Doctor of Philosophy - Electrical Engineering

Plan Description

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 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 Post-Master's subplan,
- the Post-Bachelor's subplan,
- or the Post-Bachelor's Integrated BS-PHD subplan.

The Post-Master's subplan 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 Post-Bachelor's subplan 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 Post-Bachelor's Integrated BS-PHD subplan allows students who applied up to 9 credits of graduate courses towards their B. S. degrees to complete their Ph. D. in engineering with up to 9 fewer credits than students in the Post-Bachelor's subplan. 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 Ph. D. 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. [Refer to the Dual Degree Doctor of Philosophy – Electrical Engineering and Master of Science – Mathematical Sciences program description.

For more information about your program, including your graduate program handbook and learning outcomes, please visit the Degree Directory.

Plan Admission Requirements

Application deadlines

Applications available on the UNLV Graduate College website.

Applicants are considered on an individual basis. Applicants may be admitted as a regular 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 credits will not be transferred into a PhD degree program. Informal courses such as 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 Electrical& Computer Engineering Graduate Special Topics towards the program degree as long as they adhere to the conditions of the particular program option regarding informal course credits.

To be considered for admission an applicant must:

1. Submit GRE scaled and percentile scores in quantitative, verbal reasoning, and analytical writing to the Department of Electrical and Computer Engineering and have obtained the following minimum relative percentile comparison rank of 75 in the Quantitative section, 20 in the Verbal Reasoning section, and 20 in Analytical Writing. Please note that GRE scores will only be considered valid if taken within five years prior to the time of admission and are recognized by the GRE examination board. Official scores must be obtained from an official GRE provider. The GRE requirement can be waived under the circumstances listed in the GRE Waiver section.
2. 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.
3. Submit a ~~**one page**~~ **one-page** written statement of purpose indicating the applicant's interests, motivations, and objectives. In the statement of purpose, the applicant must explicitly identify their 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**~~ **Solid-State Electronics** and ~~**Devices**~~ **Photonics** (which includes Nanotechnology). Applicants are required to account for all time beyond the B. S. degree indicating how they have developed professionally. Applicants transferring from other graduate programs without obtaining an M. 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**~~ **well-justified** explanation. Poor performance in course work in the program that the student is ~~**transferring fr om**~~ **transferrin g from** can be a cause for denial of admission. It will be the graduate committee's discretion whether to allow or deny admission**.**
4. **Submit a one-page curriculum vitae listing the applicant's project, publication, and award records**.
5. Submit three letters of recommendation (signed and dated) concerning the applicant's potential for succeeding in the graduate program directly to the Department of Electrical and Computer Engineering. Letters of reference may be electronically uploaded in the online admissions application process. If the student received a M. S. degree in electrical or computer engineering at UNLV, then only one letter of recommendation is required, and it must come from the candidate's faculty advisor who should be the student's thesis committee chair. If the applicant has attended a university or is currently enrolled in a

program beyond the M. S. degree, then at least one letter of recommendation should be solicited from that university or program and two from the university in which the M. S. degree was received. One of the three letters should be written by your thesis advisor commenting on your background and your thesis research. If the applicant has been out of school for an extended period of tim e, then letters should be solicited from the professional community who 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 you will not help you in the admission process.

6. ~~**Before international**~~ **International** applicants ~~**can be considered for admission must provide proof of English proficiency**~~, **as stated in** 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 proficiency requirements website**~~. ~~**Students whose first language is not English may be required to take and pass 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.**~~
7. All domestic and international applicants must review and follow the Graduate College Admission and Registration Requirements.
8. Application deadlines are February 1st for admission in the fall of the same year and October 1st for admission in the spring of the subsequent year.

Post-Master's subplan

1. Have a Master of Science (M. S.) degree in electrical engineering or computer engineering or a closely related field with an M. S. thesis component. The M. S. 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. (Applicants who possess a bachelor's 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 regular full graduate standing status. The graduate committee determines these courses on an individual basis.)
2. 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 B. S. degree.

Post-Bachelor's subplan:

1. Have a Bachelor of Science (B. S.) degree in electrical engineering or 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 regular full graduate

standing status. The graduate committee determines these courses on an individual basis.)
2. Have a minimum overall grade point average (GPA) of 3. 50 (A= 4. 00) for their B. S. degree in Electrical or Computer Engineering a closely related field.

Post-Bachelor's Integrated BS-PHD subplan:

The Integrated BS-PHD *subplan* program 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 Post-Bachelor's *subplan*. 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.

1. Have a minimum overall grade point average (GPA) of 3. 5 (A= 4. 00) for their B. S. degree in electrical engineering or computer engineering at UNLV.
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 Graduate Independent Study, Graduate Seminar, and Special Topics) which were applied towards the student's B. S. degree. Each graduate level course must have been completed with a minimum grade of B (GPA) of 3. 2 (A= 4. 00).

GRE Waiver:

The GRE entrance requirement will be waived for students entering the Ph. D. program if ***ALL*** of the following are satisfied~~:~~**. The final decision is up to the graduate committee.**

1. The candidate ~~**receives**~~ **received** a ~~**MS**~~ **bachelor or master's** degree **(thesis option)** in ~~**Electrical and Computer Engineering (ECE) at UNLV**~~ **electrical and/or computer engineering from an ABET-accredited electrical and/or computer engineering program**.

2. The ~~**candidate's**~~ **candidate's** BS GPA equals or exceeds 3. 0 **and MS GPA equals or exceeds 3. 6 for conventional Ph. D. applicants**. The ~~**candidate's MS**~~ **candidate's BS** GPA equals or exceeds 3. ~~**6**~~ **5 for direct Ph. D. applicants.**

3. The ~~**candidate shows**~~ **conventional Ph. D. applicant must show** evidence that a paper pertaining to ~~**their**~~ **his/her** research has been ~~**published**~~ **accepted/published** in a refereed conference (minimum requirement)~~**. A published article in**~~ **or** a ~~**refereed**~~ journal ~~**exceeds this minimum requirement**~~. ~~**In all cases, the candidate must be the first author of the publication. Galley proofs**~~ **Reviewers' comments** along with a letter of acceptance may be used as minimum evidence that a paper will be published. The ~~**candidate is**~~ **direct Ph. D. applicant must show evidence of research experience. Examples of such evidence include but** not ~~**seeking**~~ **limited to 1) a research publication; 2)** a ~~**teaching assistantship**~~ **research poster/presentation; 3) participation in a sponsored research project; 4) participation in a research internship, etc.**

4. ~~**One strong letter**~~ **Letters** of recommendation ~~**from the major professor indicating**~~ **should clearly indicate** the student's **potential and** ability ~~**for**~~ **to succeed in research and** higher education.

Students are accepted into a degree program as described in the Graduate Catalog. The faculty and corresponding sub-disciplines and sub-plans within the described programs are subject to change at any time.

Plan Requirements

See Subplan Requirements below.

Subplan 1: Post-Master's

Subplan 2: Post-Bachelor's

Subplan 3: Post-Bachelor's Integrated BS-PHD

Subplan 1 Requirements: Post-Master's

Total Credits Required: 45

Course Requirements

Major Field Courses – Credits: 6-15

Complete 6-15 credits of **advisor approved** coursework in an ~~**approved**~~ **single** major ~~**in a single**~~ area in Electrical and Computer Engineering **(suggested courses below),** with a minimum overall average GPA of 3. 33.

Communications

ECG 662 Digital Communication Systems	3
ECG 666 Wireless and Mobile Communication Systems	3
ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 763 Advanced Digital Communication Systems	3

Computer Engineering

ECG 600 Computer Communication Networks	3
ECG 603 Embedded Systems Design	**3**
ECG 604 Modern Processor Architecture	3

ECG 605 Data Compression Systems	3
ECG 607 Biometrics	3
ECG 608 Digital Design Verification and Testing	3
ECG 609 Embedded Digital Signal Processing	3
ECG 617 Internet of Things Systems	3
ECG 700 Advanced Computer System Architecture	3
ECG 701 Reliable Design of Digital Systems	3
ECG 702 Interconnection Networks for Parallel Processing Applications	3
ECG 703 Machine Learning and Applications	**3**
ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 707 Logic Synthesis Engineering	3
ECG 709 Synthesis and Optimization of Digital Systems	3

Control Systems Theory

ECG 672 Digital Control Systems	3
ECG 770 Linear Systems	3
ECG 771 Optimal and Modern Control	3
ECG 772 Nonlinear Systems	3
ECG 774 Stochastic Control	3
ECG 776 Adaptive Control	3

Electromagnetics and Optics

ECG 630 Transmission Lines	3
ECG 631 Engineering Optics	3
ECG 632 Antenna Engineering	3
ECG 633 Active and Passive Microwave Engineering	3
ECG 730 Advanced Engineering Electromagnetics I	3
ECG 731 Theoretical Techniques in Electromagnetics	3
ECG 732 Advanced Engineering Electromagnetics II	3
ECG 733 Plasma I	3

Electronics

ECG 620 Analog Integrated Circuit Design	3
ECG 621 Digital Integrated Circuit Design	3
ECG 720 Advanced Analog IC Design	3

ECG 721 Memory Circuit Design	3
ECG 722 Mixed-Signal Circuit Design	3

Power Engineering

ECG 642 Power Electronics	3
ECG 646 Photovoltaic Devices and Systems	3
ECG 740 Computer Analysis Methods for Power Systems	3
ECG 741 Electric Power Distribution System Engineering	3
ECG 742 Power System Stability and Control	3
ECG 743 Smart Electrical Power Grid	3

Signal Processing

ECG 680 Discrete-Time Signal Processing	3
ECG 682 Introduction to Biomedical Signals and Systems	**3**
ECG 703 Machine Learning and Applications	**3**
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 781 Digital Filters	3
ECG 782 Multidimensional Digital Signal Processing	3
ECG 783 Adaptive Signal Processing with Neural Networks	3

Solid State Electronics **and Photonics**

~~[After]~~ ECG - 614 - Quantum Communication [Before]	**3**
ECG 651 Electronic and Magnetic Materials and Devices	3
ECG 652 Optoelectronics	3
ECG 653 Introduction to Nanotechnology	3
[After] ECG - 712 - Optical Materials and Devices	3
[After] ECG - 715 - Biomedical Photonics	3
[After] ECG - 716 - Space Systems	3
ECG 750 Photonics	3
ECG 752 Physical Electronics	3
ECG 753 Advanced Topics in Semiconductor Devices I	3
ECG 755 Monolithic Integrated Circuit Fabrication	3
ECG 756 Advanced Topics in Semiconductor Devices II	3

ECG 757 Electron Transport Phenomena in Solid State Devices	3
ECG 758 Numerical Methods in Engineering	3

Minor Fields Courses – Credits: 6-18

Select two advisor-approved minor fields and complete coursework **(suggested courses below)** in each single area totaling 6-18 credits, with a minimum overall average GPA of 3. 33. The secondary minor can be from a field outside Electrical Engineering.

Communications

ECG 662 Digital Communication Systems	3
ECG 666 Wireless and Mobile Communication Systems	3
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3

Computer Engineering

ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 603 Embedded Systems Design	**3**
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 600 Computer Communication Networks	3
ECG 604 Modern Processor Architecture	3
ECG 605 Data Compression Systems	3
ECG 607 Biometrics	3
ECG 608 Digital Design Verification and Testing	3
[After] ECG 618 Cloud Computing in Engineering	3
~~**ECG 618 Cloud Computing in Engineering**~~	
ECG 609 Embedded Digital Signal Processing	3
ECG 617 Internet of Things Systems	3
ECG 700 Advanced Computer System Architecture	3
ECG 703 Machine Learning and Applications	**3**
ECG 701 Reliable Design of Digital Systems	3
ECG 702 Interconnection Networks for Parallel Processing Applications	3
ECG 707 Logic Synthesis Engineering	3
ECG 709 Synthesis and Optimization of Digital Systems	3

Control Systems Theory

ECG 770 Linear Systems	3
ECG 771 Optimal and Modern Control	3
ECG 772 Nonlinear Systems	3
ECG 774 Stochastic Control	3
ECG 776 Adaptive Control	3

Electromagnetics and Optics

ECG 630 Transmission Lines	3
ECG 631 Engineering Optics	3
ECG 632 Antenna Engineering	3
ECG 633 Active and Passive Microwave Engineering	3
ECG 730 Advanced Engineering Electromagnetics I	3
ECG 731 Theoretical Techniques in Electromagnetics	3
ECG 732 Advanced Engineering Electromagnetics II	3
ECG 733 Plasma I	3

Electronics

ECG 620 Analog Integrated Circuit Design	3
ECG 621 Digital Integrated Circuit Design	3
ECG 720 Advanced Analog IC Design	3
ECG 721 Memory Circuit Design	3
ECG 722 Mixed-Signal Circuit Design	3

Power Engineering

ECG 642 Power Electronics	3
ECG 646 Photovoltaic Devices and Systems	3
ECG 740 Computer Analysis Methods for Power Systems	3
ECG 741 Electric Power Distribution System Engineering	3
ECG 742 Power System Stability and Control	3
ECG 743 Smart Electrical Power Grid	3

Signal Processing

ECG 680 Discrete-Time Signal Processing	3
ECG 682 Introduction to Biomedical Signals and Systems	**3**

ECG 703 Machine Learning and Applications	**3**
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 781 Digital Filters	3
ECG 782 Multidimensional Digital Signal Processing	3
ECG 783 Adaptive Signal Processing with Neural Networks	3

Solid State Electronics **and Photonics**

[Before] ECG - 614 - Quantum Communication	3
ECG 651 Electronic and Magnetic Materials and Devices	3
ECG 652 Optoelectronics	3
ECG 653 Introduction to Nanotechnology	3
[After] ECG - 712 - Optical Materials and Devices	3
[After] ECG - 715 - Biomedical Photonics	3
[After] ECG - 716 - Space Systems	3
ECG 750 Photonics	3
ECG 752 Physical Electronics	3
ECG 753 Advanced Topics in Semiconductor Devices I	3
ECG 755 Monolithic Integrated Circuit Fabrication	3
ECG 756 Advanced Topics in Semiconductor Devices II	3
ECG 757 Electron Transport Phenomena in Solid State Devices	3
ECG 758 Numerical Methods in Engineering	3

Elective Courses – Credits: 0-15

Complete 0-15 credits of 600- or 700-level MAT, PHY, AST, CEE, CEM, ECG, EGG, CS, ME, or other advisor-approved courses.

Dissertation – Credits: 18

ECG 799 Dissertation	1 – 6

Degree Requirements

1. All Ph. D. students must satisfy the Ph. D. degree program admission requirements and be admitted to the Ph. D. program on a regular status.

2. Complete a minimum of 27 credits of graduate level courses (excluding dissertation credits) with an overall minimum GPA of 3. 20 and a minimum GPA of 2. 70 (B-) in each class applied towards the 27 credits. The final division of major, minor, and elective credits will be determined in consultation with the student's advisor.
3. Of the 27 required credits, a minimum of 18 credits must be in 700-level courses. Of these 18 credits, a minimum of 15 must be from formal courses. The student's doctoral advisory committee may add more requirements in accordance with the individual's background and field of study.
4. No more than 3 credits may be from Graduate Independent Study together with Graduate Seminar. No more than 6 credits of a combination of informal courses such as Graduate Independent Study, Special Topics, and Seminar may be applied to the degree program.
5. Beyond the Bachelor degree, a Ph. D. student must complete a minimum of 15 credits in an approved ECE major field, 9 credits an approved ECE minor (primary minor) field, and 9 credits in a second approved open 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 obtained in the major field. 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 obtained in each of the minor fields.
6. Informal courses (Graduate Independent Study, Graduate Seminar, and Special Topics) cannot be applied to the ECE major, ECE minor (primary minor) and the open minor (secondary minor) fields.
7. At the time of admission or no later than the first semester, the Ph. D. 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 Ph. D. program.
8. All regular (full graduate standing) status graduate students must select a faculty advisor in their first semester.
9. Maintain a minimum overall grade point average (GPA) of 3. 20, must maintain a minimum GPA of 3. 20 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~~ **may** 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.
10. All regular (full graduate standing) status graduate students must file an approved ~~program~~ **Plan of Study form** before the completion of their third semester. This program must be approved by the student's advisor and the graduate coordinator. All regular and provisional status graduate students must show satisfactory progress towards completion of their degree by completing at least six credits of their approved program per calendar year. If their progress towards their degree program is not satisfactory, students ~~will~~ **may** either be put on probation or expelled from the program.
11. Before beginning a dissertation, students must have their dissertation topic approved by their advisor, and 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.

Graduation Requirements

See Plan Graduation Requirements below.

Subplan 2 Requirements: Post-Bachelor's

Total Credits Required: 69

Course Requirements

Major Field Courses – Credits: 15

Complete 15 credits of **advisor approved** coursework in an ~~**approved**~~ **single** major ~~**in a single**~~ area in Electrical and Computer Engineering **(suggested courses below),** with a minimum overall GPA of 3. 33. A minimum of 9 credits must be in 700-level courses.

Communications

ECG 662 Digital Communication Systems	3
ECG 666 Wireless and Mobile Communication Systems	3
ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 763 Advanced Digital Communication Systems	3

Computer Engineering

ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 603 Embedded Systems Design	**3**
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 600 Computer Communication Networks	3
ECG 604 Modern Processor Architecture	3
ECG 605 Data Compression Systems	3
ECG 607 Biometrics	3
ECG 608 Digital Design Verification and Testing	3
ECG 609 Embedded Digital Signal Processing	3
ECG 617 Internet of Things Systems	3
ECG 700 Advanced Computer System Architecture	3
ECG 703 Machine Learning and Applications	**3**
ECG 701 Reliable Design of Digital Systems	3
ECG 702 Interconnection Networks for Parallel Processing Applications	3
ECG 707 Logic Synthesis Engineering	3
ECG 709 Synthesis and Optimization of Digital Systems	3
[After] 703 Machine Learning and Applications	3

Control Systems Theory

ECG 672 Digital Control Systems	3
ECG 770 Linear Systems	3
ECG 771 Optimal and Modern Control	3
ECG 772 Nonlinear Systems	3
ECG 774 Stochastic Control	3
ECG 776 Adaptive Control	3

Electromagnetics and Optics

ECG 630 Transmission Lines	3
ECG 631 Engineering Optics	3
ECG 632 Antenna Engineering	3
ECG 633 Active and Passive Microwave Engineering	3
ECG 730 Advanced Engineering Electromagnetics I	3
ECG 731 Theoretical Techniques in Electromagnetics	3
ECG 732 Advanced Engineering Electromagnetics II	3
ECG 733 Plasma I	3

Electronics

ECG 620 Analog Integrated Circuit Design	3
ECG 621 Digital Integrated Circuit Design	3
ECG 720 Advanced Analog IC Design	3
ECG 721 Memory Circuit Design	3
ECG 722 Mixed-Signal Circuit Design	3

Power Engineering

ECG 642 Power Electronics	3
ECG 646 Photovoltaic Devices and Systems	3
ECG 740 Computer Analysis Methods for Power Systems	3
ECG 741 Electric Power Distribution System Engineering	3
ECG 742 Power System Stability and Control	3
ECG 743 Smart Electrical Power Grid	3

Signal Processing

ECG 680 Discrete-Time Signal Processing	3
ECG 682 Introduction to Biomedical Signals and Systems	**3**
ECG 703 Machine Learning and Applications	**3**
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 781 Digital Filters	3
ECG 782 Multidimensional Digital Signal Processing	3
ECG 783 Adaptive Signal Processing with Neural Networks	3

Solid State Electronics **and Photonics**

[After] ECG - 614 - Quantum Communication	3
ECG 651 Electronic and Magnetic Materials and Devices	3
ECG 652 Optoelectronics	3
ECG 653 Introduction to Nanotechnology	3
[After] ECG-712-Optical Materials and Devices	**3**
[After] ECG - 715 - Biomedical Photonics	3
[After] ECG - 716 - Space Systems	3
ECG 750 Photonics	3
ECG 752 Physical Electronics	3
ECG 753 Advanced Topics in Semiconductor Devices I	3

ECG 755 Monolithic Integrated Circuit Fabrication	3
ECG 756 Advanced Topics in Semiconductor Devices II	3
ECG 757 Electron Transport Phenomena in Solid State Devices	3
ECG 758 Numerical Methods in Engineering	3

Minor Fields Courses – Credits: 18

Select two advisor-approved minor fields and complete 9 credits of coursework **(suggested courses below)** in each single area with a minimum overall average GPA of 3. 33. A minimum of 6 credits in each area must be in 700-level courses. The secondary minor can be from a field outside Electrical Engineering.

Communications

ECG 662 Digital Communication Systems	3
ECG 666 Wireless and Mobile Communication Systems	3
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3

Computer Engineering

ECG 600 Computer Communication Networks	3
ECG 603 Embedded Systems Design	**3**
ECG 604 Modern Processor Architecture	3
ECG 605 Data Compression Systems	3
ECG 607 Biometrics	3
ECG 608 Digital Design Verification and Testing	3
ECG 609 Embedded Digital Signal Processing	3
ECG 617 Internet of Things Systems	3
ECG 700 Advanced Computer System Architecture	3
ECG 701 Reliable Design of Digital Systems	3
ECG 702 Interconnection Networks for Parallel Processing Applications	3
ECG 703 Machine Learning and Applications	**3**
ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 707 Logic Synthesis Engineering	3

ECG 709 Synthesis and Optimization of Digital Systems	3

Control Systems Theory

ECG 770 Linear Systems	3
ECG 771 Optimal and Modern Control	3
ECG 772 Nonlinear Systems	3
ECG 774 Stochastic Control	3
ECG 776 Adaptive Control	3

Electromagnetics and Optics

ECG 630 Transmission Lines	3
ECG 631 Engineering Optics	3
ECG 632 Antenna Engineering	3
ECG 633 Active and Passive Microwave Engineering	3
ECG 730 Advanced Engineering Electromagnetics I	3
ECG 731 Theoretical Techniques in Electromagnetics	3
ECG 732 Advanced Engineering Electromagnetics II	3
ECG 733 Plasma I	3

Electronics

ECG 620 Analog Integrated Circuit Design	3
ECG 621 Digital Integrated Circuit Design	3
ECG 720 Advanced Analog IC Design	3
ECG 721 Memory Circuit Design	3
ECG 722 Mixed-Signal Circuit Design	3

Power Engineering

ECG 642 Power Electronics	3
ECG 646 Photovoltaic Devices and Systems	3
ECG 740 Computer Analysis Methods for Power Systems	3
ECG 741 Electric Power Distribution System Engineering	3
ECG 742 Power System Stability and Control	3
ECG 743 Smart Electrical Power Grid	3

Signal Processing

ECG 680 Discrete-Time Signal Processing	3

ECG 682 Introduction to Biomedical Signals and Systems	**3**
ECG 703 Machine Learning and Applications	**3**
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 781 Digital Filters	3
ECG 782 Multidimensional Digital Signal Processing	3
ECG 783 Adaptive Signal Processing with Neural Networks	3

Solid State Electronics **and Photonics**

[After] ECG - 614 - Quantum Communication	3
ECG 651 Electronic and Magnetic Materials and Devices	3
ECG 652 Optoelectronics	3
ECG 653 Introduction to Nanotechnology	3
[After] ECG - 712 - Optical Materials and Devices	3
[After] ECG - 715 - Biomedical Photonics	3
[After] ECG - 716 - Space Systems	3
ECG 750 Photonics	3
ECG 752 Physical Electronics	3
ECG 753 Advanced Topics in Semiconductor Devices I	3
ECG 755 Monolithic Integrated Circuit Fabrication	3
ECG 756 Advanced Topics in Semiconductor Devices II	3
ECG 757 Electron Transport Phenomena in Solid State Devices	3
ECG 758 Numerical Methods in Engineering	3

700-Level Elective Courses – Credits: 12

Complete 12 credits of 700-level MAT, PHY, AST, CEE, CEM, ECG, EGG, CS, ME, or other advisor-approved courses.

Elective Courses – Credits: 6

Complete 6 credits of 600- or 700-level MAT, PHY, AST, CEE, CEM, ECG, EGG, CS, ME, or other advisor-approved courses.

Dissertation – Credits: 18

ECG 799 Dissertation	1 – 6

Degree Requirements

1. All Ph. D. students must satisfy the Ph. D. degree program admission requirements and be admitted to the Ph. D. program on a regular status.
2. Complete a minimum of 51 credits (24 M. S. E. credits+ 27 Post-Master's subplan credits) of graduate level courses (excluding dissertation credits) with an overall minimum GPA of 3. 20 and a minimum GPA of 2. 70 (B-) in each class applied towards the 27 credits.
3. Of the 51 required credits, a minimum of 33 credits must be in 700-level courses. Of these 33 credits, a minimum of 30 must be from formal courses. The student's doctoral advisory committee may add more requirements in accordance with the individual's background and field of study.
4. No more than 6 credits may be from Graduate Independent Study together with Graduate Seminar. No more than 12 credits of a combination of informal courses such as Graduate Independent Study, Special Topics, and Seminar may be applied to the degree program.
5. Complete a minimum of 15 credits in an approved ECE major field, 9 credits an approved ECE minor (primary minor) field, and 9 credits in a second approved open 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 obtained in the major field. 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 obtained in each of the minor fields.
6. Informal courses (Graduate Independent Study, Graduate Seminar, and Special Topics) cannot be applied to the ECE major, ECE minor (primary minor) and the open minor (secondary minor) fields.
7. At the time of admission or no later than the first semester, the Ph. D. 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 Ph. D. program.
8. All regular (full graduate standing) status graduate students must select a faculty advisor in their first semester.
9. Students on academic probation may be transferred to the M. S. E. Program depending on the student's academic record. In such a case, the M. S. E. Program requirements must be satisfied. For example, only 6 credits of the informal courses may be applied to the M. S. E. degree program with the further constraint that up to 3 credits total of Independent Study in combination with Graduate Seminar may be in the 6 credits.
10. Maintain a minimum overall grade point average (GPA) of 3. 20, must maintain a minimum GPA of 3. 20 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**~~ **may** be placed on academic probation or expelled from the program. The Electrical and Computer Engineering Graduate Committee and/or the Graduate College will determine the

terms of the student's probation in accordance with the rules of the Graduate College.

11. All regular status graduate students must file an approved ~~**program**~~ **Plan of Study form** before the completion of their third semester. This program must be approved by the student's advisor and the graduate coordinator. All regular and provisional status graduate students must show satisfactory progress towards completion of their degree by completing at least six credits of their approved program per calendar year. If their progress towards their degree program is not satisfactory, students ~~**will**~~ **may** either be put on probation or expelled from the program.
12. Before beginning a dissertation, students must have their dissertation topic approved by their advisor, and 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.

Graduation Requirements

See Plan Graduation Requirements below.

Subplan 3 Requirements: Post-Bachelor's Integrated BS-PHD

Total Credits Required: 60-66

Course Requirements

Major Field Courses – Credits: 6-15

Complete 6-15 credits of **advisor approved** coursework in an ~~**approved**~~ **single** major ~~**in a single**~~ area in Electrical and Computer Engineering **(suggested courses below),** with a minimum overall GPA of 3. 33.

Communications

ECG 662 Digital Communication Systems	3
ECG 666 Wireless and Mobile Communication Systems	3
ECG 704 Coding with Applications in Computers and Communication Media	3

ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 763 Advanced Digital Communication Systems	3

Computer Engineering

ECG 600 Computer Communication Networks	3
ECG 603 Embedded Systems Design	**3**
ECG 604 Modern Processor Architecture	3
ECG 605 Data Compression Systems	3
ECG 607 Biometrics	3
ECG 608 Digital Design Verification and Testing	3
ECG 609 Embedded Digital Signal Processing	3
ECG 617 Internet of Things Systems	3
ECG 700 Advanced Computer System Architecture	3
ECG 701 Reliable Design of Digital Systems	3
ECG 702 Interconnection Networks for Parallel Processing Applications	3
ECG 703 Machine Learning and Applications	**3**
ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 707 Logic Synthesis Engineering	3
ECG 709 Synthesis and Optimization of Digital Systems	3

Control Systems Theory

ECG 672 Digital Control Systems	3
ECG 770 Linear Systems	3
ECG 771 Optimal and Modern Control	3
ECG 772 Nonlinear Systems	3
ECG 774 Stochastic Control	3
ECG 776 Adaptive Control	3

Electromagnetics and Optics

ECG 630 Transmission Lines	3
ECG 631 Engineering Optics	3
ECG 632 Antenna Engineering	3

ECG 633 Active and Passive Microwave Engineering	3
ECG 730 Advanced Engineering Electromagnetics I	3
ECG 731 Theoretical Techniques in Electromagnetics	3
ECG 732 Advanced Engineering Electromagnetics II	3
ECG 733 Plasma I	3

Electronics

ECG 620 Analog Integrated Circuit Design	3
ECG 621 Digital Integrated Circuit Design	3
ECG 720 Advanced Analog IC Design	3
ECG 721 Memory Circuit Design	3
ECG 722 Mixed-Signal Circuit Design	3

Power Engineering

ECG 642 Power Electronics	3
ECG 646 Photovoltaic Devices and Systems	3
ECG 740 Computer Analysis Methods for Power Systems	3
ECG 741 Electric Power Distribution System Engineering	3
ECG 742 Power System Stability and Control	3
ECG 743 Smart Electrical Power Grid	3

Signal Processing

ECG 680 Discrete-Time Signal Processing	3
ECG 682 Introduction to Biomedical Signals and Systems	**3**
ECG 703 Machine Learning and Applications	**3**
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 781 Digital Filters	3
ECG 782 Multidimensional Digital Signal Processing	3
ECG 783 Adaptive Signal Processing with Neural Networks	3

Solid State Electronics **and Photonics**

[Before] ECG - 614 - Quantum Communication	3

ECG 651 Electronic and Magnetic Materials and Devices	3
ECG 652 Optoelectronics	3
ECG 653 Introduction to Nanotechnology	3
[After] ECG - 712 - Optical Materials and Devices	3
[After] ECG - 715 - Biomedical Photonics	3
[After] ECG - 716 - Space Systems	3
ECG 750 Photonics	3
ECG 752 Physical Electronics	3
ECG 753 Advanced Topics in Semiconductor Devices I	3
ECG 755 Monolithic Integrated Circuit Fabrication	3
ECG 756 Advanced Topics in Semiconductor Devices II	3
ECG 757 Electron Transport Phenomena in Solid State Devices	3
ECG 758 Numerical Methods in Engineering	3

Minor Fields Courses – Credits: 9-18

Select two advisor-approved minor fields and complete coursework **(suggested courses below)** in each single area totaling 9-18 credits, with a minimum overall average GPA of 3. 33. The secondary minor can be from a field outside Electrical Engineering.

Communications

ECG 662 Digital Communication Systems	3
ECG 666 Wireless and Mobile Communication Systems	3
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3

Computer Engineering

ECG 600 Computer Communication Networks	3
ECG 603 Embedded Systems Design	**3**
ECG 604 Modern Processor Architecture	3
ECG 605 Data Compression Systems	3
ECG 607 Biometrics	3
ECG 608 Digital Design Verification and Testing	3
ECG 609 Embedded Digital Signal Processing	3
ECG 617 Internet of Things Systems	3
ECG 700 Advanced Computer System Architecture	3
ECG 701 Reliable Design of Digital Systems	3

ECG 702 Interconnection Networks for Parallel Processing Applications	3
ECG 703 Machine Learning and Applications	**3**
ECG 704 Coding with Applications in Computers and Communication Media	3
ECG 706 Analysis of Telecommunication and Data Networks	3
ECG 707 Logic Synthesis Engineering	3
ECG 709 Synthesis and Optimization of Digital Systems	3

Control Systems Theory

ECG 770 Linear Systems	3
ECG 771 Optimal and Modern Control	3
ECG 772 Nonlinear Systems	3
ECG 774 Stochastic Control	3
ECG 776 Adaptive Control	3

Electromagnetics and Optics

ECG 630 Transmission Lines	3
ECG 631 Engineering Optics	3
ECG 632 Antenna Engineering	3
ECG 633 Active and Passive Microwave Engineering	3
ECG 730 Advanced Engineering Electromagnetics I	3
ECG 731 Theoretical Techniques in Electromagnetics	3
ECG 732 Advanced Engineering Electromagnetics II	3
ECG 733 Plasma I	3

Electronics

ECG 620 Analog Integrated Circuit Design	3
ECG 621 Digital Integrated Circuit Design	3
ECG 720 Advanced Analog IC Design	3
ECG 721 Memory Circuit Design	3
ECG 722 Mixed-Signal Circuit Design	3

Power Engineering

ECG 642 Power Electronics	3
ECG 646 Photovoltaic Devices and Systems	3
ECG 740 Computer Analysis Methods for Power Systems	3

ECG 741 Electric Power Distribution System Engineering	3
ECG 742 Power System Stability and Control	3
ECG 743 Smart Electrical Power Grid	3

Signal Processing

ECG 680 Discrete-Time Signal Processing	3
ECG 682 Introduction to Biomedical Signals and Systems	**3**
ECG 703 Machine Learning and Applications	**3**
ECG 760 Random Processes in Engineering Problems	3
ECG 762 Detection and Estimation of Signals in Noise	3
ECG 781 Digital Filters	3
ECG 782 Multidimensional Digital Signal Processing	3
ECG 783 Adaptive Signal Processing with Neural Networks	3

Solid State Electronics **and Photonics**

[Before] ECG - 614 - Quantum Communication	3
ECG 651 Electronic and Magnetic Materials and Devices	3
ECG 652 Optoelectronics	3
ECG 653 Introduction to Nanotechnology	3
[After] ECG - 712 - Optical Materials and Devices	3
[After] ECG - 715 - Biomedical Photonics	3
[After] ECG - 716 - Space Systems	3
ECG 750 Photonics	3
ECG 752 Physical Electronics	3
ECG 753 Advanced Topics in Semiconductor Devices I	3
ECG 755 Monolithic Integrated Circuit Fabrication	3
ECG 756 Advanced Topics in Semiconductor Devices II	3
ECG 757 Electron Transport Phenomena in Solid State Devices	3
ECG 758 Numerical Methods in Engineering	3

Elective Courses – Credits: 9-18

Complete 9-18 credits of 600- or 700-level MAT, PHY, AST, CEE, CEM, ECG, EGG, CS, ME, or other advisor-approved courses.

Dissertation – Credits: 18

ECG 799 Dissertation	1 – 6

Degree Requirements

1. All Ph. D. students must satisfy the Ph. D. degree program admission requirements and be admitted to the Ph. D. program on a regular status.
2. Total credits required depends on the total number of approved graduate-level course work taken as technical electives (with a grade of B or better) during the senior year.
3. Complete a minimum of 60, 63, or 66 credits (including dissertation credits) respectively corresponding to 9, 6, or 3 credits of formally approved graduate level courses applied toward the B. S. degree yielding a total of 69 course credits. The final division of major, minor, and elective credits will be determined in consultation with the student's advisor.
4. Of the 51 required credits, a minimum of 33 credits must be in 700-level courses. Of these 33 credits, a minimum of 30 must be from formal courses. The student's doctoral advisory committee may add more requirements in accordance with the individual's background and field of study.
5. No more than 6 credits may be from Graduate Independent Study together with Graduate Seminar. No more than 12 credits of a combination of informal courses such as Graduate Independent Study, Special Topics, and Seminar may be applied to the degree program.
6. Complete a minimum of 15 credits in an approved ECE major field, 9 credits an approved ECE minor (primary minor) field, and 9 credits in a second approved open 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 obtained in the major field. 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 obtained in each of the minor fields.
7. Informal courses (Graduate Independent Study, Graduate Seminar, and Special Topics) cannot be applied to the ECE major, ECE minor (primary minor) and the open minor (secondary minor) fields.
8. All regular (full graduate standing) status graduate students must select a faculty advisor in their first semester.
9. Students on academic probation may be transferred to the M. S. E. Program depending on the student's academic record. In such a case, the M. S. E. Program requirements must be satisfied. For example, only 6 credits of the informal courses may be applied to the M. S. E. degree program with the further constraint that up to 3 credits total of Independent Study in combination with Graduate Seminar may be in the 6 credits.
10. Maintain a minimum overall grade point average (GPA) of 3. 20, must maintain a minimum GPA of 3. 20 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. 20, who do not maintain a GPA of 3. 20

each semester, or who earn more than one grade below B- ~~**will**~~ **may** either be placed on probation or expelled from the program. The Electrical and Computer Engineering Graduate Committee and/or the Graduate College will determine the terms of the student's probation in accordance with the rules of the Graduate College.

11. All regular status graduate students must file an approved ~~**program**~~ **Plan of Study form** before the completion of their third semester. This program must be approved by the student's advisor and the graduate coordinator. All regular and provisional status graduate students must show satisfactory progress towards completion of their degree by completing at least six credits of their approved program per calendar year. If their progress towards their degree program is not satisfactory, students ~~**will**~~ **may** either be put on probation or expelled from the program.
12. Before beginning a dissertation, students must have their dissertation topic approved by their advisor, and 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.

Graduation Requirements

See Plan Graduation Requirements below.

Plan Graduation Requirements

During the first semester, a Ph. D. 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 the faculty must be from the Department of Electrical and Computer Engineering. The fourth from a relevant supporting field having Full Graduate Faculty Status as recognized by the Graduate College.

Students admitted on provisional and/or conditional status are not allowed to take the qualifying exam until their provisions and/or conditions have been met. 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 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.

Pass the Qualifying Exam within 2 semesters of being admitted to the Ph. D. program on a regular (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 tests the student's general undergraduate knowledge of electrical engineering and computer engineering. 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 to the Ph. D. program on a regular status. If a student is required to take the qualifying exam and is not present to sit the exam, an automatic FAIL is assigned. 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 by 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 M. S. Degree by completing all of the requirements listed for that degree.

The Qualifying Exam is a four and one-half hour exam covering questions in the following undergraduate electrical and computer engineering fields:

Communications

Control System Theory

Electromagnetics and Optics

Electronics

Power

Signal Processing

Solid State

Digital Logic Design

Computer Architectures ~~and Organization~~

~~Digital Electronics and VLSI Design~~ **Embedded Systems**

Computer Communication Networks

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.

For more details on course specifics, exam logistics, appeal rights and procedure, and protocols regarding the qualifying exam, refer to the ECE department's Electrical Engineering Graduate Program Document.

In all Post-Bachelor's subplans, 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 in an approved ECE minor field (primary minor) in a single but different area of Electrical and Computer Engineering, and another 9 credits in a second approved minor (secondary minor) field. Currently, the Department of Electrical and Computer Engineering at UNLV offers Communications, Computer Engineering, Control System Theory, Electromagnetics and Optics, Electronics, Power Systems, Signal Processing, and Solid State ~~Materials~~ **Electronics** and ~~Devices~~ **Photonics** as major fields. Specific courses that can be applied to specific fields are listed in detail in the Electrical Engineering Graduate Program Document.

Of the 15 credits required 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 applied 15 credits of ECE major course work must attain a minimum overall GPA of 3. 33 (B+=3. 30).

Each student must complete two minor fields. To complete a minor field, a 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 must be in 700-level courses. Courses that can be applied to specific minor fields are listed in detail in the Electrical Engineering Graduate Program Document. 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. A mixed minor field may be formed with courses inside and/or outside of the Electrical Engineering Department's approved fields (e. g., mathematics and physics, computer engineering and computer science, physics, mechanical engineering, solid state and electromagnetics) A mixed minor may not be composed of courses in the Electrical Eng ineering Department that satisfy course work in the major and the other minor field. The only exception is when a course may be used in more than one field. In this case, the course may not be counted twice but may be used for either minor area. However, the student must complete at least one minor field (primary minor field) in Electrical Engineering in a single area.

After successfully completing all required course work, 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 evaluates the caliber of a student's dissertation topic. The Preliminary Exam cannot be taken more than once per semester but may be repeated until passed.

To be eligible for the Preliminary Exam, a student must have successfully completed all required course work except for the 18 credits of Dissertation.

Before the Preliminary Exam, a student must prepare a 10 to 20-page prospectus of their 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 presents their prospectus to their advisory committee. To pass the Preliminary Exam, the student's advisory committee must unanimously approve the student's prospectus. Students who pass the Preliminary Exam are advanced to candidacy for the Ph. D.

Complete a minimum of 18 credits of Dissertation and complete a dissertation containing original research. Upon completion, the student must pass the Final Exam in which the student defends their dissertation. The Final Exam is the culminating experience of the PhD program.

The Final Exam evaluates the Ph. D. candidate's dissertation. The Final Exam cannot be taken more than once per every three months but may be repeated until passed. 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 Dissertation. A minimum of 12 credits of 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 their advisory committee of the date, time, and location of their Final Exam at least two weeks prior to the Final Exam. During the Final Exam, the Ph. D. candidate will present their dissertation to their advisory committee. To pass the Final Exam, the Ph. D. candidate's advisory committee must unanimously approve the Ph. D. candidate's dissertation.

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. Further, courses taken more than six years prior to graduation cannot be applied toward the PhD degree without

permission from the Graduate College. 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 and apply coursework towards the degree program. The formal letter must explain the circumstances of why the degree was not completed within the allotted time frame and indicate the extended period of time needed to complete the degree.

The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing their degree requirements.

The student must submit and successfully defend their dissertation by the posted deadline. The defense must be advertised and is open to the public.

After the dissertation defense, the student must electronically submit a properly formatted pdf copy of their dissertation to the Graduate College for format check. Once the dissertation format has been approved by the Graduate College, the student will submit the approved electronic version to ProQuest. Deadlines for dissertation defenses, format check submissions, and the final ProQuest submission can be found here.

New Core