Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE:
Revision of Curriculum Requirements for the Ph.D. in Electrical and Computer Engineering, Department of Electrical and Computer Engineering (ECE), College of Engineering

SPONSOR:
William H. Sanders, Department Head of Electrical and Computer Engineering, 333-2301, whs@illinois.edu

COLLEGE CONTACT:
Harry Dankowicz, Associate Dean for Graduate, Professional and Online Programs, 244-1231, danko@illinois.edu

BRIEF DESCRIPTION:
With the existing 64-credit Ph.D. curriculum, ECE is requesting the following minor changes to the current coursework requirements.

- Allow up to 4-credit hours of ECE 590, Seminar, to count towards the elective coursework.
- Allow up to 12 hours of ECE 597, Individual Study, to count towards elective coursework.

In addition, ECE would like to add a 96-credit hour option to the current Ph.D. curriculum to allow students to be directly admitted into the Ph.D. program. Currently, graduate students are required to hold an approved Master’s degree before they can enter the Ph.D. program. Students without an approved Master’s degree must first complete a thesis-based M.S. degree in ECE before entering the Ph.D. program. The current Ph.D. curriculum is a 64-credit hour curriculum.

Under the 96-credit hour curriculum, termed the Direct Ph.D., students will complete the following requirements, which are outlined in detail in Appendix A.

- 48 to 56-credit hours of graduate level coursework
  - 16 credit hours must be ECE 500-level coursework other than ECE 590, ECE 597, and ECE 599
  - 3 permanent 500-level courses in 3 different Ph.D. Breadth Requirement areas
  - Remaining credit hours of 400-500 level elective coursework
- 40-48-credit hours of thesis research
- Successful completion of the Qualifying, Preliminary, and Final Defense exams.
These requirements (coursework and thesis) are equivalent to the addition of the requirements of the thesis-based ECE M.S. degree plus the 64-credit hour Ph.D. curriculum described above. In essence, the Direct Ph.D. student will fulfill exactly the same requirements as the student undertaking first an M.S. and then a Ph.D., but without preparing an M.S. thesis (or receiving an M.S. degree). It will be optional under the Direct Ph.D. curriculum for students to obtain a thesis-based M.S. degree along the way to the Ph.D.

**JUSTIFICATION:** *(Please provide a brief but complete rationale for your request.)*

The current ECE 64-credit hour Ph.D. curriculum does not allow graduate students to count any ECE 590 (Seminar) or ECE 597 (Independent Study) credits towards the coursework requirements. The current job market in several areas demand competitive candidates to have a large number of publications and products, which can take significant time. By allowing students to count ECE 597 credits, they will be able to explore multiple research avenues early in their graduate studies. In addition, by allowing a select number of ECE 590 Seminar credits to count, students are engaged to participate and learn about the latest trends.

The current ECE Ph.D. degree program requires students entering with a B.S. degree to take a minimum of 11 regular courses, which is significantly larger compared to our peer institutions (e.g., MIT: 6; Berkeley: 6). The new rules for ECE 590 and ECE 597 are the same as our CS department (many of our Computer Engineering faculty members have Ph.D. students in both the CS and ECE departments) and would bring the minimum number of regular courses to 7, which is comparable to our peers.

The substitution of ECE 590 and ECE 597 for regular courses is only optional. The ECE department is diverse with different areas having different needs for Ph.D. training. Our ECE 597 course allows students to gain not only technical skills within the field of electrical and computer engineering, but also allows hands-on experience to work through the stages of tackling a problem – identification, design, and implementation. As is also recognized by our peers, taking regular classes is no longer the only way to build the necessary background for a Ph.D. in all areas of ECE. Furthermore, we will restrict students to a maximum of 4 credit hours of ECE 597 per semester with advisor approval.

ECE 597 is different from ECE 599, Thesis Research, in that students can sign up for ECE 597 with different faculty other than the advisor and ECE 597 results in a letter grade after each semester. Hence, ECE 597 provides the opportunity for graduate students to explore different research topics before committing to a thesis agreement.

Under the current curriculum, students without an approved M.S. degree must first be admitted into the thesis-based M.S. degree program in ECE and then petition into the Ph.D. degree program. This is hindering ECE from recruiting top talent into its graduate program. Many students applying to the ECE Ph.D. degree program want to be directly admitted into the Ph.D. program without the requirement of first completing an M.S. degree. Almost all our peer ECE doctoral programs have an option to directly admit students to the Ph.D. program without requiring a prior M.S. degree. Examples include: Massachusetts Institute of Technology, University of California Berkeley, Stanford University, University of Michigan, and Carnegie Mellon University. This difference places Illinois at a distinct competitive disadvantage when recruiting top applicants who intend to pursue a Ph.D. degree. Implementing the Direct Ph.D. option keeps us competitive with our peers.

The maximum numbers of allowable ECE 590 (Seminar) and ECE 597 (Individual Study) credit hours for the revised 64-credit hour Ph.D. curriculum (for students entering with M.S. degree) and the new 96-credit hour Direct Ph.D. (for students entering with B.S. degree) were chosen so that the minimum number of regular courses for the 96-credit hour Ph.D. curriculum is
comparable with our peers, and for the 64-credit hour Ph.D. curriculum the coursework requirement is equal to that of the 96-credit hour Ph.D. curriculum subtracting the 32-credit hour M.S. program. There is no change in the MS program.

By requiring individual faculty thesis advisors to approve the substitution of up to an additional 12-credit hours of ECE 597 for regular courses, we consider this a minor change to the Ph.D. coursework requirements. Based on consultation with ECE faculty, faculty from some areas will still require their Ph.D. students to take regular courses instead of ECE 597, whereas faculty from other areas strongly feel that the inclusion of ECE 597 for elective course credit will be critical to attracting top, qualified students for their research programs.

**BUDGETARY AND STAFF IMPLICATIONS:** *(Please respond to each of the following questions.)*

1) **Resources**
   a. How does the unit intend to financially support this proposal?

      There will not be any budgetary obligations due to these changes to the ECE Ph.D. curriculum. The program implementations will be carried out with existing resources.

   b. How will the unit create capacity or surplus to appropriately resource this program? If applicable, what functions or programs will the unit no longer support to create capacity?

      There are no capacity implications with respect to the proposed change. With the direct PhD option in ECE, there will be fewer admission offers made to applicants for the thesis-based master’s degree. The department’s goal is not to increase the total number of thesis-based master’s and PhD students that is currently admitted today. There will be no additional enrollment beyond the numbers currently supported by the department. Graduate student enrollment is limited by the number of research assistantships (faculty grants) and by available teaching assistantships.

   c. Will the unit need to seek campus or other external resources? If so, please provide a summary of the sources and an indication of the approved support.

      No, there will be no additional financial obligations resulting from these changes.

   d. Please provide a letter of acknowledgment from the college that outlines the financial arrangements for the proposed program.

      There are no financial implications for these requested changes.

2) **Resource Implications**
   a. Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.

      There are no negative implications on faculty resources for either of the proposed
b. Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units. *(A letter of acknowledgement from units impacted should be included.)*

This proposed change will provide more flexibility for Ph.D. students to engage in research projects earlier in their studies. With the implementation of a 96-credit hour Direct Ph.D. option, we do not anticipate any impact on course enrollments in other units.

c. Please address the impact on the University Library *(A letter of estimated impact from the University Librarian must be included for all new program proposals. If the impact is above and beyond normal library business practices, describe provisions for how this will be resourced.)*

These proposed changes will not impact the University Library.

d. Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)

There will be no impact on technology and space.

For new degree programs only:

3) Briefly describe how this program will support the University’s mission, focus, and/or current priorities. Include specific objectives and measurable outcomes that demonstrate the program’s consistency with and centrality to that mission.

4) Please provide an analysis of the market demand for this degree program. What market indicators are driving this proposal? What type of employment outlook should these graduates expect? What resources will be provided to assist students with job placement?

5) If this is a proposed graduate program, please discuss the programs intended use of waivers. If the program is dependent on waivers, how will the unit compensate for lost tuition revenue?

**DESIRED EFFECTIVE DATE:** Spring 2019

**STATEMENT FOR PROGRAMS OF STUDY CATALOG:** See Appendix B
CLEARANCES: (Clearances should include signatures and dates of approval. These signatures must appear on a separate sheet. If multiple departments or colleges are sponsoring the proposal, please add the appropriate signature lines below.)

Signatures:

[Signature]

Unit Representative

[Signature]

College Representative

[Signature]

Graduate College Representative

Council on Teacher Education Representative

[Signature]

[Signature]

[Signature]

Dates:

August 3, 2018

9-10-18

9/27/18

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Appendix A:
Proposed 64-Credit Hour Revised Curriculum and New 96-Credit Hour Option

Revised 64 Credit Hour Ph.D. Curriculum

Current Requirements

<table>
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<tr>
<th>Course</th>
<th>Description</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ECE 599</td>
<td>Thesis Research (min-max applied toward degree)</td>
<td>32-40</td>
</tr>
<tr>
<td>ECE 500</td>
<td>ECE Colloquium (registration for 0 hours every term while in residence)</td>
<td>0</td>
</tr>
<tr>
<td>3 permanent 500-level courses in 3 different Ph.D. Breadth Requirement areas</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Elective courses (subject to Other Requirements and Conditions below)</td>
<td>12-20</td>
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</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>64</strong></td>
<td></td>
</tr>
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</table>

Other Requirements and Conditions (may overlap)

- Credit in ECE 415, ECE 445, ECE 590 (seminar), ECE 596, ECE 597 (individual study), PHYS 404, PHYS 435, and PHYS 436, STAT 400, or any other seminar or individual study course does not count toward the degree.
- At least one ECE 500-level course must be taken.
- No course used to fulfill any degree requirement may be taken using the "Credit/No Credit" option.
- A master’s degree is required for admission to the Ph.D. program.
- Ph.D. exam and dissertation requirements:
  - Qualifying exam
  - Preliminary exam
  - Final exam or dissertation defense
  - Dissertation deposit
  - Minimum GPA: 3.0

Proposed Revised Requirements

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<td></td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
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<td></td>
</tr>
</tbody>
</table>

Other Requirements and Conditions (may overlap)

- Up to 4 credit hours of ECE 590 (Seminar) can be applied towards Elective courses.
Up to 12 credit hours of ECE 597 (Independent Study) can be applied towards Elective courses.

Credit in ECE 415, ECE 445, ECE 596, PHYS 404, PHYS 435, PHYS 436, STAT 400 does not count toward the degree.

At least one ECE 500-level course must be taken other than ECE 590, ECE 597, and ECE 599.

No course used to fulfill any degree requirement may be taken using the "Credit/No Credit" option.

A master’s degree is required for admission into this Ph.D. curriculum.

Ph.D. exam and dissertation requirements:

- Qualifying exam
- Preliminary exam
- Final exam or dissertation defense
- Dissertation deposit
- Minimum GPA: 3.0

### New 96-credit Hour Option Ph.D. Curriculum

<table>
<thead>
<tr>
<th>Course</th>
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<th>Hours</th>
</tr>
</thead>
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<td>ECE 599</td>
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<td></td>
<td><strong>3 permanent 500-level courses in 3 different Ph.D. Breadth Requirement areas</strong></td>
<td>12</td>
</tr>
<tr>
<td>Elective</td>
<td>courses (subject to Other Requirements and Conditions below)</td>
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</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td>96</td>
</tr>
</tbody>
</table>

### Other Requirements and Conditions (may overlap)

**Requirement**

- Up to 4 credit hours of ECE 590 (Seminar) can be applied towards Elective courses.
- Up to 16 credit hours of ECE 597 (Independent Study) can be applied towards Elective courses.
- Credit in ECE 415, ECE 445, ECE 596, PHYS 404, PHYS 435, PHYS 436, STAT 400 does not count toward the degree.
- 16-credit hours must be ECE 500-level courses other than ECE 590, ECE 597, and ECE 599
- No course used to fulfill any degree requirement may be taken using the "Credit/No Credit" option.

Ph.D. exam and dissertation requirements:

- Qualifying exam
- Preliminary exam
- Final exam or dissertation defense
- Dissertation deposit
- Minimum GPA: 3.0
## Overview of Both Curriculums Side-by-Side

<table>
<thead>
<tr>
<th>Ph.D. Degree</th>
<th>Entering with approved M.S. Degree</th>
<th>Entering with B.S. Degree</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(Revised 64-credit hour curriculum)</td>
<td>(96-credit hour option, consisting of the 64-credit hour curriculum to the left plus the ECE M.S. curriculum)</td>
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<td>ECE 599 Research (minimum applied toward degree)</td>
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<tr>
<td>Breadth Requirement</td>
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<tr>
<td>Elective Coursework</td>
<td>12-20</td>
<td>36-44</td>
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</table>
Appendix B:
Program of Study

http://ece.illinois.edu

Head of the Department: William H. Sanders
Director of Graduate Studies: Michael Oelze
Graduate Programs
2120 Electrical and Computer Engineering Building
306 N. Wright St.
Urbana, IL 61801
(217) 300-2414
Email: ece-grad-apps@illinois.edu

Major: Electrical and Computer Engineering
Degrees Offered: M.Eng., M.S., Ph.D.

Graduate Degree Programs
The department offers graduate study and research in electrical and computer engineering leading to the degrees of Master of Engineering, Master of Science, and Doctor of Philosophy. Virtually every specialty within electrical and computer engineering is represented. Courses and research opportunities exist in the following areas, among others:

- bioengineering, acoustics, and magnetic resonance engineering
- communications
- computer-aided design and test
- computer systems
- computer vision and robotics
- decision and control
- dependability and cyber security
- electromagnetic fields
- electrooptics, lasers, and plasmas
- integrated circuits
- microelectro-mechanical systems
- mobile computing and communication
- optoelectronics
- power and energy systems
- power electronics
- remote sensing and propagation
- semiconductor materials and devices
- semiconductor physics and computational electronics
- signal, image, and speech processing

The Master of Engineering degree in ECE is designed for students having a B.S. degree in ECE or a related field and offers an opportunity to broaden knowledge of areas in ECE beyond what is possible in a four-year undergraduate curriculum. The M.Eng. is a professional degree and is not intended for students interested in obtaining research experience. Students interested in a research-oriented career and all students interested in obtaining a Ph.D. should apply to the direct Ph.D. program.
ECE graduate programs are purposely flexible to encourage interdisciplinary studies and research. Opportunity also exists for specializing in:

1. computational science and engineering via the Computational Science and Engineering (CSE) Option
2. energy and sustainability engineering via the Energy and Sustainability Engineering (EaSE) Option.

For complete program information, visit the Electrical and Computer Engineering graduate program Web site.

**Admission**

Applicants must have completed an electrical engineering curriculum or a computer engineering curriculum substantially equivalent to those of the University of Illinois at Urbana-Champaign. A minimum grade point average of 3.00 (A = 4.00) for the last two years of undergraduate study is required. However, because of space limitations, applicants with GPAs below 3.50 are rarely admitted. All applicants must submit scores from the general test of the Graduate Record Examination (GRE).

Ph.D. applicants with master's degrees are admitted only if a faculty member is willing to serve as the Ph.D. thesis advisor. Accordingly, such applicants should write, call, or e-mail prospective Ph.D. advisors and discuss their research interests and potential Ph.D. thesis topics well in advance of application deadlines. Admission for the spring semester is possible, in addition to the usual fall semester admissions.

Graduates of curricula in the physical sciences, mathematics, and computer science may be admitted if they are judged to have the necessary background to profit from graduate work in electrical and computer engineering.

All applicants whose native language is not English must submit a minimum TOEFL score of 96 (iBT), 243 (CBT), or 590 (PBT); or minimum International English Language Testing System (IELTS) academic exam scores of 6.5 overall and 6.0 in all subsections. Applicants may be exempt from the TOEFL if certain criteria are met. For those taking the TOEFL or IELTS, full admission status is granted for scores greater than 102 (TOEFL iBT), 253 (TOEFL CBT), 610 (TOEFL PBT), or 6.5 (IELTS). Limited status is granted for lesser scores and requires enrollment in English as a Second Language (ESL) courses based on an ESL Placement Test (EPT) taken upon arrival to campus.

**Faculty Research Interests**

Research interests of the Electrical and Computer Engineering faculty include the broad areas of study described in the graduate programs section and more. Many faculty members hold affiliate status with other departments, and a number of faculty members from other departments hold affiliate status with the department. In addition, some faculty hold appointments in the Beckman Institute for Advanced Science and Technology, the Coordinated Science Laboratory, the Materials Research Laboratory, and the Micro and Nanotechnology Laboratory. All these affiliations provide opportunities for graduate student appointments to conduct research. For a detailed list of current research interests of the faculty, visit the department’s research Web site.

**Centers, Programs, and Institutes**
There are numerous interdisciplinary programs, laboratories, and centers for research within the department. These are described at the department's research Web site.

**Financial Aid**

Fellowships, research assistantships, and teaching assistantships (all of which include tuition and partial fee waivers) are available for the majority of students who are admitted to the M.S. and Ph.D. programs. International applicants generally are not awarded teaching assistantships but are eligible for the other forms of financial aid. All applicants, regardless of U.S. citizenship, whose native language is not English and who wish to be considered for teaching assistantships must demonstrate spoken English language proficiency by achieving a minimum score of 24 on the speaking subsection of the TOEFL iBT or 8 on the speaking subsection of the IELTS. For students who are unable to take the iBT or IELTS, a minimum score of 5 is required on the EPI test, offered on campus. All new teaching assistants are required to participate in the Graduate Academy for College Teaching conducted prior to the start of the semester. Please see the financial aid eligibility for the M.Eng. in Electrical and Computer Engineering under the "Masters" tab.

**Doctor of Philosophy in Electrical and Computer Engineering**

**Entering with approved M.S. degree**

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<thead>
<tr>
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<tbody>
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<td></td>
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**Total Hours** 64

**Other Requirements and Conditions**

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<td>Qualifying exam</td>
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<td>Description</td>
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<td>Minimum GPA:</td>
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**Entering with B.S. degree**

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**Total Hours**: 96

**Other Requirements and Conditions**

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Hello Allison -

I was able to connect with Michael Oelze this weekend. Below is the response to the your question in your email below.

ECE students who wish to register for ECE 597, Independent Study, must complete a form and describe the project that will be completed for the semester. The supervising faculty must also sign the form. The form is then returned to the ECE Graduate Academic Office for final review to ensure the project meets the department’s requirements for independent study. ECE guidelines for independent study require that students completing a project for ECE 597 must submit a final report at the end of the semester that describes the project details and findings. ECE does require this to be independent of a student PhD dissertation.

Please let me know if you have any additional questions.

Thank you!

Rhonda

--- Original message ---
From: "McKinney, Allison Ann" <agrindly@illinois.edu>
Date: 9/21/18 4:01 PM (GMT-06:00)
To: "Dankowicz, Harry" <danko@illinois.edu>
Subject: Proposal Follow up - Revision for the PhD in ECE

Dear Dean Dankowicz,

The Graduate College Executive Committee reviewed the proposal for a “Revision of Curriculum Requirements for the Ph.D. in Electrical and Computer Engineering” on September 14, 2018. Upon review, the committee approved the proposal to move forward pending the receipt of the following note of clarification:
It was noted that it should be clear to students that academic work for ECE 597 should be separate from thesis research/ECE 599. Could the program please clarify how the independent study process in ECE is currently managed?

Please let me know if you have any questions.

Sincerely,

Allison McKinney
Senior Director
Academic Affairs
Graduate College
October 1, 2018

Gay Miller, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Miller:

Enclosed is a copy of a proposal from the College of Engineering to revise the Ph.D. in Electrical and Computer Engineering.

Sincerely,

Kathryn A. Martensen
Assistant Provost

Enclosures

c: W. Hwu
   H. Dankowicz
   R. McElroy
   J. Hart
   A. McKinney
September 27, 2018

Kathy Martensen
Office of the Provost

Dear Kathy,

Included is a proposal from the College of Engineering for a “Revision of Curriculum Requirements for the Ph.D. in Electrical and Computer Engineering, Department of Electrical and Computer Engineering”.

The proposal was received on September 10, 2018 and reviewed at the Graduate College Executive Committee meeting on September 14, 2018. The committee approved the proposal pending the clarification regarding the independent study approval process. The College of Engineering has provided clarification for this process and I have included that clarification with this proposal.

We have found that this proposal meets the standards of Graduate Education at Illinois and we now forward for your review.

Sincerely,

John C. Hart
Executive Associate Dean
Graduate College

c: H. Dankowicz
W. Sanders
Dear Allison,

The College of Engineering Executive Committee has reviewed and approved the following program revision. We now submit for campus approval.

"Revision of Curriculum Requirements for the Ph.D. in Electrical and Computer Engineering, Department of Electrical and Computer Engineering, College of Engineering"

Attached is a copy of the request.

Sincerely yours,

Henrique Reis, Vice Chair
Executive Committee

Approval Recommended:

Tamer Başar, Dean
College of Engineering

Harry Dankowicz
Rhonda McElroy
Henrique Reis

10-10-2018
Date.
Senate Educational Policy Committee
Proposal Check Sheet

PROPOSAL TITLE (Same as on proposal): Revision of Curriculum Requirements for the Ph.D. in Electrical and Computer Engineering, Department of Electrical and Computer Engineering (ECE), College of Engineering

PROPOSAL TYPE (select all that apply below):

A. ☑ Proposal for a NEW or REVISED degree program. Please consult the Programs of Study Catalog for official titles of existing degree programs.

1. Degree program level:
   ☑ Graduate     ☐ Professional     ☐ Undergraduate

2. ☐ Proposal for a new degree (e.g. B.S., M.A. or Ph.D.):
   Degree name, "e.g., Bachelor of Arts or Master of Science":

3. ☑ Proposal for a new or revised major, concentration, or minor:
   ☐ New or ☑ Revised Major in (name of existing or proposed major): Ph.D. in Electrical and Computer Engineering
   ☐ New or ☐ Revised Concentration in (name of existing or proposed concentration):
   ☐ New or ☐ Revised Minor in (name of existing or proposed minor):

4. ☐ Proposal to rename an existing major, concentration, or minor:
   ☐ Major     ☐ Concentration     ☐ Minor
   Current name:
   Proposed new name:

5. ☐ Proposal to terminate an existing degree, major, concentration, or minor:
   ☐ Degree     ☐ Major     ☐ Concentration     ☐ Minor
   Name of existing degree, major, or concentration:

6. ☐ Proposal involving a multi-institutional degree:
☐ New  ☐ Revision  ☐ Termination

Name of existing Illinois (UIUC) degree: ____

Name of non-Illinois partnering institution: ____

Location of non-Illinois partnering institution:
☐ State of Illinois  ☐ US State: ____  ☐ Foreign country: ____

B. ☐ Proposal to create a new academic unit (college, school, department, program or other academic unit):

Name of proposed new unit: ____

C. ☐ Proposal to rename an existing academic unit (college, school, department, or other academic unit):

Current name of unit: ____

Proposed new name of unit: ____

D. ☐ Proposal to reorganize existing units (colleges, schools, departments, or program):

1. ☐ Proposal to change the status of an existing and approved unit (e.g. change from a program to department)

Name of current unit including status: ____

2. ☐ Proposal to transfer an existing unit:

Current unit’s name and home: ____

Proposed new home for the unit: ____

3. ☐ Proposal to merge two or more existing units (e.g., merge department A with department B):

Name and college of unit one to be merged: ____

Name and college of unit two to be merged: ____

Proposed name and college of new (merged) unit: ____

4. ☐ Proposal to terminate an existing unit:

Current unit’s name and status: ____

E. ☐ Other educational policy proposals (e.g., academic calendar, grading policies, etc.)

Nature of the proposal: ____

Revised 10/2012