by the thesis advisor commenting on the applicant’s background and the thesis research. If the applicant has been out of school for an extended period of time, then letters should be solicited from the professional community that can comment on the applicant’s technical background and/or from the applicant’s most recent academic institution. Letters of recommendation written beyond a six-month period prior to applying for admission to our graduate program will not be accepted. Strong letters of recommendation illustrate technical talent and professional accomplishments beyond the grade point average or course grade. The graduate committee is interested in the applicant’s technical, conceptual, verbal, ethical, and social skills. The graduate committee is interested in the applicant’s ability to perform research with evidence to substantiate claims made. Note that letters from professors that casually know the applicant will not help in the admission process.

6) All domestic and international applicants must review and follow the Graduate College Admission and Registration Requirements.
5.1.2 Additional Admission Requirements for International Applicants [Graduate College Policy – International Applicants]

Before international applicants can be considered for admission, the Graduate College requires that all international applicants 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 better than 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 toward their graduate degree. Those awarded a teaching assistant must satisfy the requirements of in Section 3.4.

5.2 Ph.D. Degree Requirements

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 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 or expelled from the program. 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.
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, 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 MSEEE 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. Not more than six credits of a combination of informal courses such as ECG 791 Graduate Independent Study, ECG 659/795 Special Topics, and Seminar may be applied to the degree program. These informal courses (ECG 791 Graduate Independent Study, graduate seminar, 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.

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 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, and ECG 659/795 Special Topics may be cumulatively applied to the degree program. Informal courses (ECG 791 Graduate Independent Study, graduate seminar, 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. Students on academic probation may be transferred to the M.S.E.E. Program depending on the student’s academic record. In such a case, the MSEEE Program requirements must be satisfied. For example, only six credits of the informal courses may be applied to the MSEEE 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.

Fast Track Ph.D. Program Option
Students who have been admitted into the Fast Track Ph.D. Program Option must complete a minimum of 42, 45, or 48 credits in the fast track 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, 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 and graduate seminar. Not more than twelve credits of the combination of ECG 791 Graduate Independent Study, graduate seminar, and ECG 659/795 Special Topics may be applied to the degree program. Informal courses (e.g. ECG 791 Graduate Independent Study, graduate seminar, 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. Students on academic probation may 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 either be put on probation or expelled 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. 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, 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 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.
9) After passing the Qualifying Exam, successfully completing all courses for a major field, and successfully completing all courses for the ECE minor (primary minor) field, students are eligible to take the Comprehensive Exam. All students must pass the Comprehensive Exam within two semesters after successfully completing all required coursework except for the 18 credits of ECG 799 Dissertation. [NOTE: Up to six credits of ECG 799 Dissertation taken prior to the successful completion of the Preliminary Exam may count towards the degree program.] The Comprehensive Exam cannot be taken more than once per semester and cannot be taken more than twice. The Comprehensive Exam is described in detail in Section 5.4 of this manual.

10) After successfully completing all required coursework and passing the Comprehensive Exam, the candidate must pass the Preliminary Exam. The Preliminary Exam cannot be taken more than once per semester but may be repeated until passed. The Preliminary Exam is described in detail in Section 5.5 of this manual. [NOTE: Up to six credits of ECG 799 Dissertation taken prior to the successful completion of the Preliminary Exam may count towards the degree program.]

11) 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.

5.3 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 of 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 have not completed 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 of the requirements listed in Section 4. Master of Science Program Options in Electrical Engineering of this document.

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 420
5. Power EE 340  
6. Signal Processing EE 480  
7. Solid State EE 450  
8. Digital Logic Design – CpE 302 (Previously CpE 410) [Questions are not related to a specific HDL (programming language) or a specific FPGA (hardware)]  
9. Computer Architectures and Organization – CpE 300  
10. Digital Electronics and VLSI Design – EE 420 and EE 421  
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 5.9.1. 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.

5.3.1 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.

5.4 Comprehensive Exam

The Comprehensive Exam tests the candidate’s depth of knowledge in both his/her chosen ECE major field and ECE minor 1 (primary minor) field. All PhD candidates must pass the Comprehensive Exam within two semesters (excluding the summer semester) after successfully completing all required course work except for the 18 credits of ECG 799 Dissertation. The Comprehensive Exam is offered once every fall semester and once every spring
semester. The Comprehensive Exam cannot be taken more than twice. Candidates who have received a FAIL grade for the Comprehensive Exam will automatically be placed on academic probation consistent with Graduate College policy. Candidates who have not passed the Comprehensive Exam within this time frame will be terminated from the Ph.D. program. Candidates who have not passed the Comprehensive Exam following their second attempt will be terminated from the Ph.D. program.

Before a student is eligible to register for the Comprehensive Exam, the candidate must have obtained full graduate standing admission status, passed the Qualifying Exam, and must have successfully completed all of the course requirements for the ECE major field and the ECE minor (primary minor; minor 1) field. The student must have acquired a minimum GPA of 3.33 in both the major and minor fields separately. If the minor field GPA is less than 3.33 and/or the major field GPA is less than 3.33, then the minor and/or minor field requirement has not been successfully completed. The candidate will not be allowed to take the Comprehensive Exam until both the major and minor 3.33 GPA requirements are fulfilled. Further, the student must have a minimum overall GPA of 3.2 and have satisfied all other Ph.D. degree program admission requirements. If a student takes the Comprehensive Exam before any one of these requirements has been satisfied, the student will automatically receive a FAIL grade for the exam. At their discretion, the Graduate Committee may also count this failing grade as one of the student's attempts for the Comprehensive Exam. To register for the Comprehensive Exam, eligible students must notify the graduate coordinator no later than one month prior to the examination date.

To pass the Comprehensive Exam, a student must pass a five-hour exam covering courses in his/her ECE major and ECE (primary minor) field. The major and minor area exam will emphasize graduate coursework taking in the ECE major and ECE minor (primary minor; minor 1) fields. The exam will evaluate the student's ability to apply his/her theoretical and analytical abilities to problems in his/her ECE major and ECE minor (primary minor) field. However, the exam may require knowledge of undergraduate material related to the student’s major and minor fields. Students should expect problems that require advanced thinking. Specific problems need not be familiar textbook problems nor may the student be necessarily familiar with the problem. A pass or fail grade will be given for the exam. The graduate committee will notify students of the exam results.

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 see the calculator may contact the 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 Comprehensive 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. The Comprehensive Exam Committee is responsible for producing questions for the exam and providing those questions to the graduate coordinator at least one week prior to the exam. The Comprehensive Exam Committee is solely responsible for grading the exam. The committee must provide a pass or fail result for the exams 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 the exam, the graduate committee will submit that entire exam to the committee for re-grading. After the exam has been graded, the graduate committee will notify students of the results of the exam.

5.4.1 Appeals

Any student may appeal the results of the Comprehensive 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 Comprehensive Exam more than once.
5.5 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 separating the student from the program for failure to progress. [Graduate College Policy] To be eligible for the Preliminary Exam, a student must have passed the Comprehensive Exam, and 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 College Policy]. 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 College Policy]. 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 College Policy]. Generally, the preliminary exam may be taken only twice. Two failures of the preliminary exam lead to separating the student from the program for failure to progress. [Graduate College Policy]

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

5.6 Final Exam

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. Two failures for the final exam lead to separating the student from the program for failure to progress. [Graduate College Policy] 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. A minimum of 12 credits of ECG 799 Dissertation must be taken after the successful completion 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 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 publically defend the dissertation to the advisory committee. After the exam, the advisory committee will privately discuss the student’s accomplishments and advancement in candidacy. To pass the Final Exam, the Ph.D. candidate’s advisory committee must unanimously approve the Ph.D. candidate’s dissertation [Graduate College Policy]. 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 a second examination [Graduate College Policy]. The Final Exam cannot be taken more than once per every three months [Graduate College Policy] 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.

5.7 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.
5.8 Ph.D. Major and Minor Fields

Beyond the Bachelor 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, Computer Engineering, Control System Theory, Electronics, Electromagnetics and Optics, Electronics, 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.

5.9 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.

5.9.1 Recommended Reading for Qualifying Exam - Summarized

1. Communications - EE 460

   Recommended Reading for Communications Qualifying Exam
2. Control Systems - EE 370

Recommended Reading for Control System Theory Qualifying Exam

- Kuo, Automatic Control Systems, Prentice Hall.

3. Electromagnetics and Optics - EE 330

Recommended Reading for Electromagnetics and Optics Qualifying Exam


4. Electronics - EE 420

Recommended Reading for Electronics Qualifying Exam


5. Power - EE 340

Recommended Reading for


6. Signal Processing - EE 480

Recommended Reading for Signal Processing Qualifying Exam

- Oppenheim and R. Schafer, Discrete-Time Signal Processing, Prentice Hall, 1989. Chapters 1 to 5, 8, 9

7. Solid State - EE 450

Recommended Reading for Solid State Electronics Qualifying Exam

- 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:
9. **Computer Architectures and Organization – CpE 300**
   Recommended reading:

10. **Digital Electronics and VLSI Design – EE420 and EE421**
    Recommended reading:

11. **Computer Communication Networks – CpE 400**
    Recommended reading:

**NOTE:** Items 8, 9, 10, and 11 take the place of Computer Engineering field in regards only to the Qualifying Exam requirement.

5.9.2 MSEE and PhD Field/Area Disciplines in ECE with Delineated Course Listings

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

General Electrical Engineering Area

Applied Mathematics

Approved Major Field Courses for Communications

- ECG 662 Digital Communication Systems
- ECG 704 Coding with Applications in Computers and Communication Media
- 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 704 Coding with Applications in Computers and Communication Media
- 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


Computer Engineering

General Electrical Engineering Area

Applied Mathematics

Approved Major Field Courses for Computer Engineering

- ECG 600  Computer Communication Networks
- ECG 603  Embedded Systems Design
- ECG 604  Modern Processor Architecture
- ECG 605  Data Compression Systems
- ECG 607  Biometrics
- ECG 608  Digital Design Verification and Testing
- 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 Computer Engineering

All major field courses.

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

Recommended Reading for Computer Engineering Qualifying Exam

Refer to items 8-11 listed in Section 5.9.1 Recommended Reading for Qualifying Exam – Summarized. Computer engineering has been divided into four subheadings for the qualifying exam.
Control System Theory

General Electrical Engineering Area

Applied Mathematics

Approved Major Field Courses for Control System Theory

ECG 672 Digital Control Systems
ECG 674 Recent Topics in Control
ECG 770 Linear Systems Theory
ECG 771 Optimal and Modern Controls
ECG 772 Nonlinear System I
ECG 774 Stochastic Control
ECG 776 Adaptive Control

Approved Minor Courses for Control System Theory

ECG 770 Linear Systems Theory
ECG 771 Optimal and Modern Controls
ECG 772 Nonlinear System I

Area Coordinators: Singh and Kachroo

Recommended Reading for Control System Theory Qualifying Exam

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


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
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 Controls
- ECG 743  Smart Power Grids (Under evaluation)

Approved Minor Courses for Power Engineering

All major field courses.

Area Coordinators:  Baghzouz

Recommended Reading for

Signal Processing

General Electrical Engineering Area

Applied Mathematics

Approved Major Field Courses for Signal Processing

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECG 680</td>
<td>Discrete-Time Signal Processing</td>
</tr>
<tr>
<td>ECG 762</td>
<td>Detection and Estimation of Signals in Noise</td>
</tr>
<tr>
<td>ECG 781</td>
<td>Digital Filters</td>
</tr>
<tr>
<td>ECG 782</td>
<td>Multidimensional Digital Signal Processing</td>
</tr>
<tr>
<td>ECG 783</td>
<td>Adaptive Signal Processing with Neural Networks</td>
</tr>
</tbody>
</table>

Approved Minor Courses for Signal Processing

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>ECG 680</td>
<td>Discrete-Time Signal Processing</td>
</tr>
<tr>
<td>ECG 762</td>
<td>Detection and Estimation of Signals in Noise</td>
</tr>
<tr>
<td>ECG 781</td>
<td>Digital Filters</td>
</tr>
</tbody>
</table>

Area Coordinators: Stubberud, Morris, and Kachroo

Recommended Reading for Signal Processing Qualifying Exam


Solid State Electronics

General Electrical Engineering Area

Applied Physics

Approved Major Field Courses for Solid State Electronics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECG 651</td>
<td>Electronic and Magnetic Materials and Devices</td>
</tr>
<tr>
<td>ECG 652</td>
<td>Optoelectronics</td>
</tr>
<tr>
<td>ECG 653</td>
<td>Introduction to Nanotechnology</td>
</tr>
<tr>
<td>ECG 750</td>
<td>Optical Electronics I</td>
</tr>
<tr>
<td>ECG 752</td>
<td>Physical Electronics</td>
</tr>
<tr>
<td>ECG 753</td>
<td>Advanced Topics in Semiconductor Devices I</td>
</tr>
<tr>
<td>ECG 755</td>
<td>Monolithic Integrated Circuit Fabrication</td>
</tr>
<tr>
<td>ECG 756</td>
<td>Advanced Topics in Semiconductor Devices II</td>
</tr>
<tr>
<td>ECG 757</td>
<td>Electron Transport Phenomena in Solid State Devices</td>
</tr>
</tbody>
</table>

Approved Minor Courses for Solid State Electronics

All major field courses.

Area Coordinators: Venkat, Das, and Sun

Recommended Reading for Solid State Electronics Qualifying Exam

7. Sze, High Speed Semiconductor Devices, 1990
6. Electrical Engineering Graduate Courses

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

MSEE Admission Requirements

Thesis Option
30 Credits Minimum

Course Only Option
30 Credits Minimum

12 Credits in ECE and/or Other Approved Disciplines

18 ECE Credits Courses Minimum (Excludes ECG 695/795 & 791)

21 ECE Credits Minimum (Excludes ECG 695/795 & 791)

9 Credits in ECE and/or Other Approved Disciplines

15 Credits 700 Level

3 Credits 600/700 Level

21 Credits ECE 700 Level

9 Credits 600/700 Level

6 Credits –Course 600/700 Level

Culminating Experience
6 Credits Thesis ECG 797

Six year time limit for MS degree

Minimum of 3 ECE credits per area in a minimum of three areas
1. Computer Engineering
2. Communications
3. Control Systems
4. Electromagnetics & Optics
5. Electronics
6. Power Systems
7. Signal Processing
8. Solid State Electronics & Devices

Culminating Experience
Pass Comprehensive Exam (Final Year)

Continuing Education Option

Final Advanced Professional Degree Option

Major ECE field of interest

Six year time limit for MS degree

Required
MS Program Course Credits with Limits on Informal Courses such as Seminar, Special Topics, and Ind. Study
Total Credits: 30 credits (Both Thesis Option and Course Only Option)

Open Option
Open Option 1 - ECG 791 Independent Study, ECG 695/795 Special Topics, Seminar, Dual Degree Credits, and Transfer Credit (ECE and non-ECE)
Open Option 2 - ECE Transfer Credit

Final Advanced Professional Degree Option

Culminating Experience
MS Course Only Option
Pass Comprehensive Exam (Last Year)

Notes:
1. Dual degree programs may apply shared credits in Open Option 1 slots.
2. Informal courses (e.g., ECG 791, seminar, and ECG 695/795) may not be applied towards the required 18 (thesis option) or 21 (course only option) ECE credits of coursework.
3. FC – Formal Courses (refer to Section 3.6)

Transfer Credits (Overall allowed 15 credits):
1. Max. 6 non-UNLV credits in MS program from another regionally accredited university
2. 15 credits maximum of UNLV course credits
Roadmap Ph.D. Program

Admission Requirements

Ph.D. Degree Req.
Full Graduate Standing Status

Qualifying Exam
Examines Undergrad. Background
Must pass within first 2 semesters.
Two sittings allowed

Select Advisor & Advisory Committee
First Semester
Five members on committee

Beyond BS
33 credits
15 cr. in Major
9 cr. ea. in 2 Minors

Conventional Ph.D.

Beyond MS
27 credits
Overall 3.2 GPA min
Each Class 2.7 min

Comprehensive Exam
Examines Graduate Background
Upon completion of major area
Two sittings allowed

Preliminary Exam
Initial Eval. of Dissertation Topic
May be taken repeatedly

Final Exam - Dissertation
18 cr. ECG 799 Dissertation

Direct Ph.D.
51 cr. (24 +27)
33 in 700 level min.
Same 3.2/2.7 GPA

Six year time limit for Ph.D. degree
Typical PhD Program Course Credits with Limits on Informal Courses
(Special Topics, Seminar, and Indep. Study: Overall Total 6 credits max/degree)
Total Credits: 51 credits (MS and PhD Course Credits: Joint Program)
[Max. 18 Course Credits 600 Level] [Min. 33 Course Credits 700 Level]
NOTE: ECE Minor 1 – Primary Minor; Open Minor 2 – Secondary Minor
Conventional PhD Program Option: 6 credits in the major field and 3 credits in each minor
field must be from credits applied to the PhD program
!Dissertation and Thesis Credits are not considered as Course Credits!

Open Option 1 – Informal courses (such as ECG 791 Independent Study, ECG 695/795 Special Topics, Seminar
[Refer to Section 3.6]) and Dual Degree Credits

NOTES
1. FC – Formal courses (Refer to Section 3.6)
2. If appropriate, shared credits in Dual Degree Option may be
applied towards partial completion of Open Minor 2.
3. Informal courses (max. 6 cr./deg. progr.) cannot be applied
towards the major or two minor fields. (Refer to Section 3.6)

Ph.D. Flowchart

MS Program
24 Course Credits

15 Credits
700 Level

9 Credits
600/700 Level

6 Credits
600/700 Level

Open Option 1

9 Credits
700 Level

6 Credits
700 Level

(FC only)

3 Credits
700 Level

(FC only)

3 Credits
ECE Major 700 Level

3 Credits ECE Minor 1 700 Level

3 Credits Open Minor 2 700 Level

PhD Program
27 Course Credits

18 Credits
700 Level

9 Credits
600/700 Level

15 Credits
700 Level

6 Credits
600/700 Level

Open Option 1

9 Credits
600/700 Level

Open Option 1

(e.g., a 3 cr. informal course plus 6
credits of dual degree coursework)

3 Credits Max.
700 Level

(FC only)

Open Option 1

6 Credits
ECE Major 700 Level

6 Credits ECE Minor 1 600/700

6 Credits Open Minor 2 600/700

Transfer Credits (Overall allowed 15 cr.):
1. Max. 6 credits in MS prog. and Max. 9 credits in PhD prog. from another
   regionally accredited university;
2. 15 cr. Max of UNLV course credits

Course Level  | ECE Major  | ECE Minor 1 (Primary) | ECE Minor 1 (Secondary) | Open Minor 2 | Major & Minors -- 3.33 GPA each
---------------|------------|-----------------------|-------------------------|--------------|-----------------------
700 Level      | 9 Credits  | 6 Credits              | 6 Credits               | 6 Credits     | = 21 Credits ~2/3 Course Credits
600/700        | 6 Credits  | 3 Credits              | 3 Credits               | 3 Credits     | = 12 Credits ~1/3 Course Credits
Total          | 15 Credits | 9 Credits             |                         | 9 Credits     | = 33 Credits