



College of Engineering

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Date: 17 September 2010

To: Randy Smith
Vice Provost, Office of Academic Affairs

From: Ed McCaul 
Secretary College of Engineering Committee on Academy Affairs (CCAA)

Subject: Semester Conversion Proposals for the AP, MS, and PhD Degrees in
Electrical and Computer Engineering

Attached are letters from, Robert Lee, Department Chair of Electrical and Computer Engineering, as well as semester conversion proposals for the AP, MS, PhD degrees in Electrical and Computer Engineering.

These proposals were reviewed by a subcommittee of CCAA. After reviewing the proposals and having some changes made to them the subcommittee recommended to the full committee that they be approved. After a discussion, CCAA unanimously approved the proposals on the 16th of September 2010 and requested that I forward the proposals to you for consideration by CAA. If you have any questions concerning these proposals please let me know.



Department of Electrical and Computer Engineering

205 Drees Laboratories
2015 Neil Avenue
Columbus, OH 43210-1272

Phone (614) 292-2572
Fax (614) 292-7596

To: Office of Academic Affairs

From: Robert Lee, ECE Department Chair

Date: 8 September 2010

Re: Semesters Program Proposals for the BS, MS, PhD and Combined BS/MS in Electrical and Computer Engineering and the Advanced Professional Degree in Electrical Engineering

The faculty of the Department of Electrical and Computer Engineering have prepared each of the semesters conversion proposals following the processes described therein. The faculty have voted to approve these proposals as our semester plans for the BS, MS, and PhD in Electrical and Computer Engineering and for conversion of the Electrical Engineering Advanced Professional Degree to semesters, and I recommend approval.

The faculty vote was conducted using electronic ballots, with a quorum of 24 needed. The outcome of the faculty vote was:

	BS	MS & PhD	Adv. Prof. Degree
Yes	34	32	28
No	0	0	0
Abstained	0	0	1

The ECE Department currently administers the following academic programs.

- PhD in Electrical and Computer Engineering
- MS in Electrical and Computer Engineering
- Electrical Engineering Advanced Professional Degree (**attached here**)
- BS in Electrical and Computer Engineering
- Combined BS/MS in Electrical and Computer Engineering

None of the academic programs is being withdrawn, however we request that the Electrical Engineering Advanced Professional Degree be marked as inactive following conversion to semesters until such time as we re-evaluate how it may be best used and submit a new proposal for revising it.

Robert Lee, ECE Department Chair

PROGRAM PROPOSAL

1. *Electrical and Computer Engineering Advanced Professional Degree*

Current name “Electrical Engineering Advanced Professional Degree”

2. *Electrical and Computer Engineer*

Current name: Electrical Engineer

3. *Academic unit:*

Department of Electrical and Computer Engineering

4. *Type of program:*

Professional degree program.

5. *Semester conversion designation:*

Converted with minimal changes to program goals and curricular requirements.

6. *Program learning goals:*

Students receive advanced training beyond the baccalaureate degree.

Experienced practicing engineers receive advanced training.

Graduates of other engineering disciplines are prepared for a change in career to electrical and computer engineering.

Interdisciplinary students are trained in electrical and computer engineering.

7. *Semester courses*

Students must complete 30 credit hours of courses approved by the student’s advisor and the department’s Graduate Studies Committee. All courses must be at course levels 5000 and above. A minimum of 24 credits must be in Electrical and Computer Engineering. At least 6 credits must be from the list of ECE Advanced Courses. Up to six credits may be outside ECE. At least 24 credits must be letter-graded; any independent study pass/fail courses must be in ECE. An overall GPA of 2.5 is required for the degree.

8. *Advising sheet (appended)*

9. *Curriculum Map*

Not applicable

10. Rationale for proposed program changes

The Department of Electrical and Computer Engineering has had the Advanced Professional Degree program, but has not used it in many years. While we do not anticipate using it again in the near future, we are proposing it here to have it on the books, so that we may make the program active later if we so choose.

The previous program only specified the number of hours to the degree (45 quarter hours, translated here to 30 semester hours). The following items were added in the new proposal:

- 1) All courses must be at course levels 5000 and above.

Rationale: standard for a graduate program.

- 2) A minimum of 24 credits must be in Electrical and Computer Engineering.

Rationale: To ensure the student's focus is Electrical and Computer Engineering; that is, they may not take a wide range of courses not in ECE to obtain the Electrical and Computer Engineer degree.

- 3) At least 6 credits must be from the list of ECE Advanced Courses.

Rationale: To ensure technical depth. This is the same as we require for the Master's degree.

- 4) Up to six credits may be outside ECE.

Rationale: To ensure focus in ECE but allow some breadth for interdisciplinary students.

- 5) At least 24 credits must be letter-graded; any independent study or S/U courses must be in ECE.

Rationale: To ensure rigor, letter-graded courses are required. The S/U option is included to allow students to do independent study projects or research, but require it to be in ECE.

- 6) An overall GPA of 2.5 is required for the degree.

Rationale: Quality control.

11. Check for Credit hour changes

Program credit hour requirements:	A) Number of credit hours in current program (Quarter hour credits)	B) Calculated result for 2/3rds of current quarter credit hours	c) Number of credit hours required for proposed program (semester credit hours)
Total credit hours required for completion of program	45	30	30
Prerequisite credit hours required for admission to program that are not counted toward total hours	N/A	N/A	N/A
Required credit hours offered by the unit	45	30	24-30
Required credit hours offered outside the unit	0	0	0-6

12. Rationale for change in credit hours if the difference is more than 4 semester credits hours between the values listed in Columns B and C for a row in the table above.

See Section 10

13. Transition policy

As the advanced professional degree has not been active for some years, we do not anticipate any students transitioning to semester during their program. If it should happen, however, a simple quarter-to-semester credit calculation can be used.

14. Assessment conversion

Not applicable.

15. Assessment plan

Not applicable.



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- MS in Electrical and Computer Engineering (**attached here**)
- Electrical Engineering Advanced Professional Degree
- BS in Electrical and Computer Engineering
- Combined BS/MS in Electrical and Computer Engineering

None of the academic programs is being withdrawn, however we request that the Electrical Engineering Advanced Professional Degree be marked as inactive following conversion to semesters until such time as we re-evaluate how it may be best used and submit a new proposal for revising it.


Robert Lee, ECE Department Chair

M.S. in Electrical and Computer Engineering Program

Primary contact: Fusun Ozguner (ozguner.2, 292-2768)

1. Name of Program

Electrical and Computer Engineering

2. Name of Degree

Master of Science in Electrical and Computer Engineering

3. Responsible Academic Unit

Department of Electrical and Computer Engineering (ECE)

4. Type of Program

d. Graduate Master of Science degree program

5. Semester Conversion Designation

b. Converted with minimal changes to program goals and/or curricular requirements.

6. Program Learning Goals

Not required of graduate programs.

7. M.S. in ECE Proposed Program Requirements

The M.S. degree is offered in Electrical and Computer Engineering with two options: Thesis and Non-thesis. A minimum of 30 Graduate credit hours is required to earn a master's degree. Proposed program requirements for both tracks are outlined in Attachment #3. Since there are no specific courses that are required and students take the number of hours specified in each of the categories (ECE courses, advanced ECE courses, approved outside electives, individual studies and thesis research) to meet M.S. degree requirements, Attachment #1 lists all proposed ECE graduate courses.

8. Current and Proposed Advising Sheets

See Attachment #2 for Current M.S. Advising Sheets and Attachment # 3 for Proposed M.S. Advising Sheets

9. Curriculum Map

Not required of graduate programs.

10. Rationale for Program Changes and Description of Changes

ECE graduate programs underwent a major revision in 2007. In the current program, graduate students need to take a required number of hours of ECE courses and advanced

MS in ECE Program Proposal – 9/8/2010

ECE courses, approved outside electives, individual studies and thesis research to meet M.S. degree requirements. Since we had recently revised the graduate program, we did not make any changes in the requirements and mostly adapted the number of hours in each category for the semester system.

11. Credit Hour Changes

Program credit hour requirements:	A)Number of credit hours in current program <i>(quarter credit hours)</i>	B)Calculated result for 2/3rds of current quarter credit hours	C) Number of credit hours required for proposed program
Total credit hours required for completion of program	45	30	30
Prerequisite credit hours required for admission to program which are not counted toward total hours	N/A	N/A	N/A
Required credit hours offered by unit	18-45	12-30	12-30
Required credit hours offered outside unit	0-27	0-18	0-18

12. Rationale for Significant Change in Credit Hours

Not applicable

13. Transition Policy

No ECE M.S. or Ph. D. student who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters.

Since the ECE graduate program was revised in 2007, the semester conversion for both degrees was mainly an adaptation of the requirements in the quarter system. In the current M.S. program, graduate students need to take a required number of hours of ECE courses, advanced ECE courses, approved outside electives, individual studies and M.S.

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thesis research to meet degree requirements. Since our graduate programs are very flexible and we offer a wide choice of courses to choose from, these requirements can easily be met by a combination of quarter and semester courses. During the transition, quarter based courses taken by the student will be calculated in terms of semester requirements (with a factor of 2/3 conversion for credit hours). Any prerequisite issues arising during the transition will be handled on a case-by-case basis. Advising support will be provided to M.S. students to assist them in planning their course schedules before and after the transition to semesters. If it is determined that the standard ECE transition plans would result in a particular student facing an unavoidable delay in graduation due to the change to semesters – *rather than the student's failure to meet with an advisor to complete the transition worksheet or to make satisfactory progress through the mutually agreed program plan* – then arrangements will be worked out for that student by the advising staff with the approval of the ECE Graduate Studies Committee.

Robert Lee, ECE Department Chair

14. Assessment Practices

Not required of graduate programs.

15. Assessment Plan on File with OAA

Not required of graduate programs.

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Attachment #1: ECE Graduate Courses

Course Number	Course Title	Credit Hours
5000	Introduction to Analog and Digital Communications	3.0
5010	Wireless Propagation and Radar	3.0
5011	Antennas	3.0
5012	Integrated Optics	3.0
5017	Microwave Engineering	4.0
5020	Mixed Signal VLSI	3.0
5021	Analog Integrated Circuits	3.0
5022	Radio frequency integrated circuits	3.0
5025	Power Electronics Devices, Circuits, and Applications	3.0
5027	Microwave Electronics	4.0
5031	Semiconductor Process Technology	3.0
5033	Surfaces and Interfaces of Electronic Materials	3.0
5037	Solid State Microelectronics Laboratory	4.0
5041	Electric Machines	3.0
5042	Power Systems	3.0
5047	High Voltage Engineering and Laboratory	3.0
5101	Introduction to Wireless Networking	3.0
5120	Introduction to Integrated Circuits Test and Measurement	3.0
5127	Power Electronics Lab	1.0
5131	Lasers	3.0
5132	Photonics	3.0
5137	Photonics Lab	0.5
5194.01 to .25	Group Studies in Electrical and Computer Engineering	0.0 - 6.0
5200	Introduction to Digital Signal Processing	3.0
5206.01	Medical Imaging and Processing	3.0
5206.02	Medical Imaging and Processing	3.0
5237	Photovoltaics Laboratory	3.0
5362	Computer architecture and design	3.0
5400	Instrumentation, signals, and control in transportation applications	3.0
5460	Image Processing	3.0
5462	HDL Design and Verification	3.0
5463	Introduction to Real Time Robotics Systems	3.0
5465	Advanced Microcomputers	3.0
5468	Firmware Development for Embedded Systems	3.0
5510	Introduction to Computational Electromagnetics	3.0
5511	Nonlinear Optics	3.0

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Course Number	Course Title	Credit Hours
5530	Fundamentals of Semiconductors for Microelectronics and Photonics	3.0
5531	Fundamentals of Semiconductor Devices	3.0
5532	Nanofabrication and Nanoscale Devices	3.0
5541	Sustainable Energy and Power Systems II	3.0
5551	State-Space Control Systems	3.0
5553.01	Powertrain Control Systems	3.0
5553.02	Autonomy in Vehicles	3.0
5557	Control System Implementation Laboratory	1.0
5750	Linear Systems Theory	3.0
5754	Nonlinear Systems Theory	3.0
5759	Optimization for Static and Dynamic Systems	3.0
6001	Probability and Random Variables	3.0
6010	Electromagnetic Field Theory I	3.0
6101	Computer Communication Networks	3.0
6102	Wireless Networks	3.0
6193	Individual Studies in Electrical and Computer Engineering	0.0 - 12.0
6194.01 to .25	Group Studies in Electrical and Computer Engineering	0.0 - 6.0
6200	Signal Processing	3.0
6202	Stochastic Signal Processing	3.0
6999	Research for Thesis	0.5 - 15.0
7001	Stochastic Processes, Detection, and Estimation	3.0
7003	Wireless Communication Theory	3.0
7005	Information Theory	3.0
7010	Electromagnetic Field Theory II	3.0
7011	Computational Electromagnetics	3.0
7019.01	Electromagnetic Interference and Compatibility	3.0
7019.02	Electromagnetic Guided Waves	3.0
7019.03	Advanced Antenna Theory and Design	3.0
7019.04	Microwave Remote Sensing	3.0
7021	Analog VLSI Design	3.0
7022	Advanced RF Integrated Circuits	3.0
7041.01	Advanced Topics in Power Electronics	3.0
7041.03	Advanced Topics in Power Systems	3.0
7100	Network Optimization and Algorithms	3.0
7103	Discrete Stochastic Processes	3.0
7831	Microwave Semiconductor Devices	3.0
7832	Advanced Photovoltaics	3.0
7833	Organic Conducting Devices	3.0

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Course Number	Course Title	Credit Hours
7854	Nonlinear and Adaptive Control	3.0
7855	Large Scale and Cyber-Physical Systems	3.0
7858	Intelligent Control	3.0
7859	Sliding mode control in electromechanical systems	3.0
7861	Scientific Computing on Emerging Architectures	3.0
7864	Advanced Computer Design	3.0
7866	Computer Vision and Multisensor Integration	3.0
7868	Pattern Recognition and Machine Learning	3.0
7920.01	Mixed Signal Verification and CAD tools	3.0
7920.02	Advanced Nonlinear Microwave Circuit Engineering	3.0
8001	Advanced Topics in Communications	3.0
8019	Advanced Topics in Electromagnetics and Optics	3.0
8060.01	Special Topic on Computational Modeling	3.0
8060.02	Special topics in Advanced Computer Design Methodologies	3.0
8101	Advanced Topics in Networking	3.0
8193	Individual Studies in Electrical and Computer Engineering	0.0 - 12.0
8194.01 to .25	Group Studies in Electrical and Computer Engineering	0.0 - 6.0
8201	Advanced Topics in Signal Processing	3.0
8881.01	Interdisciplinary Seminar On Biomedical Images	0.0 - 3.0
8891	Seminar in Electrical and Computer Engineering	0.5 - 2.0
8898	Open Graduate Seminar	0.5 - 3.0
8998.01	Graduate Research in Electrical and Computer Engineering	0.5 - 3.0
8998.02	Graduate Research in Electrical and Computer Engineering	0.5 - 3.0
8999	Research for Dissertation	0.5 - 15.0

Attachment #2: Current M.S. Advising Sheets

THE MASTER OF SCIENCE PROGRAM

The M.S. degree is offered in Electrical and Computer Engineering with two options: Thesis and Non-thesis. A minimum of 45 Graduate credit hours is required to earn a master's degree. Eighty (80) percent of those required credit hours must be completed at this university over a period of at least 2 quarters. A student must be registered for at least three (3) graduate credit hours the quarter in which graduation is expected.

Time Limit

The M.S. program (either option) has a 6 year time limit for completion.

Satisfactory Performance

The minimum grade average over all courses acceptable to the Graduate School is 3.0/4.0 and is the same minimum recognized by the department.

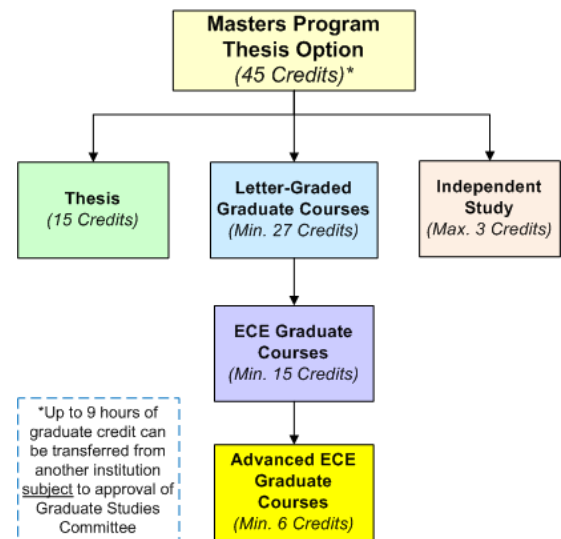
Requirement of 800-level Course for M.S. Degree

A requirement of the M.S. degree is that the student must take 6 credits of ECE graded courses that are at the 800-level or higher. For the purposes of this requirement, the following courses count as 800-level courses: ECE 724, ECE 741, ECE 744, ECE 764, ECE 767, and ECE 769. This list can be updated when requested by an area

Thesis Option

The thesis option requires at least 45 hours of graduate credit with an average grade of 3.0 or better and including:

1. No more than 9 hours of graduate credit transferred from another institution.
2. A satisfactory thesis represented by not less than 15 hours of ECE 999 credits.
3. At least 30 hours of graduate course work exclusive of thesis (ECE 999). Of these 30 hours:
 - a. At least 27 must be letter-graded (no S/U), of which
 - b. At least 15 must be ECE courses, of which
 - c. At least 6 must be from ECE courses 800 level or higher.



The thesis option also requires satisfactory performance on a 1-hour final oral examination (Master's Examination) with emphasis on the thesis investigation. The thesis approval and the oral examination are conducted by the student's M.S. committee, consisting of the advisor and at least one other faculty member

Non-thesis Option

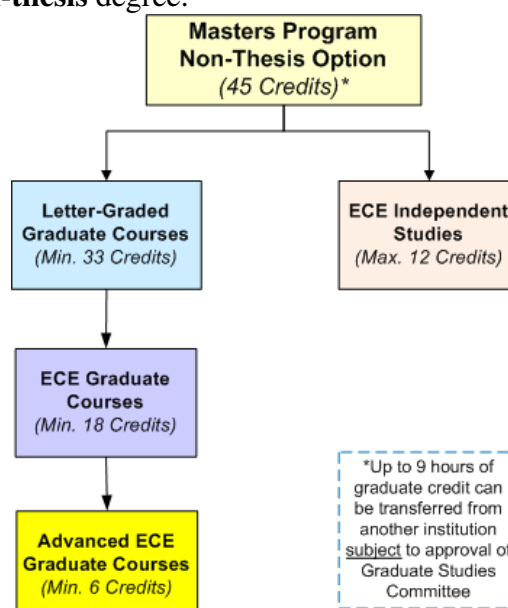
The Non-thesis option requires at least 45 hours of graduate credit with an average grade of 3.0 or better and including:

1. Not more than 9 hours of graduate credit transferred from another institution.
2. At least 45 hours of courses and of these 45 hours:
 - a. At least 33 must be letter-graded (no S/U), of which
 - b. At least 18 must be ECE courses, of which
 - c. At least 6 must be from ECE courses 800 level or higher.
 - d. For non-thesis students a limit of 12 hours of Individual Studies (ECE 793) credit is permitted.
3. ECE 881, ECE 888, ECE 891 and ECE 999 credit hours do not count toward the fulfillment of the 45 hours required for the **M.S. Non-thesis** degree.

The non-thesis option also requires satisfactory performance on the **M.S. Non-thesis** exam, which consists of a **take home written exam** based on the individual studies courses taken by the student, followed by a 1-hour **oral exam** given in the quarter the student files an application to graduate. An M.S. exam committee consisting of the advisor and one more faculty member administers both portions of the exam.

For the take home written exam, the student will be asked to read assigned papers, do a literature survey on a given topic and/or run simulations and write a report. The student will have two weeks to complete the written exam.

The **M.S. non-thesis** program is structured to allow its completion within **one-year (four quarters)**. An example of a possible course load sequence for completion in one-year is given in the Table below:



Quarter	Graduate Credit Hours		
	Letter-graded ECE courses	Letter-graded technical electives	Individual studies (ECE 793)
Fall	12		
Winter	9	3	
Spring	9		3
Summer			9

Dual Master's Degree Program

In certain circumstances graduate students in Electrical and Computer Engineering may wish to pursue a dual M.S. degree in conjunction with another department. The Graduate School provides a mechanism for such a plan of study, and the necessary form, the **Program Plan for Dual Degree Students**, is available there. The requirements set down by the Electrical and Computer Engineering Department over and above those of the Graduate School are as follows:

1. Two advisors, one from each department, must assist in the formulation and approve the student's dual degree plan, and the student-prepared dual degree proposal. At the time the plan is submitted for approval, no more than 50 percent of the total graduate hours included in the plan for either degree may have been completed.
2. If the two degrees are to be taken with thesis, a single thesis will suffice, but its topic must be interdisciplinary in nature and must have the approval and require the expertise of both advisors. In the Non-thesis option, the ECE Non-thesis M.S. Exam must be passed. The dual degree *cannot* be taken with thesis in one program and without thesis in the other; that would not constitute an integrated program.
3. Two readers (or secondary committee members if Non-thesis), one from each program, are required.
4. At least 30 hours of credit toward the dual degree must be exclusive to the ECE degree. This number must include at least 15 hours of letter-graded ECE courses. At least 6 of these 15 hours must be from courses at the 800 level or higher.

Attachment #3: Proposed M.S. Advising Sheets

THE MASTER OF SCIENCE PROGRAM

The M.S. degree is offered in Electrical and Computer Engineering with two options: Thesis and Non-thesis. A minimum of 30 Graduate credit hours is required to earn a master's degree. A student must be registered for at least three (3) graduate credit hours the semester in which graduation is expected.

Time Limit

The M.S. program (either option) has a 6 year time limit for completion.

Satisfactory Performance

The minimum grade average over all courses acceptable to the Graduate School is 3.0/4.0 and is the same minimum recognized by the department.

Requirement of Advanced ECE Courses for M.S. Degree

A requirement of the M.S. degree is that the student must take 6 credits of letter-graded advanced ECE courses, as defined by a list kept by the department. This list is periodically updated by the Graduate Studies Committee.

Thesis Option

The thesis option requires at least 30 hours of graduate credit with an average grade of 3.0 or better and including:

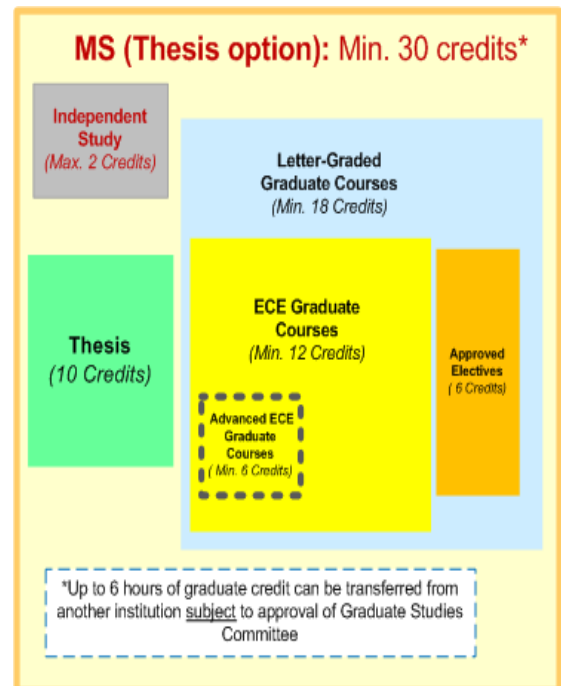
1. No more than 6 hours of graduate credit transferred from another institution.

2. A satisfactory thesis represented by not less than 10 hours of ECE 6999 credits.

3. At least 20 hours of graduate course work exclusive of thesis (ECE 6999). Of these 20 hours:

- At least 18 must be letter-graded (no S/U), of which
- At least 12 must be ECE courses, of which
- At least 6 must be from the list of advanced ECE courses.

The thesis option also requires satisfactory performance on a 1-hour final oral examination (Master's Examination) with emphasis on the thesis research. The thesis approval and the oral examination are conducted by the student's M.S. committee, consisting of the advisor and at least one other faculty member.



Non-thesis Option

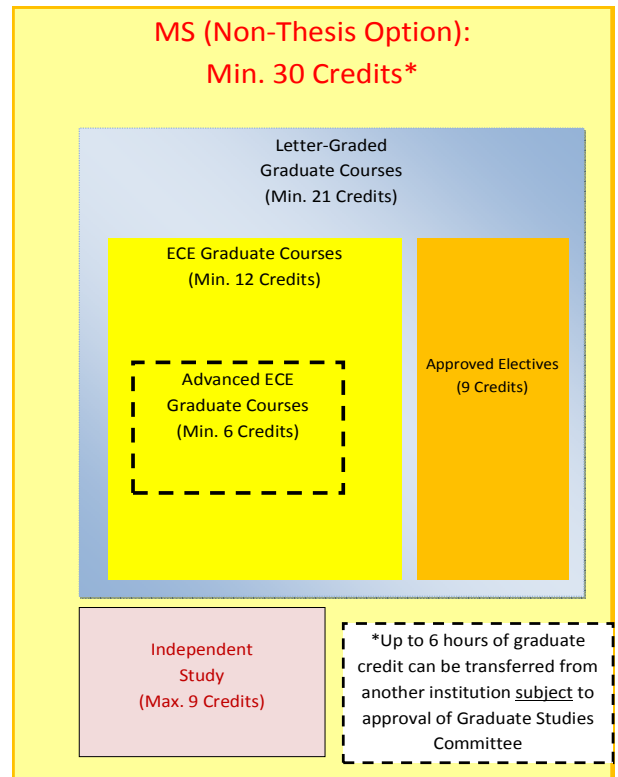
The Non-thesis option requires at least 30 hours of graduate credit with an average grade of 3.0 or better and including:

1. Not more than 6 hours of graduate credit transferred from another institution.
2. At least 30 hours of courses and of these 30 hours:
 - At least 21 must be letter-graded (no S/U), of which
 - At least 12 must be ECE courses, of which
 - At least 6 must be from the list of advanced ECE courses.
 - For non-thesis students a limit of 9 hours of Individual Studies (ECE 5193) credit is permitted.
3. ECE 8881, ECE 8898, ECE 8891 and ECE 6999 credit hours do not count toward the fulfillment of the 30 hours required for the **M.S. Non-thesis** degree.

The non-thesis option also requires satisfactory performance on the **M.S. Non-thesis** exam, which consists of a **take home written exam** based on the

individual studies courses taken by the student, followed by a 1-hour **oral exam**.

The **M.S. non-thesis** program is structured to allow its completion within **one year**.



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2. If the two degrees are to be taken with thesis, a single thesis will suffice, but its topic must be interdisciplinary in nature and must have the approval and require the expertise of both advisors. In the Non-thesis option, the ECE Non-thesis M.S. Exam must be passed. The

MS in ECE Program Proposal – 9/8/2010

dual degree *cannot* be taken with thesis in one program and without thesis in the other; that would not constitute an integrated program.

3. Two readers (or secondary committee members if Non-thesis), one from each program, are required.

4. At least 20 hours of credit toward the dual degree must be exclusive to the ECE degree. This number must include at least 12 hours of letter-graded ECE courses. At least 6 of these 12 hours must be advanced ECE courses.



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Robert Lee, ECE Department Chair

Ph. D. in Electrical and Computer Engineering Program

Primary contact: Fusun Ozguner (ozguner.2, 292-2768)

1. Name of Program

Electrical and Computer Engineering

2. Name of Degree

Ph. D. in Electrical and Computer Engineering

3. Responsible Academic Unit

Department of Electrical and Computer Engineering (ECE)

4. Type of Program

d. Graduate Ph. D. degree program

5. Semester Conversion Designation

b. Converted with minimal changes to program goals and/or curricular requirements.

6. Program Learning Goals

Not required of graduate programs.

7. Proposed Program Requirements

The Ph.D. degree is offered by the Electrical and Computer Engineering Graduate Program in all areas of specialization. There are two different tracks to pursue a Ph.D. degree:

- Direct Ph.D. from the B.S. degree
- Ph.D. after the M.S. degree

Proposed program requirements for both tracks are outlined in Attachment #3. Since there are no specific courses that are required and students take the number of hours specified in each of the categories (ECE courses, advanced ECE courses, approved outside electives, individual studies and dissertation research) to meet Ph.D. degree requirements, Attachment #1 lists all proposed ECE graduate courses.

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See Attachment #2 for Current Ph. D. Advising Sheets and Attachment # 3 for Proposed Ph. D. Advising Sheets.

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ECE graduate programs underwent a major revision in 2007. In the current program, graduate students need to take a required number of hours of ECE courses and advanced ECE courses, approved outside electives, individual studies and dissertation research to meet Ph.D. degree requirements. Since we had recently revised the graduate program, we did not make any changes in the requirements and mostly adapted the number of hours in each category for the semester system.

11. Credit Hour Changes

Program credit hour requirements:	A)Number of credit hours in current program <i>(quarter credit hours)</i>	B)Calculated result for 2/3rds of current quarter credit hours	C) Number of credit hours required for proposed program
Total credit hours required for completion of program	120	80	80
Prerequisite credit hours required for admission to program which are not counted toward total hours	N/A	N/A	N/A
Required credit hours offered by unit	108-120	72-80	71-80
Required credit hours offered outside unit	0-12	0-8	0-9

12. Rationale for Significant Change in Credit Hours

Not applicable

13. Transition Policy

No ECE M.S. or Ph. D. student who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters.

Since the ECE graduate program was revised in 2007, the semester conversion for both degrees was mainly an adaptation of the requirements in the quarter system. In the

ECE Ph. D. Program Proposal – 9/8/2010

current M.S. and Ph.D. programs, graduate students need to take a required number of hours of ECE courses, advanced ECE courses, approved outside electives, individual studies and M.S. thesis or Ph. D. dissertation research to meet degree requirements. Since our graduate programs are very flexible and we offer a wide choice of courses to choose from, these requirements can easily be met by a combination of quarter and semester courses. During the transition, quarter based courses taken by the student will be calculated in terms of semester requirements (with a factor of $2/3$ conversion for credit hours).

After passing the qualifying exam and before admission to regular status in the Ph. D. program, Ph.D. students submit a Plan of Study that lists all classes they will take and when they will take them. This Plan is approved by the student's advisor, a secondary area faculty member and the Graduate Studies Chair. For a Ph. D. student who began the degree program under quarters, this plan will have both quarter and semester courses converted as described above. Any prerequisite issues arising during the transition will be handled on a case-by-case basis. If it is determined that the standard ECE transition plans would result in a particular student facing an unavoidable delay in graduation due to the change to semesters – *rather than the student's failure to meet with an advisor to complete the transition worksheet or to make satisfactory progress through the mutually agreed program plan* – then arrangements will be worked out for that student by the advising staff and the ECE Graduate Studies Chair with the approval of the ECE Graduate Studies Committee.

Robert Lee, ECE Department Chair

14. Assessment Practices

Not required of graduate programs.

15. Assessment Plan on File with OAA

Not required of graduate programs.

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Attachment #1: ECE Graduate Courses

Course Number	Course Title	Credit Hours
5000	Introduction to Analog and Digital Communications	3.0
5010	Wireless Propagation and Radar	3.0
5011	Antennas	3.0
5012	Integrated Optics	3.0
5017	Microwave Engineering	4.0
5020	Mixed Signal VLSI	3.0
5021	Analog Integrated Circuits	3.0
5022	Radio frequency integrated circuits	3.0
5025	Power Electronics Devices, Circuits, and Applications	3.0
5027	Microwave Electronics	4.0
5031	Semiconductor Process Technology	3.0
5033	Surfaces and Interfaces of Electronic Materials	3.0
5037	Solid State Microelectronics Laboratory	4.0
5041	Electric Machines	3.0
5042	Power Systems	3.0
5047	High Voltage Engineering and Laboratory	3.0
5101	Introduction to Wireless Networking	3.0
5120	Introduction to Integrated Circuits Test and Measurement	3.0
5127	Power Electronics Lab	1.0
5131	Lasers	3.0
5132	Photonics	3.0
5137	Photonics Lab	0.5
5194.01 to .25	Group Studies in Electrical and Computer Engineering	0.0 - 6.0
5200	Introduction to Digital Signal Processing	3.0
5206.01	Medical Imaging and Processing	3.0
5206.02	Medical Imaging and Processing	3.0
5237	Photovoltaics Laboratory	3.0
5362	Computer architecture and design	3.0
5400	Instrumentation, signals, and control in transportation applications	3.0
5460	Image Processing	3.0
5462	HDL Design and Verification	3.0
5463	Introduction to Real Time Robotics Systems	3.0
5465	Advanced Microcomputers	3.0
5468	Firmware Development for Embedded Systems	3.0
5510	Introduction to Computational Electromagnetics	3.0
5511	Nonlinear Optics	3.0

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Course Number	Course Title	Credit Hours
5530	Fundamentals of Semiconductors for Microelectronics and Photonics	3.0
5531	Fundamentals of Semiconductor Devices	3.0
5532	Nanofabrication and Nanoscale Devices	3.0
5541	Sustainable Energy and Power Systems II	3.0
5551	State-Space Control Systems	3.0
5553.01	Powertrain Control Systems	3.0
5553.02	Autonomy in Vehicles	3.0
5557	Control System Implementation Laboratory	1.0
5750	Linear Systems Theory	3.0
5754	Nonlinear Systems Theory	3.0
5759	Optimization for Static and Dynamic Systems	3.0
6001	Probability and Random Variables	3.0
6010	Electromagnetic Field Theory I	3.0
6101	Computer Communication Networks	3.0
6102	Wireless Networks	3.0
6193	Individual Studies in Electrical and Computer Engineering	0.0 - 12.0
6194.01 to .25	Group Studies in Electrical and Computer Engineering	0.0 - 6.0
6200	Signal Processing	3.0
6202	Stochastic Signal Processing	3.0
6999	Research for Thesis	0.5 - 15.0
7001	Stochastic Processes, Detection, and Estimation	3.0
7003	Wireless Communication Theory	3.0
7005	Information Theory	3.0
7010	Electromagnetic Field Theory II	3.0
7011	Computational Electromagnetics	3.0
7019.01	Electromagnetic Interference and Compatibility	3.0
7019.02	Electromagnetic Guided Waves	3.0
7019.03	Advanced Antenna Theory and Design	3.0
7019.04	Microwave Remote Sensing	3.0
7021	Analog VLSI Design	3.0
7022	Advanced RF Integrated Circuits	3.0
7041.01	Advanced Topics in Power Electronics	3.0
7041.03	Advanced Topics in Power Systems	3.0
7100	Network Optimization and Algorithms	3.0
7103	Discrete Stochastic Processes	3.0
7831	Microwave Semiconductor Devices	3.0
7832	Advanced Photovoltaics	3.0
7833	Organic Conducting Devices	3.0

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Course Number	Course Title	Credit Hours
7854	Nonlinear and Adaptive Control	3.0
7855	Large Scale and Cyber-Physical Systems	3.0
7858	Intelligent Control	3.0
7859	Sliding mode control in electromechanical systems	3.0
7861	Scientific Computing on Emerging Architectures	3.0
7864	Advanced Computer Design	3.0
7866	Computer Vision and Multisensor Integration	3.0
7868	Pattern Recognition and Machine Learning	3.0
7920.01	Mixed Signal Verification and CAD tools	3.0
7920.02	Advanced Nonlinear Microwave Circuit Engineering	3.0
8001	Advanced Topics in Communications	3.0
8019	Advanced Topics in Electromagnetics and Optics	3.0
8060.01	Special Topic on Computational Modeling	3.0
8060.02	Special topics in Advanced Computer Design Methodologies	3.0
8101	Advanced Topics in Networking	3.0
8193	Individual Studies in Electrical and Computer Engineering	0.0 - 12.0
8194.01 to .25	Group Studies in Electrical and Computer Engineering	0.0 - 6.0
8201	Advanced Topics in Signal Processing	3.0
8881.01	Interdisciplinary Seminar On Biomedical Images	0.0 - 3.0
8891	Seminar in Electrical and Computer Engineering	0.5 - 2.0
8898	Open Graduate Seminar	0.5 - 3.0
8998.01	Graduate Research in Electrical and Computer Engineering	0.5 - 3.0
8998.02	Graduate Research in Electrical and Computer Engineering	0.5 - 3.0
8999	Research for Dissertation	0.5 - 15.0

Attachment #2: Ph.D. Current Advising Sheets

THE DOCTOR OF PHILOSOPHY PROGRAM

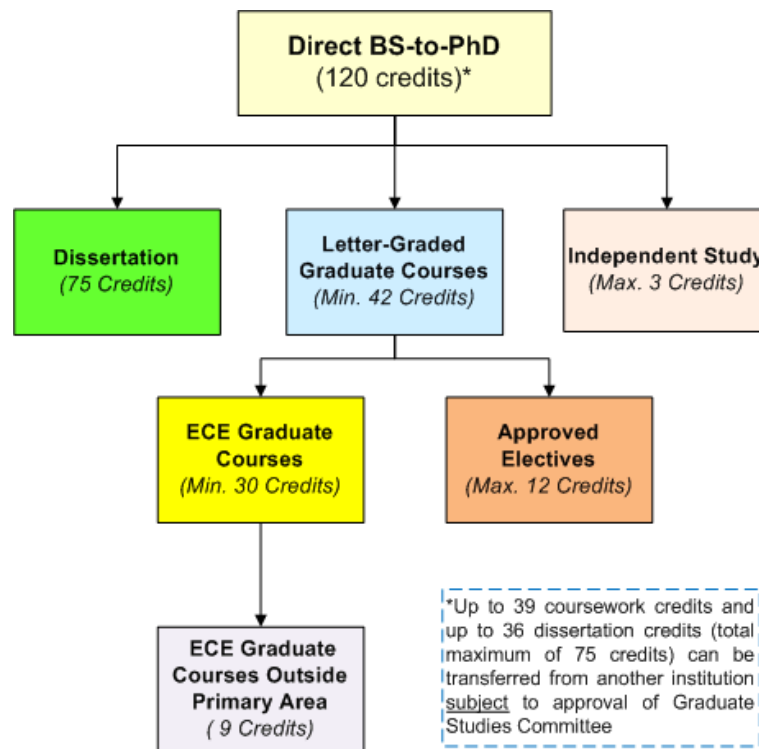
The ECE department offers two different tracks to pursue a Ph.D. degree

- Direct Ph.D. from BS degree
- Ph.D. after the M.S. degree

Summary Requirements for the Ph.D. Degree

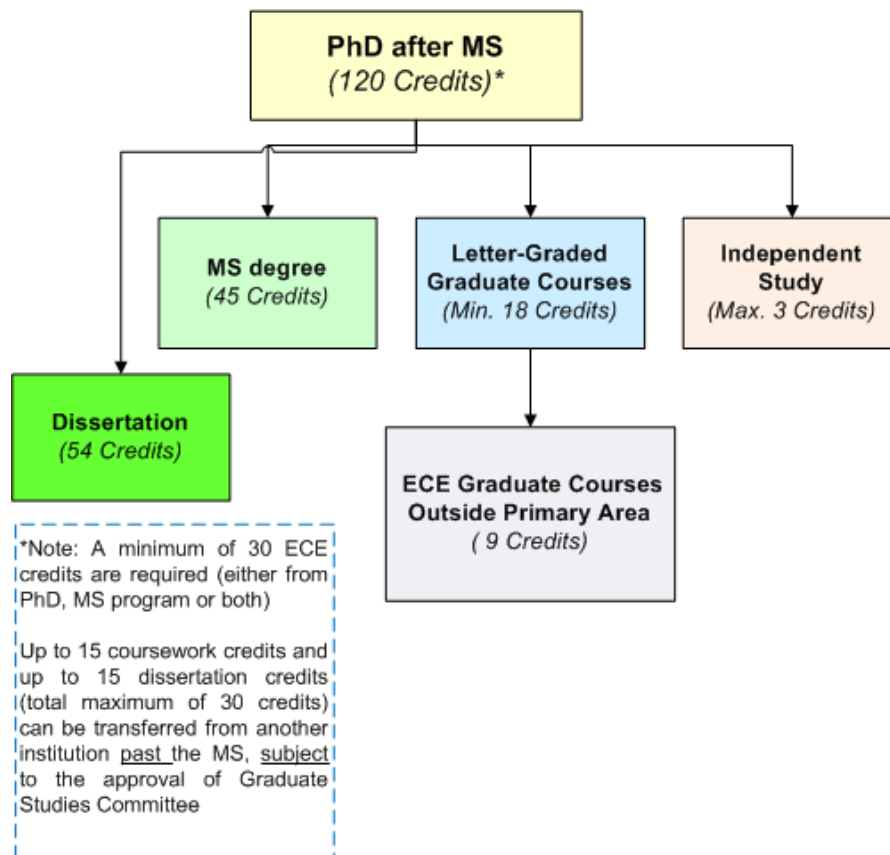
Direct Ph.D. degree from the BS:

1. At least 45 graduate credit hours of coursework beyond the Bachelor's degree of which 30 credits must be graded ECE courses and 15 credits must be approved electives. Of the 30 ECE graded course credits, 9 must be associated with an area of concentration outside the student's *primary area* of study (does not have to match the traditional areas in department). Of the 45 credits of coursework, 42 must be graded courses and 3 can be independent study. Up to 39 coursework credits and up to 36 dissertation credits (for a maximum total of 75 credits) from another institution can be transferred into the direct Ph.D. program, subject to the approval of the Graduate Studies Committee.
2. A dissertation embodying a significant original research contribution and counting 75 hours (ECE 999) toward the 120 hour requirement.



Ph.D. program from M.S. degree

1. M.S. degree counts for 45 credits
2. 21 credits of coursework of which 18 must be graded coursework and 3 credits can be independent study. All 21 credits of coursework must be approved electives. Up to 15 coursework credits and up to 15 dissertation credits (for a maximum total of 30 credits) from another institution can be transferred past the M.S., subject to the approval of the Graduate Studies Committee.
3. A dissertation embodying a significant original research contribution and counting 54 hours (ECE 999) toward the 120 hour requirement.
4. The student must have taken at least 30 quarter credits of letter graded ECE courses. These 30 credits can come from either the M.S. or Ph.D. program. The ECE courses from the M.S. program (non-OSU M.S.) must be approved by the Graduate Studies Chair as being equivalent to ECE courses at OSU. Nine (9) of the 30 ECE credits must be associated with an area of concentration outside the student’s *primary area of study* (does not have to match the traditional areas in department).
5. When a doctoral student has taken a master’s degree at this university and has earned graduate credit in excess of the minimum required for that degree, the student’s advisor, with the approval of the Graduate Studies Committee, notifies the Graduate School of the courses to be counted toward the graduate credit hours required for the doctoral degree. This notification must occur no later than the end of the first quarter of enrollment beyond completion of the master’s degree.



Additional Requirements for the Ph.D. (both direct and from M.S.)

1. At least 6 credits of OSU ECE graded courses that are of the 800-level or higher must be taken. For the purpose of this requirement, some 700-level courses can count as 800-level courses by some area (more below).
2. **Residency Requirement:** The following requirements must be fulfilled after the master's degree has been earned or after the first 45 hours of graduate credit have been completed:
 - A minimum of 45 graduate credit hours must be completed at this university
 - A minimum of three out of four consecutive quarters with an enrollment of at least 9 graduate credit hours per quarter must be completed while in residence at this university.
3. Submission of an acceptable Ph.D. Plan of Study.
4. Passage of the Ph.D. Qualifying Examination (discussed in more detail in **Section 7.4** of the ECE Graduate Handbook).
5. Graduate seminars (ECE 881) of at least two credit hours. Credits for these seminars are not included in the 120 hour requirement.
6. Passage of the Candidacy Examination, with both written and oral parts and judged by the student's Candidacy Exam Committee.
7. **Post Candidacy Ph.D. students:** Doctoral students (domestic and international) who have passed the Candidacy Examination must register for 3 graduate hours (per quarter). You will need special permission to register for more than 3 credits. At a minimum, a doctoral student must be enrolled for at least two quarters and at least six graduate credits after passing the candidacy exam.
8. Submission of at least one substantial, original paper based on the dissertation research to a refereed, archival journal before approval of the final defense of the dissertation is granted. A signed form from the advisor (form is online) stating the status of the paper along with a copy of the paper must be provided with the Application to Graduate at the beginning of the quarter of graduation to the ECE graduate counselor. If the paper has not yet been published, the student must also provide a copy of the letter or e-mail acknowledging the acceptance or submission of the paper to the journal. Typically, advisors expect two or more journal papers from their Ph.D. students.
9. A final oral examination in defense of the dissertation.

Voluntary Breadth Increase:

With their advisor's consent, Ph.D. students can petition to have up to 9 credits of additional OSU ECE coursework (above the Ph.D. course requirement) counted toward their dissertation credits.

Definition of Technical Elective:

Any course that the advisor approves is considered a technical elective. Technical electives can therefore be non ECE courses.

Current list of courses which can be counted as 800-level courses:

ECE 724, 741, 744, 764, 767, 769.

Note that this list can be updated when requested by an area to the graduate studies committee.

Ph.D. Plan of Study

The Ph.D. Plan of Study (form in your orientation package) will define an ECE primary area of emphasis, an ECE minor area of emphasis, and a secondary area of emphasis outside ECE. Approval of the outside secondary coursework (outside the student's *primary area of study*) is at the discretion of the advisor. All *graduate* courses taken at The Ohio State University must be listed on this form. If you have a Master from another institution a transcript must accompany the Plan of Study form.

Students interested in pursuing multi-disciplinary or cross-disciplinary programs of study in either their nominal primary or secondary area are encouraged to do so. These students may submit such a Plan of Study to the Graduate Studies Committee, with a brief letter of explanation and the advisor's endorsement, for approval. The formulation of the student's Candidacy Exam Committee should also be chosen, and will be approved, according to these area definitions.

Two faculty signatures are required on the Plan prior to submission: the advisor and a secondary area representative. In the event of a nontraditional secondary area (one not exclusively drawn from courses in one of the curricular areas listed above), the secondary area representative (not necessarily an ECE) signing the Plan is also agreeing to serve as the secondary area examiner on the student's Candidacy Exam committee, and should be from outside the student's primary area, as defined above.

Ph.D. Qualifier Exam

The Ph.D. Qualifying Examination (QE) serves as one of the key filters in allowing a student to pass from Special (simple admission to the program) to Regular doctoral student status. As such, the QE is designed in accordance with the following principles:

- The examination promotes breadth in the preparation for doctoral studies. The examination also accommodates those students wishing to pursue nontraditional paths of scholarship, since much of the most exciting new work can occur "between" traditional curricular areas.
- The examination establishes that the student is prepared for further advanced studies at the doctoral level.
- Since there is some flexibility in the nature of the exam, the student must carefully discuss with his/her advisor details about the material that will be covered in the exam.

Other Requirements:

To pass from Special to Regular status, the doctoral student must have a **GPA of at least 3.5** and also obtain a commitment from a faculty advisor on his or her Ph.D. Plan of Study. Thus the QE is not the sole determinant for acceptance as a Regular doctoral student. Students who have demonstrated significant research activity and an excellent academic record while at OSU may be able to waive the qualifier.

Attachment #3: Ph.D. Proposed Advising Sheets

THE DOCTOR OF PHILOSOPHY PROGRAM

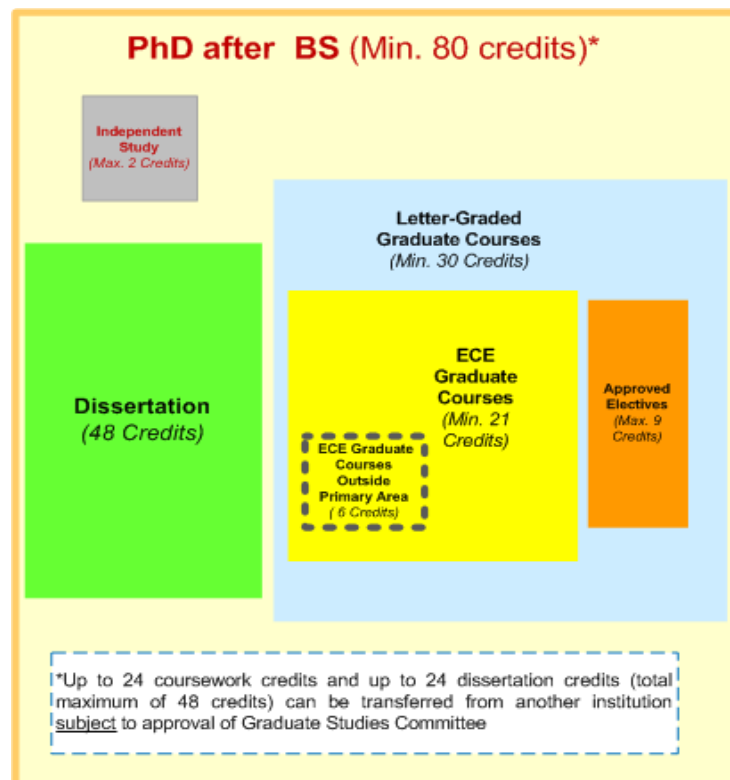
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- Direct Ph.D. from BS degree
- Ph. D. after the M.S. degree

Summary Requirements for the Ph.D. Degree

Direct Ph.D. degree from the BS:

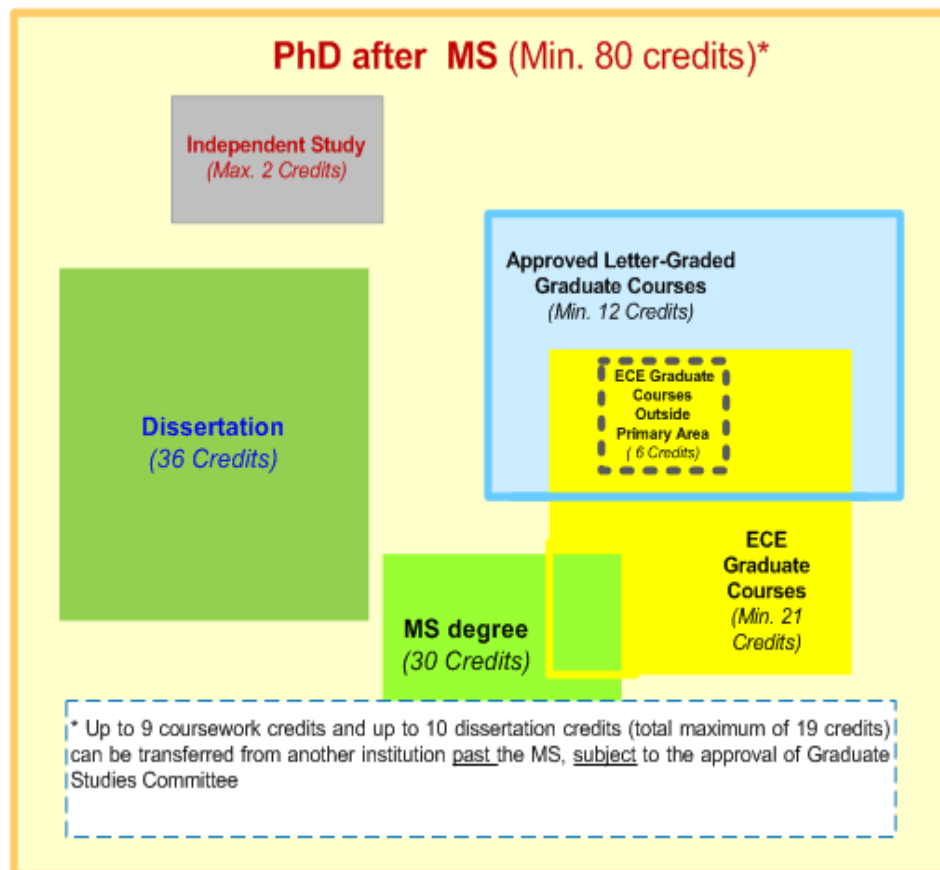
1. At least 30 graduate credit hours of coursework beyond the Bachelor’s degree of which 21 credits must be graded ECE courses and 9 credits must be approved electives. Of the 21 ECE graded course credits, 6 must be associated with an area of concentration outside the student’s *primary area* of study (does not have to match the traditional areas in department). Of the 30 credits of coursework, 28 must be letter-graded courses and 2 can be independent study. Up to 24 coursework credits and up to 24 dissertation credits (for a maximum total of 48 credits) from another institution can be transferred into the direct Ph.D. program, subject to the approval of the Graduate Studies Committee.
2. A dissertation embodying a significant original research contribution and counting 48 hours (ECE 8999) toward the 80 hour requirement.



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Ph.D. program from M.S. degree

1. M.S. degree counts for 30 credits
2. 14 credits of coursework of which 12 must be letter-graded coursework and 2 credits can be independent study. All 14 credits of coursework must be approved electives. Up to 9 coursework credits and up to 10 dissertation credits (for a maximum total of 19 credits) from another institution can be transferred past the M.S., subject to the approval of the Graduate Studies Committee.
3. A dissertation embodying a significant original research contribution and counting 36 hours (ECE 8999) toward the 80 hour requirement.
4. The student must have taken at least 21 quarter credits of letter graded ECE courses. These 21 credits can come from either the M.S. or Ph.D. program. The ECE courses from the M.S. program (non-OSU M.S.) must be approved by the Graduate Studies Chair as being equivalent to ECE courses at OSU. 6 of the 21 ECE credits must be associated with an area of concentration outside the student's *primary area of study* (does not have to match the traditional areas in department).
5. When a doctoral student has taken a master's degree at this university and has earned graduate credit in excess of the minimum required for that degree, the student's advisor, with the approval of the Graduate Studies Committee, notifies the Graduate School of the courses to be counted toward the graduate credit hours required for the doctoral degree. This notification must occur no later than the end of the first semester of enrollment beyond completion of the master's degree.



Additional Requirements for the Ph.D. (both direct and from M.S.)

1. Submission of an acceptable Ph.D. Plan of Study.
2. Passage of the Ph.D. Qualifying Examination
3. Graduate seminars (ECE 8891) of at least two credit hours. Credits for these seminars are not included in the 80 hour requirement.
4. Passage of the Candidacy Examination, with both written and oral parts and judged by the student's Candidacy Exam Committee.
5. Submission of at least one substantial, original paper based on the dissertation research to a refereed, archival journal before approval of the final defense of the dissertation is granted. A signed form from the advisor (form is online) stating the status of the paper along with a copy of the paper must be provided with the Application to Graduate at the beginning of the quarter of graduation to the ECE graduate counselor. If the paper has not yet been published, the student must also provide a copy of the letter or e-mail acknowledging the acceptance or submission of the paper to the journal. Typically, advisors expect two or more journal papers from their Ph.D. students.
6. A final oral examination in defense of the dissertation.

Voluntary Breadth Increase:

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Definition of Technical Elective:

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The Ph.D. Plan of Study (form in your orientation package) will define an ECE primary area of emphasis, an ECE minor area of emphasis, and a secondary area of emphasis outside ECE. Approval of the outside secondary coursework (outside the student's *primary area of study*) is at the discretion of the advisor. All *graduate* courses taken at The Ohio State University must be listed on this form. If you have a Master from another institution a transcript must accompany the Plan of Study form.

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The Ph.D. Qualifying Examination (QE) serves as one of the key filters in allowing a student to pass from Special (simple admission to the program) to Regular doctoral student status. As such, the QE is designed in accordance with the following principles:

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- The examination establishes that the student is prepared for further advanced studies at the doctoral level.
- Since there is some flexibility in the nature of the exam, the student must carefully discuss with his/her advisor details about the material that will be covered in the exam.

Other Requirements:

To pass from Special to Regular status, the doctoral student must have a **GPA of at least 3.5** and also obtain a commitment from a faculty advisor on his or her Ph.D. Plan of Study. Thus the QE is not the sole determinant for acceptance as a Regular doctoral student. Students who have demonstrated significant research activity and an excellent academic record while at OSU may be able to waive the qualifier.