Brothers, Sheila C.

From: Vincent, Leslie H.
Sent: Friday, November 15, 2019 2:34 PM
To: Bird-Pollan, Jennifer; Brothers, Sheila C.; Woolery, Stephanie L.; Ett-Mims, Joanie; Cramer, Aaron M.
Cc: Raphael Finkel
Subject: NEW PhD: Computer Engineering
Attachments: PhD in Computer Engineering.pdf

Proposed New PhD Program in Computer Engineering

This is a recommendation that the University Senate approve, for submission to the Board of Trustees, the establishment of a new PhD in Computer Engineering, in the College of Engineering.

Rationale:

The proposed program will provide an advanced degree in the area of Computer Engineering, an area in which we already have a successful undergraduate program and successful faculty research. The field of computer engineering integrates expertise from both electrical engineering and computer science, emphasizing an understanding of computer architecture, hardware/software interface, and the integration of computers into products and systems at a larger scale. The program would include faculty from both the ECE and CS departments working collaboratively with the program being housed in the Department of Computer Science. The proposed program will support the College of Engineering's mission "to provide education, research, and service in a scholarly environment in a way that prepares our students for successful professional careers, addresses the changing needs of our other constituents, and responds to the technological challenges facing the Commonwealth and the Nation." Development of graduate programs in Computer Engineering will further enhance the College's ability to pursue its "Top 50" vision of being internationally recognized and ranked as one of the top 50 colleges of engineering in the United
States. Demand and salaries in computer engineering continue to be strong. Enrollment of 10 new students per year is anticipated.

SAPC Statement: SAPC considered the required collaboration between the Department of ECE and CS extensively as indicated within the proposal. Throughout the review process the committee asked for a formal MOU between the departments. Furthermore, we asked the proposer to document faculty support for the MOU developed and the response was that faculty did not vote on the MOU. There was concern among the SAPC regarding the potential for differing levels of faculty support from both departments. The proposal was evaluated based on SAPC's charge to consider programs based on academic excellence, need, and impact, desirability, and priority of the new academic program in relation to other programs, and its recommendation to approve the program was based on a vote of: 2 in favor, 1 opposed, and 3 abstaining.

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NEW DOCTORAL DEGREE PROGRAM

1. *This form has three sections. Section A contains information required by the University Senate and Registrar's office. Sections B and C contain information required by two external entities, the CPE (Council on Postsecondary Education) and SACS-COC (Southern Association of Colleges and Schools Commission on Colleges). Section C contains information required only for the Advance Practice Doctorate… Although only Section A is required for University Senate approval, every question must be answered to receive CPE approval. Please write "not applicable" wherever that is the appropriate response, leaving no area blank.*

2. *The CPE requires that a pre-proposal and full proposal be submitted. The pre-proposal is submitted after a proposed program has received college-level approval. Answers to questions identified with an * by the question number on this form should be used for the CPE's pre-proposal. Such questions are in both Section A and Section B. Please email institutionaleffectiveness@uky.edu for more information about the CPE's pre-proposal process. The CPE's full proposal requires completion of both Sections A and B of this form and is submitted after approval by UK's Board of Trustees.*

~~3.~~ *Once approved at the college level, your college will send the proposal to the appropriate Senate academic council (HCCC and/or GC) for review and approval. Once approved at the academic council level, the academic council will send your proposal to the Senate Council office for additional review via a committee and then to the Senate for approval. Once approved by the Senate, the Senate Council office will send the proposal to the appropriate entities for it to be placed on an agenda for the Board of Trustees. The contact person listed on the form will be informed when the proposal has been sent to committee and other times as appropriate.*

1a	Date of contact with Institutional Effectiveness[1]:	*July 16, 2018*		
	☐ Appended to the end of this form is a PDF of the reply from Institutional Effectiveness.			
1b	Home College: *Engineering*			
1c	Home Educational Unit (school, department, college[2]): *Computer Science*			
	ECE and CS are collaborating for this joint program. About half the courses come from each of these departments. ECE is the home department for the undergraduate program; for balance, both ECE and CS have agreed that CS should be the home department for the graduate programs (MS and PhD). Both departments will work closely together to make sure the programs are intellectually sound.			
1d*	Degree Level/Designation (Professional Practice, Research, or Other, e.g. Advance Practice Doctorate): Please make the appropriate selection			
	☐ Professional Practice (e.g. MD, PharmD, or JD)	☒ Research/Scholarship (e.g. PhD)	OR	☐ Other (Advance Practice) (e.g. DNP)
1e*	Program Name (Biology, Finance, etc.):			
	Doctor of *Computer Engineering*			
1g*	CIP Code (provided by Planning and Institutional Effectiveness): *14.09 01*			

1 You can reach Planning and Institutional Effectiveness by phone or email (257-2873 or institutionaleffectiveness@uky.edu).

2 Only interdisciplinary graduate degrees may be homed at the college level.

1h	Is there a specialized accrediting agency related to this program?			Yes ☐	No ☒
	If "Yes," name:				
1i	Was this particular program ever previously offered at UK but subsequently suspended?			Yes ☐	No ☒
	If "Yes," describe. (*300 word limit*)				
1j*	Requested UK effective date:	☒ Fall semester following approval	OR	☐ Specific Date[3]: *Fall 20___*	
1k*	Anticipated date for granting first degree(s): *Spring 2022*				
1l*	Proposed Implementation Date (or Anticipated Date of First Student Enrolled in the Program) (*similar to/based on information provided in 12f*))				
	Specific Date[4]:	*Fall 20 19*	OR	*Spring 20 __*	
1m*	Contact person name (include position title): *Raphael Finkel, professor*		Email: *raphael@cs.uky.edu*		Phone: *257-3885*

2a*	Provide a brief description of the proposed program. (*300 word limit*, Pre-proposal question: Mission, 1)
	The proposed doctoral program in Computer Engineering (PhD Computer Engineering) will provide an advanced degree in the area of Computer Engineering, an area in which we already have a successful undergraduate program and successful faculty research. *The field of computer engineering integrates expertise from both electrical engineering and computer science, emphasizing an understanding of computer architecture, hardware/software interface, and the integration of computers into products and systems at a larger scale. It involves developing technical skills in traditional areas of electrical engineering, such as analog and digital circuit design and communications systems, as well as in areas related to computer science, such as software development and operating systems. Sub-disciplines within Computer Engineering include Computer Software Engineering and Computer Hardware Engineering, which emphasize the software and hardware sides of computer systems, respectively. As might be expected in such a broad field, there are many specialty areas as well, which change regularly to match the needs of the job market.* *The proposed program will support the College of Engineering's mission "to provide education, research, and service in a scholarly environment in a way that prepares our students for successful professional careers, addresses the changing needs of our other constituents, and responds to the technological challenges facing the Commonwealth and the Nation." Development of graduate programs in Computer Engineering will further enhance the College's ability to pursue its "Top 50" vision of being internationally recognized and ranked as one of the top 50 colleges of engineering in the United States.*
2b*	What is the need for the proposed program? For example, is there a shortage of trained professionals or has an accrediting/professional/government body expressed a need for this type of program? Provide justification and evidence to support the need and demand for this proposed program. Include any data on student demand; career opportunities at the regional, state, and national levels; and any changes or trends in the discipline(s) that necessitate a new program. (*300 word limit*)

3 Programs are effective the semester following approval. No program will be made effective unless all approvals, up through and including Board of Trustees and CPE approval, are received.

4 Programs are effective the semester following approval. No program will be made effective unless all approvals, up through and including Board of Trustees and CPE approval, are received.

	Strong motivating factors support the need to implement graduate programs in the area of Computer Engineering. This program will enable us to: • *Provide advanced training in the areas of computer hardware and software engineering needed to support continued regional and national workforce demands.* • *Improve our ability to recruit and retain faculty in this area, in support of not only the CPE undergraduate program but the CS and EE undergraduate and graduate programs as well.* • *Improve our ability to recruit qualified graduate Teaching Assistants with backgrounds in Computer Engineering, in support of CPE, CS, and EE programs.* • *Create an appropriate curriculum and program infrastructure for those faculty and graduate students who are already conducting research in the area of Computer Engineering. (Currently graduate students doing work in this area must identify as either CS or EE and fulfill those program requirements.)* • *Strengthen our research infrastructure by providing much-needed research and technical support for the many other disciplines and projects throughout UK who rely on expertise in Computer Engineering to support and carry out their scholarly work. The need for advanced knowledge in high-performance computing systems is growing across nearly all branches of scholarship.* *Demand and salaries in computer engineering continue to be strong. According to Bureau of Labor Statistics estimates, employment in computer occupations is projected to increase by 12.5 percent from 2014 to 2024; this growth is expected to result in nearly half a million new jobs, far more than in any other STEM field. Currently, the median annual wage for Computer Engineers ranges from $107K to $150K depending on factors like employment sector (industry, academia, government) and geographical location.(Bureau of Labor Statistics, 2015)*
2c*	List the program objectives. These objectives should deal with how students will benefit from the program, both tangibly and intangibly. Give evidence that they will benefit. (*300 word limit, (similar to 11a))* Pre-proposal question: Mission, 2)
	The goal of this program is to provide strong research and development expertise in the areas of computer hardware and software engineering needed to support continued regional and national workforce demands. Specific program objectives, reflecting expectations for accomplishments of our students in the years following graduation, are that graduates of our program will: *1. Obtain employment and advance in careers appropriate to a doctoral degree, through leadership roles in industry, entrepreneurship and business development, or positions in academia.* *2. Use their technical and professional skills to make a positive impact on society and the world.* *3. Engage in continued professional development and life-long learning.*
2d*	List the student learning outcomes (SLOs) for the proposed program. (*300 word limit)* (*More detailed information will be addressed in Section A, part 5.* Pre-proposal question: Quality, 1)
	Student Learning Outcomes (SLOs) for the proposed program, reflecting skills and abilities that students are expected to possess by the time they graduate, include the ability to: *1. Identify, analyze and solve complex technical problems in the field of computer engineering.* *2. Independently identify open questions in their areas of expertise and conduct scholarly research to address these questions.* *3. Communicate technical concepts effectively, both orally and in writing.*
2e	Provide the rationale and motivation for the program. Give reference to national context, including equivalents at benchmark institutions. *(150 word limit)*
	The number of undergraduate and graduate programs in the area of Computer Engineering is growing rapidly nationally. The fastest growth within STEM fields in recent years has been in fields related to computer

	engineering. At the graduate level, computer engineering-related programs have had some of the largest percentage increases among all engineering fields. The number of PhD degrees granted in Computer Engineering has grown more than 200% over the past 15 years. (Yoder, 2016). According to ASEE 2016 data, 46 universities now offer doctoral programs in Computer Engineering. The only program in Kentucky that covers this area is the University of Louisville, which has a doctoral program in "Computer Science and Computer Engineering" that crosses both disciplines. There is a clear need for developing a strength in this area.
2f	Describe the proposed program's uniqueness within UK. *(250 word limit)*
	The proposed Computer Engineering program does not duplicate existing programs. *First, Computer Engineering is a well-established discipline, separate from either Electrical Engineering or Computer Science. The undergraduate engineering accrediting organization, ABET, recognizes and accredits these as three separate disciplines (Electrical Engineering, Computer Science, Computer Engineering). Nearly all R1 institutions offers all three as separate undergraduate degrees. At the graduate level, the trend and most common structure is also to have a separately named degree program, as we propose. A complete discussion of the discipline and benchmark programs is included in Section 5 of the full proposal document attached with the senate forms.* *Second, Computer Engineering fits in the intersection between the CS and the ECE programs. There are large CS and EE areas that lie outside the scope of the proposed program. CS MS students are required, for instance, to take at least two of CS515 (Algorithms), CS537 (Numerical), CS575 (Theory). These courses are irrelevant for Computer Engineering. EE MS students are required to take at least three of EE611 (Deterministic Systems), EE621 (Electromagnetic Fields), EE640 (Stochastic Systems), EE661 (Solid State Electronics), EE685 (Digital Computer Structure), EE641 (Advanced Power Systems). Of these only EE661 and EE685 are relevant to Computer Engineering.* *Third, neither ECE nor CS provides the full scope of the proposed program. An MS student who wishes to concentrate in Computer Engineering would not be able to do that in either program without taking a significant amount of outside coursework.*
2g	Describe the target audience. *(150 word limit)*
	The target audience includes strong undergraduate and Master's students in Computer Engineering, Electrical Engineering, and Computer Science wishing to pursue graduate studies. It particularly pertains to students looking to work in the research and development area in industry, work in academia, or start new business ventures in this quickly growing area.
2h*	Does the program allow for any specializations? (Pre-proposal question: Mission, 1) — Yes ☐ No ☒
2i*	If "Yes," name the specialization(s). *(Specific course requirements will be described in Section A, part 7.)*
	Specialization #1:
	Specialization #2:
	Specialization #3:
2j*	Are necessary resources available for the proposed new program? (*A more detailed answer is requested in Section A, part 4.* Pre-proposal question: Cost, A) — Yes ☒ No ☐
2k	Describe how the proposed program will be administered, including admissions, student advising, retention,

	etc. *(150 word limit)*		
	The Computer Engineering PhD program will be administered by the CS department. The DGS will be in charge of advising and retention. The DGS will chair a Computer Engineering Graduate Committee consisting of 6 members of the faculty of record, appointed by the Chairs of CS (3 members, including the DGS) and ECE (3 members).		
2l	Are multiple units/programs collaborating to offer this program?	Yes ☒	No ☐
	If "Yes," please discuss the resource contribution(s) from each participating unit/program. *(150 word limit)* *(Letters of support will be addressed in Part A, section 7.)*		
	The faculty of record will include a subset of the graduate faculty from the CS and ECE departments; the DGS will be a CS member of the faculty of record. (Details are in Question 2n.)		
2m	Are there any UK programs, which the proposed program could be perceived as replicating?	Yes ☐	No ☒
	If "Yes," give a rationale for why this is not duplication, or is a necessary duplication. *(250 word limit)*		
	See description of proposed program for summary of field and how it is different from Electrical Engineering and Computer Science		
	If "Yes," two pieces of supporting documentation are required. ☐ Check to confirm that appended to the end of this form is a letter of support from the unit chair/director who may perceive this program as a replicate. ☐ Check to confirm that appended to the end of this form is verification that the chair/director of the other unit has agreement from the faculty members of the unit. This typically takes the form of meeting minutes.		
2n	Will the faculty of record for the proposed new Doctoral degree be the graduate faculty of the department/school offering the proposed new degree?	Yes ☐	No ☒
	If "No," please describe the faculty of record for the proposed Doctoral program, including: selection criteria; term of service; and method for adding/removing members. Will the existing director of graduate studies (DGS) in the department/school be the DGS for this proposed Doctoral degree?		
	The faculty of record will include a subset of the graduate faculty from the CS and ECE departments. The selection criteria will be the vote of the faculty of each of CS and ECE for their respective members. Term of service will be unlimited; faculty may be added and removed by vote of the CS or ECE faculty with respect to their respective members. The DGS will be a CS member of the faculty of record of the proposed program, selected by the chairs of the CS and ECE departments.		
2o	Will the program have an advisory board[5]?	Yes ☐	No ☒
	If "Yes," please describe the standards by which the faculty of record will select members of the advisory board, the duration of service on the board, and criteria for removal. *(150 word limit)*		
	UK DLP and eLearning Office		
3a*	Initially, will any portion of the proposed program's core courses be offered via	Yes ☐	No ☒

5 An advisory board includes both faculty and non-faculty who are expected to advise the faculty of record on matters related to the program, e.g. national trends and industry expectations of graduates.

6 For questions about alternative delivery modes, please contact UK's Distance Learning Programs and e-Learning office (http://www.uky.edu/DistanceLearning/).

	distance learning[7]? (Pre-proposal question: Quality, 4)				
	If "Yes," please indicate below the percentage of core courses that will be offered via distance learning.				
(check one)	1% - 24% ☐	25% - 49% ☐	50% - 74% ☐	75 - 99% ☐	100% ☐
	NOTE: Programs in which 25% or more of the program will be offered via distance learning may need to submit a substantive change prospectus to SACS. Please contact institutionaleffectiveness@uky.edu for assistance. *The prospectus is required by SACS, but it is NOT required for Senate review.*				
3b	If *any* percentage of the program will be offered via the alternative learning formats below, check all that apply, below.				
	☐	Distance learning.			
	☐	Courses that combine various modes of interaction, such as face-to-face, videoconferencing, audio-conferencing, mail, telephone, fax, email, interactive television, or World Wide Web.			
	☐	Technology-enhanced instruction.			
	☐	Evening/weekend/early morning classes.			
	☐	Accelerated courses.			
	☐	Instruction at nontraditional locations, such as employer worksite.			
	☐	Courses with multiple entry, exit, and reentry points.			
	☐	Modularized courses.			
3c	Give pedagogical rationale for the use of alternative delivery modes in the proposed program. Consider the aspects below and elaborate as appropriate. *(200 word limit)* • Synchronous and asynchronous components. • Balance between traditional and non-traditional aspects. • Hybrid elements.				
	None of the existing courses for the program include these alternative learning formats at this time.				
4a*	Will the program's home educational unit require new or additional faculty? (Pre-proposal question: Quality, 6 and Cost, B)			Yes ☐	No ☒
	If "Yes," provide a plan to ensure that appropriate faculty resources are available, either within UK or externally, to support the program. Note whether the new and additional faculty will be part-time or full-time faculty. If "No," explain why. *(150 word limit)*				
	The existing faculty in the ECE and CS departments are sufficient to cover the courses and advise doctoral students in the proposed PhD program.				
	If "Yes," when will the faculty be appointed? *(150 word limit)*				
4b*	Will the program's home educational unit require additional non-faculty resources, e.g. classroom space, lab space, or equipment? (Pre-proposal question: Cost, B)			Yes ☐	No ☒
	If "Yes," provide a brief summary of additional non-faculty resources that will be needed to implement this program over the next five (5) years. If "No," explain why. *(150 word limit)*				
	There is no specific additional space need for this proposed PhD program.				
4c	Will the program include courses from another educational unit(s)?			Yes ☐	No ☒
	If "Yes," list the courses and identify the other educational units and subunits that have approved the				

7 Per the Southern Association of Colleges and Schools Commission on Colleges (SACS) definition of distance education, distance education is a formal educational process in which the majority of the instruction (interaction between students and instructors and among students) in a course occurs when students and instructors are not in the same place. Instruction may be synchronous or asynchronous.

	inclusion of their courses. *(150 word limit)*
	ECE and CS will provide all primary required courses.

4d	Fill out the faculty roster below for full-time and part-time faculty teaching major core courses in the proposed new Doctoral program. *(similar to question 19)*

NAME List name & identify faculty member as FT (full-time) or PT (part-time).	**FACULTY CIP CODE**[8] List the applicable CIP Code for the faculty member.	**MAJOR CORE COURSES IN THE PROGRAM** List the major core courses in the program that the faculty member will teach and the frequency of the offering (e.g. "every spring")	**OTHER QUALIFICATIONS** *If applicable*, list any other qualifications and comment on how they pertain to the courses in the program the faculty member will teach. *If not applicable*, mark with "n/a."
Dakshramoorthy Manivannan FT	*11.07*	*CS570 Operating Systems, every fall*	*N/A unless noted otherwise*
Raphael Finkel FT	*11.07*	*CS541 Compiler Design, every fall*	
James Lumpp FT	*14.10*	*EE580 Advanced Embedded Systems (new class, schedule tbd)*	
Henry Dietz FT	*14.10*	*EE685 Digital Computer Structure, every fall*	

8 Consult your college's associate dean for faculty affairs for specific assistance with Classification of Instructional Programs codes (CIP codes).

5a	Referring to program objectives, student benefits, and the target audience (questions 2c and 2g), explain how the *program* will be assessed, which is different from assessing student learning outcomes. Include how the faculty of record will determine whether the program is a success or a failure. List the benchmarks, the assessment tools, and the plan of action if the program does not meet its objectives. *(250 word limit)*
	The Computer Engineering Graduate Committee will meet annually to review the program benchmark and SLO assessment data, and to assess the overall program quality and success. Primary program benchmarks include enrollment numbers, GPA, time to graduation statistics, publications per student, percentage of students receiving extramural funding, and the results of alumni surveys (planned for every 3-5 years).
5b	Based on the SLOs from question 2c, append a PDF of the program's curriculum map[9] to the end of this form. *(related to 2d and 14d)*
5c	Append an assessment plan[10] for the SLOs to the end of this form.

6a	Will the program require completion of a master's degree from a fully accredited institution of higher learning?	Yes ☐	No ☒
	If "No," explain below. (*150 word limit*)		
	Students with or without an MS degree may apply and be admitted, but there are differential course requirements (36 credits for students without an MS, 18 credits for students with an MS). Students entering the doctoral program without an MS degree may optionally receive an MS in Computer Engineering, once they have completed at least 24 total course credits and their PhD qualifying exam.		
6b	The Graduate School requires applicants to have an overall GPA of 2.75 on undergraduate work. Will the program have a higher undergraduate GPA requirement?	Yes ☒	No ☐
	If "Yes," describe below. (*150 word limit*)		
	Admission requirements include a minimum GPA of 3.0 in an ABET or CSAB accredited undergraduate program in Computer Engineering, Computer Science, or Electrical Engineering. (These agencies only accredit undergraduate programs.)		
6c	Will the proposed program include requirements for testing (e.g. GRE, GMAT, TOEFL) to be considered for admission?	Yes ☒	No ☐
	If "Yes," name each test and describe the specific requirements, scores, etc. below. (*150 word limit*)		
	GRE quantitative and verbal test are required, as well as TOEFL or IELTS for international or ESL applicants. There are no explicit minimum scores beyond any criteria established by the UK graduate school, but the overall strength of the application package including standardized test scores is considered in its entirety.		

9 Course mapping (or "curricular mapping") is a representation of how faculty intend to approach and assess each of the student learning outcomes identified for the courses for the degree program, with an emphasis on only those courses required for all degree candidates. It is a master chart that indicates which objectives are being met, to what extent, and how often. This identifies whether an objective is "introduced," "developed," and/or "mastered" within a given course; it may be helpful also to chart any classroom-based assessment measures used to demonstrate that claim.

10 An assessment plan is typically a tabular grid that illustrates the artifacts, rubrics, assessment team, and periods of assessment for the SLOs.

6d	Will the program have a world language requirement?	Yes ☐	No ☒
	If "Yes," describe below. (*150 word limit*)		
6e	The Graduate School allows transfer of up to nine credits or 25% of course work. Please describe transfer credit limitations below for the proposed program. (*150 word limit*)		
	None other than the established graduate school limitations.		
6f	Will the program have a research proposal requirement (Plan A)?	Yes ☒	No ☐
	(If "Yes," explain the requirements below. If "No," proceed to question 6g.)		
	All doctoral students are required to pass a Qualifying Exam (QE), no earlier than their third semester of study and no later than their sixth semester of study. The form of this qualifying exam is to be determined by the student's advisory committee, typically consisting of a written component focused on technical preparedness and background and an oral component taking the form of a dissertation proposal. The QE must be scheduled and conducted in accordance with graduate school guidelines.		
6g	Provide the final examination criteria.	Yes ☒	No ☐
	Once students have carried out the proposed research work with the guidance of their adviser and doctoral advisory committee, they prepare a dissertation document representing their original contribution to the field and present this work in a publicly announced dissertation defense. Both the dissertation document and the oral defense must be implemented in accordance with graduate school guidelines.		
6h	Describe termination criteria.	Yes ☐	No ☐
	Students must maintain a GPA of 3.0 to be considered as making satisfactory academic progress. A student whose GPA is less than 3.0 at the end of a semester is on probation; if the GPA is still below 3.0 at the end of the subsequent regular semester (Spring or Fall), the DGS may dismiss the student. All doctoral students and advisors will complete annual progress reports each year to document their progress towards degree completion.		

7a	Document the total credit hours required by level below. At least two-thirds of the minimum requirements for the Doctoral or specialist degree must be in regular courses, and at least half of the minimum course requirements (excluding thesis, practicum, or internship credit) must be in 600- or 700-level courses.			
	400G-level: *See below*	500-level: *See below*	600-level: *See below*	700-level: *See below*
7b	What is the total number of credit hours required for the degree? (e.g. 24, 32)			*36*
	If an explanation about the total credit hours is necessary, use the space below. (*150 word limit*)			
	Students entering the doctoral program with a BS degree must complete at least 36 credits of course work and complete a doctoral dissertation. Of the 36 course credits, at least 24 credits must be courses in CS, EE, or CPE. The remaining courses must be approved by the DGS. At least 18 credits of the total coursework, including 12 credits of the CS/EE/CPE coursework, must be taken at the 600 or 700 level. Students entering the doctoral program with an MS degree in a relevant discipline (typically CS, EE, or CPE, or other technical discipline relevant to their area of study as determined by the Director of Graduate Studies) must complete at least 18 credit hours of additional course work beyond their MS. Of these 18 course credits, at least 12 must be courses in CS, EE, or CPE. At least 9 credits of the total coursework, including 6 credits of the CS/EE/CPE course work, must be taken at the 600 or 700 level. All students must take 9 credits of core coursework, consisting of 3 of the 4 core classes.			

Use the grids below to list core courses, electives, courses for a concentration, etc.
Use the course title from the Bulletin or from the most recent new/change course form.

7c **Degree/Program Major Core Courses.** These courses are required for all students in the program and include prerequisite courses. Check the appropriate box to describe the course as either "program core" or "prerequisite."

Prefix & Number	Course Title	Type of Course	Credit Hrs	Course Status[11]
CS275	*Discrete Mathematics or equivalent*	Pgm Core X Prerequisite	*3*	No Change
CS315	*Algorithm Design, or equivalent*	☐ Pgm Core ☒ Prerequisite	*3*	No Change
EE280	*Digital Logic, or equivalent*	☐ Pgm Core ☒ Prerequisite	*3*	No Change
CPE287	*Embedded Systems, or equivalent*	☐ Pgm Core ☒ Prerequisite	*3*	No Change
CPE380	*Computer Architecture, or equivalent*	☐ Pgm Core ☒ Prerequisite	*3*	No Change
CS570	*Operating Systems*	☒ Pgm Core ☐ Prerequisite	*3*	No Change
EE685	*Digital Computer Structure*	☒ Pgm Core ☐ Prerequisite	*3*	No Change
CS541	*Compiler Design*	☒ Pgm Core ☐ Prerequisite	*3*	No Change
EE580	*Embedded Systems*	☒ Pgm Core ☐ Prerequisite	*3*	No Change
		*Total **Core Courses** Credit Hours:*	*12 (9 required)*	

7d	Is there any narrative about prerequisite courses for the program that should be included in the Bulletin?	Yes ☒	No ☐
	If "Yes," note below. (*150 word limit*)		
	Specific program prerequisites include a programming background (equivalent to CS215 or higher) and at least 3 of the following 5 undergraduate courses: Algorithm Design (CS315 or equivalent), Discrete Mathematics (CS275 or equivalent), digital logic (EE280 or equivalent), Embedded Systems (CPE287 or equivalent), and Computer Architecture (CPE380 or equivalent)		

7e	Is there any narrative about core courses for the program that should be included in the Bulletin?	Yes ☒	No ☐
	If "Yes," note below.		
	Students are required to take 9 credits of core coursework, to include 3 of the following 4 courses: *CS570 Operating Systems* *EE685 Digital Computer Structure* *CS541 Compiler Design* *EE580 Embedded Systems*		

11 Use the drop-down list to indicate if the course is a new course ("new"), an existing course that will change ("change"), or if the course is an existing course that will not change ("no change").

	Program Guided Electives[12] (Guided electives for all students in the program.)		
7f	Does the program include any guided electives?	Yes ☐	No ☒
	(If "Yes," indicate and note the specific courses in the grid below (7g). If "No," indicate and proceed to question 7i.)		

12 Guided electives are available to all students in the program and are organized as groups of elective courses, from which a student chooses one (or two, or three, etc.).

7g	Using the grid provided, list the guided electives below.			
Prefix & Number	Course Title		Credit Hrs	Course Status[13]
				Select one....
				Select one....
				Select one....
				Select one....
				Select one....
				Select one....
				Select one....
				Select one....
				Select one....
				Select one....
		Total Credit Hours as Guided Electives:		

7h	Is there any narrative about guided electives courses that should be included in the Bulletin?	Yes ☐	No ☒
	If "Yes," note below. (*150 word limit*)		

	Program Free Electives[14]. (Free electives for all students in the program.)		
7i	Does the program include any free electives?	Yes ☒	No ☐
	(If "Yes," indicate and proceed to question 7j. If "No," indicate and proceed to 7l.)		

7j	What is the total number of credit hours in free electives?	*27*
	We require 9 hours of core courses. An additional 27 hours adds up to 36 credits, which is the number for students coming without a Master's degree. Students coming with a Master's degree only need 9 hours past the core courses, but they likely already have some of those core courses, making the situation more complex.	
7k	Provide the free electives courses language that will be included in the Graduate School Bulletin. (*150 word limit*)	
	Aside from the 9 core-course credits, the student may select all required credits from any graduate course in CS/EE/CPE. Courses outside these departments may also count toward the credit requirement with the approval of the DGS.	

	Courses for a program's specialization(s).		
	Click HERE for a template for additional specializations[15].		
7l	Does the program include any specializations?	Yes ☐	No ☒
	(If "Yes," indicate and proceed to question 7m. If "No," indicate and proceed to 7p.)		

13 Use the drop-down list to indicate if the course is a new course ("new"), an existing course that will change ("change"), or if the course is an existing course that will not change ("no change").

14 Program free electives are available to all students in the program (regardless of any concentration(s)) and the choice of which course(s) to take is up to the student. Courses are not grouped but can be described as "student must take three courses at the 600-level or above."

15 Append a PDF with each concentration's courses to the end of this form.

7m	Specialization name:

Prefix & Number	Course Title (Check the appropriate box to describe the course as "a core course for the concentration" or "an elective course for the specialization.")		Credit Hrs	Course Status[16]
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….

7n	Provide specialization-related language that should be included in the Graduate School Bulletin. (*150 word limit*)		
7o	Does the program have an additional specialization?	Yes ☐	No ☒
	(If "Yes," indicate and proceed to question 7p. If "No," indicate and proceed to 7r.)		
7p	Specialization #2 Name:		

Prefix & Number	Course Title (Check the appropriate box to describe the course as "a core course for the specialization" or "an elective course for the specialization.")		Credit Hrs	Course Status[17]
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….
		☐ Core ☐ Elective		Select one….

16 Use the drop-down list to indicate if the course is a new course ("new"), an existing course that will change ("change"), or if the course is an existing course that will not change ("no change").

17 Use the drop-down list to indicate if the course is a new course ("new"), an existing course that will change ("change"), or if the course is an existing course that will not change ("no change").

		☐ Core ☐ Elective		Select one….
		Total Credit Hours, Concentration #2:		

7q	Provide specialization-related language that should be included in the Graduate School Bulletin for the second specialization. (*150 word limit*)
7r	Is there anything else about the proposed program that should be mentioned? *(150 word limit)*

8a	Create a degree plan for the proposed program by listing in the table below the courses that a typical student would take each semester. Use the spaces for "Year 3" and beyond only if necessary. If multiple concentrations are available, click HERE for a template for additional concentrations. Append a PDF with each concentration's semester-by-semester program of study to the end of this form.			
	YEAR 1 - FALL:	*3 CS570 Operating Systems* *3 CS541 Compiler Design* *3 EE685 Digital Computer Structure*	**YEAR 1 - SPRING:**	*3 EE580 Embedded Systems* *3 Elective* *3 Elective*
	YEAR 2 - FALL :	*3 Elective* *3 Elective* *3 Elective*	**YEAR 2 - SPRING:**	*(qualifying exam and oral proposal)* *3 Elective* *3 Elective* *3 Elective*
	YEAR 3 - FALL:	*(dissertation work)*	**YEAR 3 - SPRING:**	*(dissertation work)*
	YEAR 4 - FALL:	*(dissertation work)*	**YEAR 4 - SPRING:**	*(dissertation work & final defense)*
	YEAR 5 - FALL:		**YEAR 5 - SPRING:**	

8b	With reference to the degree plan above, explain how there is progression in rigor and complexity in the courses that make up the program. *(150 word limit)*
	Students in the program typically start with the core courses most connected to their area of interest, then progress to more advanced courses in their area of expertise as well as additional core courses. *Early in the program, students find a dissertation advisor, research their field to identify a specific problem of interest, and begin to work on their dissertation as they continue to take related advanced coursework. The dissertation process includes problem characterization, literature review and study of prior work, hypothesized solution and detailed experimental design, study implementation, data analysis and dissemination of work. Students work closely with their dissertation advisor to understand and move through this process.*

Brothers, Sheila C.

From: Nikou, Roshan
Sent: Tuesday, February 26, 2019 9:19 AM
To: Bird-Pollan, Jennifer; Jackson, Brian; Brothers, Sheila; Ett-Mims, Joanie; Price, Cleophus; Congleton, Nathan; Nikou, Roshan
Cc: Finkel, Raphael; Truszczynski, Miroslaw
Subject: Transmittals
Attachments: MS in Computer Enginnering.pdf; PhD in Computer Engineering.pdf; MS in Data Science.pdf

TO: Jennifer Bird-Pollan, Chair and Sheila Brothers, Coordinator

FROM: Brian Jackson, Chair and Roshan Nikou, Coordinator
Graduate Council

The Graduate Council approved the following proposals and is now forwarding them to the Senate Council to approve.

Programs:

MS in Computer Engineering
PhD in Computer Engineering
MS in Data Science

University of Kentucky
The Graduate School

Roshan Nikou, MA
Graduate Council Coordinator
101 Ezra Gillis Building | Lexington, KY 40506-0033
(859)257-1457 | www.gradschool.uky.edu
roshan.nikou@uky.edu

University of Kentucky
College of Engineering
Office of the Dean
353 Ralph G. Anderson Bldg.
Lexington, KY 40506
P: 859-257-1687
F: 859-257-5727 www.uky.edu

February 25, 2019

Brian Jackson
Interim Dean, Graduate School
University of Kentucky Graduate School
Ezra Gillis Building
502 Administration Drive
Lexington, KY 40506-0033

Dear Dean Jackson,

The College of Engineering has reviewed the proposal for the PhD in Computer Engineering. This review included the educational aspects and administrative feasibility of the proposed structure. I confirm that the proposal is administratively feasible, and it has the support of our college.

Sincerely,

Rudolph G. Buchheit
Dean, College of Engineering
Professor, Chemical and Materials Engineering

seeblue.

An Equal Opportunity University

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351 Ralph G. Anderson Bldg.
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www.engr.uky.edu

November 13, 2018

To Whom It May Concern:

The College of Engineering faculty reviewed the new doctoral degree program for Computer Engineering via email. There were no concerns or objections raised.

Sincerely,

Kimberly Anderson, Ph.D.
Associate Dean for Administration and Academic Affairs

Brandenburg, Barbara

From: Johnson, Michael
Sent: Thursday, September 13, 2018 1:29 PM
To: Brandenburg, Barbara
Cc: Finkel, Raphael
Subject: ECE approval of MS and PhD Computer Engineering proposal

Hi BJ,

The ECE department voted last Friday to approve the proposal for MS and PhD programs in Computer Engineering. There are a few minor wording changes, but from discussing with Raphael none of these will require re-voting of CS or ECE, so it can be considered approved by both departments. Raphael can get you an updated version.

Mike

==========

Dr. Michael T. Johnson
Professor and Chair, Electrical and Computer Engineering
FPAT 453, (859) 257-0717
University of Kentucky
http://johnson.engineering.uky.edu/

Brandenburg, Barbara

From: Brent Seales <seales@netlab.uky.edu>
Sent: Wednesday, November 7, 2018 1:30 AM
To: Brandenburg, Barbara
Subject: Re: MS/PhD Computer Engineering

Barbara,
The faculty voted unanimously on October 18 to approve the proposal with its final changes.
Brent

On Mon, Nov 5, 2018 at 11:23 PM Brandenburg, Barbara <barbara.brandenburg@uky.edu> wrote:

> Dr. Seales,
>
> I was getting ready to send these out of the College, but I can't find a date on the form where the CS faculty voted to approve it. Will you please send it to me via email?
>
> Thank you,
>
> BJ
>
> BJ Brandenburg
>
> College of Engineering
>
> Director of Student Records
>
> 355-S F. Paul Anderson Tower
>
> University of Kentucky
>
> Lexington, KY 40506-0046
>
> Tel: (859) 257-7978
>
> Fax: (859) 257-5727

SECTION B – INFORMATION REQUIRED BY CPE AND SACS			
10. Mission: Centrality to the Institution's Mission and Consistency with State's Goals			
10a	List the objectives of the proposed program. These objectives should deal with the specific institutional and societal needs that this program will address. (Pre-proposal question: Mission, 2)		
	The goal of this program is to provide strong research and development expertise in the areas of computer hardware and software engineering needed to support continued regional and national workforce demands. Specific program objectives, reflecting expectations for accomplishments of our students in the years following graduation, are that graduates of our program will: *1. Obtain employment and advance in careers appropriate to a doctoral degree, through leadership roles in industry, entrepreneurship and business development, or positions in academia.* *2. Use their technical and professional skills to make a positive impact on society and the world.* *3. Engage in continued professional development and life-long learning.*		
10b*	*Explain how the proposed program relates to the UK institutional mission and academic strategic plan.* (Pre-proposal question: Mission, 3)		
	As a key area of national growth and prominence with great cross-disciplinary impact, Computer Engineering supports UK's dedication to "improving people's lives through excellence in education, research and creative work, service, and health care" through facilitating learning, expanding knowledge, and serving as a global community for dissemination of knowledge. *Similarly, the proposed program will support the College of Engineering's mission "to provide education, research, and service in a scholarly environment in a way that prepares our students for successful professional careers, addresses the changing needs of our other of our other constituents, and responds to the technological challenges facing the Commonwealth and the Nation."*		
10c*	Explain how the proposed program addresses the state's postsecondary education strategic agenda. (Pre-proposal question: Mission, 3)		
	This program will support the CPE priority to "Increase degree and certificate completion, fill workforce shortages, and guide more graduates to a career path" as well as to "Create economic growth and development and make our state more prosperous". As noted above, demand and salaries in the area of computer engineering are a strong long-term growth area.		
10d*	Explain how the proposed program furthers the statewide implementation plan. (Pre-proposal question: Mission, 3)		
	This program is supportive of all of the CPE objectives and strategies, but most specifically supports the CPE strategies 8.4 (Prepare Kentucky postsecondary students for 21st century challenges), 9.5 (Identify current and emerging workforce demands and entrepreneurial business opportunities), 9.6 (Advance Kentucky's STEM and health agendas), 10.2 (Expand commercialization and technology transfer), 10.4 (Increase opportunities for undergraduate students to conduct or assist in research.), and 10.5 (Foster a more innovative, creative, and entrepreneurial culture). Computer Engineering is a high and long-term growth field in the STEM area, with tremendous opportunities for commercialization and tech transfer, impact on the health field, and promotion of undergraduate research efforts.		
10e*	Is an approval letter from an Educational Professional Standards Board (EPSB) required? (i.e. any program leading to teacher, principal, or superintendent certification, rank change, etc.) (Pre-proposal question: Mission, 4)	Yes ☐	No ☒
	If "Yes," please append a PDF version of the letter to this form.		
11. Quality: Program Quality and Student Success			
11a*	List all student learning outcomes of the program. (Pre-proposal question: Quality, 1)		
	Student Learning Outcomes (SLOs) for the proposed program, reflecting skills and abilities that students are expected to possess by the time they graduate, include the ability to: *1. Identify, analyze and solve complex technical problems in the field of computer engineering.*		

	2. Independently identify open questions in their areas of expertise and conduct scholarly research to address these questions. *3. Communicate technical concepts effectively, both orally and in writing.*		
11b	Explain how the curriculum achieves the program-level student learning outcomes by describing the relationship between the overall curriculum or the major curricular components and the program objectives.		
	The program core courses support the technical foundations (Developing SLOs 1 and 3, and introducing SLO 2) necessary to perform advanced research and scholarship in this area. The path of the scholarly work involved with the doctoral dissertation advances mastery of all three SLOs.		
11c*	Highlight any distinctive qualities of this proposed program. (Pre-proposal question: Demand, 2)		
	This program is a logical continuation of the undergraduate program in Computer Engineering, which began in 2006. The original proposal for that program, approved at the department and college levels, included both MS and PhD programs. The undergraduate program has grown from zero to over 200 students in the past 10 years, and CS and ECE departments already both have multiple faculty who do research in areas related to Computer Engineering. These faculty regularly bring in funding and carry out research in this area, but it is challenging to recruit graduate students (as well as TAs to support the undergraduate program) given the lack of a graduate program in this area. Addition of MS and PhD programs in Computer Engineering is an important strategic priority for the ECE and CS departments, and lack of these graduate programs inhibits our ability to recruit faculty and graduate students and carry out research work.		
11d*	Will this program replace any existing program(s) or specializations within an existing program? (Pre-proposal question: Quality, 3)		
	No		
11e*	Please specify. (Pre-proposal question: Quality, 3)		
11f	Include the projected faculty/student in major ratio.		
	We expect a steady state of approximately 10 students in this program. A proximately 10 faculty members will be involved in presenting classes and supervising dissertations at any time pertaining to this program. So the faculty-to-student ratio will be 1:1. However, this program is administered by the faculty of two departmental units who already support multiple undergraduate programs and graduate programs, so this figure is misleading.		
11g	Is there a specialized accrediting agency related to this program?	Yes ☐	No ☒
11h	Please identify the agency.		
11i	Do you plan to seek accreditation?	Yes ☐	No ☒
11j	Please explain your plans for accreditation.		
11k	Attach SACS Faculty Roster Form.		
11l*	Resources (Pre-proposal question: Quality, 2)		
11l.i	A. Describe the library resources available to support this program. You may attach any documentation provided to SACS.		
	UK library resources are already sufficient to support this program.		
11l.ii	B. Describe the physical facilities and instructional equipment available to support this program. Physical		

	facilities and instructional equipment must be adequate to support a high quality program. The proposal must address the availability of classroom, laboratory, and office space as well as any equipment needs.
	Physical facilities and instructional resources are already available to support this program. The addition of this PhD program is not likely to place undue pressure on those resources.
11m	Clearly state the admission, and retention, and completion standards designed to encourage high quality.
	The Computer Engineering graduate committee of ECE and CS faculty, led by the DGS for the program, will be in charge of the recruitment and selection process for the program. Admission guidelines are based on completion of appropriate ABET- and CSAB-accredited undergraduate degrees (these agencies only accredit undergraduate programs) plus a set of prerequisite technical coursework. Annual reviews monitoring student progress toward degree completion will be completed to mointor and encourage student success. *Many students will come through our own UK CS, EE, or Computer Engineering undergraduate programs. Eligibile students will be considered for TAs in the CS or ECE departments to support Computer Engineering courses, and faculty in both CS and ECE will recruit applicants for RA positions as well.*
11n	Clearly state the degree completion requirements for the program.

	Name	Total number of hours required for degree	Number of hours in degree program core	Number of hours in guided electives	Number of hours in free electives
	Program	*36*	*9*	*0*	*27*

11o	Describe how the proposed program will articulate with related programs in the state. It should describe the extent to which student transfer has been explored and coordinated with other institutions. Attach all draft articulation agreements related to this proposed program.
	The University of Louisville is the only university in Kentucky with graduate programs that include the area of Computer Engineering, offering both MS and PhD degrees in "Computer Engineering and Computer Science". (However, it does not offer stand-alone Computer Engineering degrees.) U of L, UK, and Western Kentucky have accredited undergrad EE programs, and U of L, UK, and Eastern Kentucky have accredited undergrad CS programs, and students from any of those programs would be eligible to apply to the proposed doctoral program. Since this is a doctoral program based primarily on faculty mentorship and research work rather than coursework, and both U of L and UK allow for course transfer between programs, there is no need for an explicit articulation agreement.
11p	List courses under the appropriate curricular headings. (*refer to question 18 for template*)
	Refer to question 18 for course listings.
11q*	Will this program utilize alternative learning formats (e.g. distance learning, technology-enhanced instruction, evening/weekend classes, and accelerated courses)? (Pre-proposal question: Quality, 4)
	No.

12. Demand: Program Demand/Unnecessary Duplication

Student Demand:

12a*	Provide justification and evidence to support the need and demand for this proposed program. Include any data on student demand; career opportunities at the regional, state, and national levels; and any changes or trends in the discipline(s) that necessitate a new program. For example, is there a shortage of trained professionals or has an accrediting/professional/government body expressed a need for this type of program? (Pre-proposal question: Demand, 1; *same as question 2b*)
	STEM fields are continuing their upward growth in terms of undergraduate and graduate degrees awarded. Of those degrees, the largest percentage increases in recent years have been in fields related to computer engineering. For example, from the most recent ASEE data, growth in Bachelor's degrees in Computer

Engineering from 2014 to 2015 was 16.2% while combined Electrical and Computer Engineering Bachelor's grew 21.3%. At the graduate level as well, computer engineering-related programs had some of the largest percentage increases among all engineering fields. Nationally, PhD degrees awarded in Computer Engineering have grown more than 200% in the past 15 years (Yoder, 2016).
Salary growth in computer engineering continues to be strong. According to Bureau of Labor Statistics estimates, employment in computer occupations is projected to increase by 12.5 percent from 2014 to 2024; this growth is expected to result in nearly half a million new jobs, far more than in any other STEM field. Currently, the median annual wage for Computer Engineers ranges from $107K to $150K depending on factors like employment sector (industry, academia, government) and geographical location.(Bureau of Labor Statistics, 2015)
In fact, nearly all of the 10 fastest growing STEM occupations that require a bachelor's or higher degree are in the computer and mathematics groups. Some of the fastest growing of these are in computer systems design and related services. The rapid growth projected is due in large part to the projected growth for the industry of 23 percent. (Fayer, 2017)

12b Identify the applicant pool and how they will be reached.

Students will be actively recruited by faculty within our ECE and CS departments to their existing and new funded research programs, through contact on campus, at conferences and workshops and through online advertisements. We also plan to actively recruit our own UK CS, EE, and CPE undergraduate students, including through the University Scholars program as well as undergraduate research programs.
Computer Engineering is a high-demand field and there is a large pool of eligible applicants

12c Describe the student recruitment and selection process.

The graduate committee, led by the DGS for the program, will be in charge of the recruitment and selection process for the program. Faculty in the program will also personally recruit students in their area of interest to apply to the program.

12d Identify the primary feeders for the program.

All state and national undergraduate programs in EE, CS, or Computer Engineering. Primary feeders are UK undergraduate programs, and faculty-recruited graduate students in specific research areas. There are now hundreds of programs in each of these areas.

12e Provide any evidence of a projected net increase in total student enrollments to the campus as a result of the proposed program.

Estimated net increase in student enrollments is around 5-8 students total.

12f Project estimated student demand for the first five years of the program.

Academic Year	Degrees Conferred	Majors (Headcount) - Fall Semester
2016-2017	*0*	*4*
2017-2018	*0*	*7*
2018-2019	*2*	*10*
2019-2020	*2*	*10*
2020-2021	*2*	*10*

12g Employer Demand:

Describe the types of jobs available for graduates, average wages for these jobs, and the number of anticipated openings for each type of jobs at the regional, state, and national levels.

The following table shows a 5-year prediction of number of jobs and average salary (or salary range) for several job categories related to this degree program. The data come from the Kentucky Future Skills Report at kcews.ky.gov and the Federal Department of Labor Bureau of Labor Statistics at www.bls.gov. The categories do not exactly fit the range of jobs that graduates of this program will seek.

Job category	Regional	State	National
Network and Computer Systems administrator	85 ($61K)	395 ($53K-$77K)	1,956,500 ($81K)
Computer Systems Analyst	193 ($76K)	973 ($66K-$80k)	3,002,500 ($88K)
Software Developers, Systems Software	107 ($84K)	341 ($72K-$91K)	6,281,000 ($104K)
Computer and Information Research Scientists	6 ($103K)	20 ($91K-$112K)	139,500 ($115K)

12h	Similar programs:		
	Are there similar programs in other Southern Regional Education Board (SREB) states and in the nation?	Yes ☒	No ☐
	If "Yes," please identify similar programs in other SREB states and in the nation.		
	There are approximately 46 doctoral programs in Computer Engineering in the nation, broadly distributed geographically. See ASEE data for full list of these programs.		
12i*	Academic Disciplinary Needs:		
	Is the proposed program an advance practice doctorate? (Pre-proposal question: Advanced Practice Doctorate, 1)	Yes ☐	No ☒
	If "Yes," please, explain the new practice or licensure requirements in the profession and/or requirements by specialized accrediting agencies that necessitate a new doctoral program.		
	If "Yes," completion of Section C (Advance Practice Doctorate) is required.		

Please note: Section 13 has been replaced with Section C (at the end of the document).

14. Assessment and Oversight

14a* Describe how each program-level student learning outcome will be assessed and how assessment results will be used to improve the program. ***(Pre-proposal question: Assess, 1)***

Student Learning Outcomes

Student Learning Outcomes (SLOs) for the proposed program, reflecting skills and abilities that students are expected to possess by the time they graduate, include the ability to:

1. Identify, analyze and solve complex technical problems in the field of computer engineering.
2. Independently identify open questions in their areas of expertise and conduct scholarly research to address these questions.
3. Communicate technical concepts effectively, both orally and in writing.

Required curricular program elements include:

- 3 of the following 4 core courses; CS570 Operating Systems, EE685 Digital Computer Structure, CS541 Compiler Design, EE580 Embedded Systems
- A doctoral qualifying exam, which typically includes both a written and oral component

- A doctoral dissertation including a written dissertation document and oral defense

SLO Curriculum Mapping

	Problem solving	Contribution to scholarly work	Effective Communication
CS570	Dev	Introduce	Dev
EE685	Dev	Introduce	Dev
CS441	Dev	Introduce	Dev
EE580	Dev	Introduce	Dev
Dissertation	Master	Dev & Master	Master

SLO Assessment

SLOs are assessed through SLO-targeted assignments and test questions in each of the core courses, as well as through the written and oral components of the PhD dissertation.

Specifically, CS570 and CS441 will include assessment of SLO 1 and 2. CS685 and EE580 will include assessment of SLO3.. A rubric with separate sub-elements for each of the 3 SLOs will be filled out by committee members at the time of the thesis oral defense, assessing both the written report document and the oral defense as primary assessment artifacts.

The DGS for the program will collect this data from course instructors and student committee members. The program graduate curriculum committee will meet annually to review this data, identify any concerns or weaknesses, and recommend course or program changes to address those concerns.

14b Describe program evaluation procedures for the proposed program. These procedures may include evaluation of courses and faculty by students, administrators, and departmental personnel as appropriate. Program review procedures shall include standards and guidelines for the assessment of student outcomes implied by the program objectives and consistent with the institutional mission. *(300 word limit)*

The graduate committee for the program will annually meet to review the program benchmark data and SLO assessment data, and assess the overall program quality and success. Primary program benchmarks include FT and PT enrollment numbers, GPA, time to graduation statistics, student placement data including job placement and continued graduate study, and the results of alumni surveys (planned for every 3-5 years). Also see the attached curriculum map and assessment plan.

14c Identify both the direct and indirect methods by which the intended student learning outcomes (SLOs) will be assessed. *(300 word limit)*

All currently planned SLO assessment is through direct methods. We will likely include some additional indirect assessment, especially early in the program implementation, in the form of student surveys that include questions about their opinions of SLO achievement through the program.

SLOs are assessed through SLO-targeted assignments and test questions in each of the core courses, as well as through the written and oral components of the PhD dissertation.

Specifically, CS570 and CS441 will include assessment of SLO 1 and 2. CS685 and EE580 will include assessment of SLO3. A rubric with separate sub-elements for each of the 3 SLOs will be filled out by committee members at the time of the dissertation oral defense, assessing both the written report document and the oral defense as primary assessment artifacts.

Also see the attached curriculum map and assessment plan.

14d **Procedures for Course Mapping of SLOs *(related to question 5b)***

14d.i	Which components will be evaluated, i.e. course mapping? *(300 word limit)*
	Instructors will select specific assignment components and test questions to assess that match the desired SLO for the course. Specifically, CS570 And CS441 will include assessment of SLO 1 and 2. CS685 And EE580 will include assessment Of SLO 3. *A standard rubric will cover all 3 SLOs for the dissertation defense and report document.*
14d.ii	When will components be evaluated? *(150 word limit)*
	Instructors will be contacted by the DGS and Computer Engineering graduate committee regarding the needed assessment, and the committee will review the selected components on a semi-annual basis.
14d.iii	When will the data be collected? *(150 word limit)*
	Course-based assessment will be assessed by instructors during the course. All 4 SLOs will be assessed at the time of the dissertation defense.
14d.iv	How will the data be collected? *(150 word limit)*
	For course assessment as well as for dissertation assessment, instructors will assess the applicable SLO via a standardized rubric.
14d.v	What will be the benchmarks and/or targets to be achieved? *(150 word limit)*
	The rubrics will include sub-elements with categories of "below expectations"=1, "meets expectations"=2, and "exceeds expectations"=3. The mean of these sub-elements will be computed, with a benchmark of a mean value of at least 2 for each SLO.
14d.vi	What individuals or groups will be responsible for data collection? *(150 word limit)*
	Course instructors and faculty committee members will collect the data and give it to the DGS for aggregation and review by the graduate committee.
14d.vii	How will the data and findings be shared with faculty? *(150 word limit)*
	The graduate committee will review and make recommendations for action items, which will be distributed to faculty in ECE and CS departments for approval at faculty assessment meetings held each fall semester.
14d.viii	How will the data be used for making programmatic improvements? *(150 word limit)*
	The graduate committee will make recommendations for programmatic improvements based on the assessment results.
14d.ix	What are the measures of teaching effectiveness? *(150 word limit)*
	Evaluation of teaching effectiveness is separate from program evaluation or evaluation of SLOs. *Instructors in the program will be individually assessed for teaching effectiveness using TCE as well as peer review and other measures in accordance with the performance evaluation standards used in each instructors home department.* *If SLO assessment indicates problems with teaching effectiveness within specific core courses, that information will be shared with the department chair for discussion and follow up with instructors as a part of the regualr performance evaluation process.*
14d.x	What efforts to improve teaching effectiveness will be pursued based on these measures? *(150 word limit)*
	Efforts to improve teaching effectiveness will be pursued on a case-by-case basis with individual faculty involved with the program.
14d.xi	What are the plans to evaluate students' post-graduate success? *(150 word limit)*
	We plan to conduct an alumni survey approximately every 3-5 years. (More frequently in the first few years after the program has started operating.)

15. Cost and Funding of the Proposed Program[18]			
15a	Will this program require additional resources?	Yes ☐	No ☒
	If "Yes," please provide a brief summary of additional resources that will be needed to implement this program over the next five years. *(300 word limit)*		
	We currently have adequate faculty to support the core PhD program as laid out in this proposal.		
15b	Will this program impact existing programs and/or organizational units within your institution? *(300 word limit)*	Yes ☐	No ☒
	If "Yes," briefly describe.		
	All faculty with research related to this area will be positively affected by the addition of graduate students and programs that better align to their field.		
15c	Provide adequate documentation to demonstrate sufficient return on investment to the state to offset new costs and justify approval for the proposed program. *(300 word limit)*		
	See question 2b and 12a. *There is minimal new investment required for implementing either the MS or PhD programs in this area.* *The benefit is significant — implementing these graduate programs is a top priority of the CS and ECE faculty in this area, because lack of the programs has impeded our ability to recruit both faculty and grad students and restricts our ability to perform cutting-edge research in this important growth area.* *Computer Engineering is an area of national need, rapid workforce development, and one in which we already have an undergraduate program but not the graduate programs that are necessary to recruit faculty, support research work, or recruit TAs for those undergraduate programs. Since the undergraduate program and departmental support structure is already in place, the cost of adding the proposed program is minimal.*		

16.* Budget Funding Sources, by Year of Program					
All the fields in number 16 are required for the CPE's pre-proposal form. Estimate the level of new and existing resources that will be required to implement and sustain the program using the spreadsheet below. Please answer in terms of dollar amounts. All narratives have a 100-word limit. (Pre-proposal question: Cost, A)					
Total Resources Available from Federal Sources (Federal sources include grants, earmarks, etc.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative/Explanation:	*No known federal resources for creation of new program in this area*				
Total Resources Available from Other Non-State Sources (Non-state sources include philanthropies, foundations, individual donors, etc.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative/Explanation:	*No established donors identified for this effort.* *Initial creation of Computer Engineering program was aided by $650k grant from Lexmark, which at that time was intended to fund undergraduate and graduate programs in this area.*				

18 For questions about cost and funding of the program, please contact your department chair, business officer, or associate dean for academic affairs.

State Resources (State sources include general fund revenue, grants, pass-thru funds, etc.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative/Explanation:	*No specific state allocations have been made.*				
Internal (The source and process of allocation and reallocation should be detailed, including an analysis of the impact of the reduction on existing programs and/or organization units.)[19]:	1st Year	2nd Year	3rd Year	4th Year	5th Year
(New) Allocated Resources	*0*	*0*	*0*	*0*	*0*
(Existing) Reallocated Resources	*0*	*0*	*0*	*0*	*0*
Narrative/Explanation:	*There is already an undergraduate program in this area operated by CS and ECE together, and an existing departmental structure with allocated faculty lines in CS and ECE. Because budgeting is at the unit level and there is no budgeting differentiation between resources at the programmatic level (i.e. specific allocations to individual undergraduate and graduate programs), there is no need for any re-budgeting to support the proposed graduate program.*				
Student Tuition (Describe the impact of this program on enrollment, tuition, and fees.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*10100*	*40600*	*71100*	*71100*	*71100*
Existing	*30500*	*30500*	*30500*	*30500*	*30500*
Narrative/Explanation:	*Estimated enrollments in program of 4, 7, 10, 10, 10, with about 1/3 of those students who would otherwise be in either CS or ECE. (New = 1, 4, 7, 7, 7, Existing = 3,3,3,3,3) Approximately 50% of our current student base are in-state, so a 50/50 balance has been assumed for tuition rates .*				
Total Funding Sources	1st Year	2nd Year	3rd Year	4th Year	5th Year
Total New	*10100*	*40600*	*71100*	*71100*	*71100*
Total Existing	*30500*	*30500*	*30500*	*30500*	*30500*
TOTAL FUNDING SOURCES	40600	71100	101600	101600	101600
17.* Breakdown of Program Expenses/Requirements[4]					
(Please note – all the fields in number 17 are required for the CPE's pre-proposal form.) (Pre-proposal question: Cost, B)					
Staff: Executive, Administrative & Managerial (Include salaries and whether new hires will be part time or full time.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*7500*	*7500*	*7500*	*7500*	*7500*

19 The source and process of allocation and reallocation should be detailed, including an analysis of the impact of the reduction on existing programs and/or organizational units.

Existing	*3250*	*3250*	*3250*	*3250*	*3250*
Narrative/Explanation[20]:	*Primary administrative and logistical support is already in place in the CS and ECE departments. New cost is reflective of the need for a new DGS position, including 1 month of summer salary, which would support both proposed MS and PhD programs (so 1/2 of position included in this proposal). Existing cost is reflective of administrative support within departments for additional students. Currently grad student logistics represents less than 1/4 time of a staff member, estimate is that additional students causes increase in workload by less than 50%, so equivalent to 1/8 of a staff person. As with DGS, 1/2 of this included in this proposal, 1/2 in the MS program proposal.*				
Other Professional (Include salaries.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	0	0	0	0	0
Existing	0	0	0	0	0
Narrative/Explanation:					
Faculty (Include salaries and whether new hires will be part time or full time.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative/Explanation[21]:					
Graduate Assistants (Include salaries and/or stipends.)[22]	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*27000*	*27000*	*27000*	*27000*	*27000*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:	*Budgeting 1 additional TA position in both CS and ECE to support courses, approximately 54k per year including 30k stipends and 24k tuition. As with other costs, 1/2 of this included in this proposal and 1/2 in the PhD proposal.*				
Student Employees (Include salaries and/or stipends.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Equipment and Instructional Materials	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Library (Include new journal subscriptions, collections, and	1st Year	2nd Year	3rd Year	4th Year	5th Year

20 Discuss whether new hires will be full-time or part-time.

21 If new hires are involved, explain whether new hires will be full-time or part-time.

22 Identify the number of assistantships/stipends to be provided; include the level of support for each.

electronic access.)					
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Contractual Services	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Academic and/or Student Services	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Other Support Services	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Faculty Development (Include travel, conference fees, consultants, etc.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Assessment (Include personnel, software tools, data collection tools, survey administration, outside consulting services, etc.)	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:	*Both departments already have assessment plans and processes in place, so there is negligible new cost to implement this process.*				
Student Space and Equipment	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:	*Students are expected to be seated in faculty research labs. This is a pressing issue due to overall growth in the department and the college, but will be negligibly affected by this new program.*				
Other	1st Year	2nd Year	3rd Year	4th Year	5th Year
New	*0*	*0*	*0*	*0*	*0*
Existing	*0*	*0*	*0*	*0*	*0*
Narrative Explanation/Justification:					
Total Expenses/Requirements	1st Year	2nd Year	3rd Year	4th Year	5th Year

New	*34500*	*34500*	*34500*	*34500*	*34500*
Existing	*3250*	*3250*	*3250*	*3250*	*3250*
TOTAL Program Budgeted Expenses/Requirements:	*37750 annual continuing cost*				
GRAND TOTAL	1st Year	2nd Year	3rd Year	4th Year	5th Year
Total Funding Sources	*10100*	*40600*	*71100*	*71100*	*71100*
Total Expenses/Requirements	*37750*	*37750*	*37750*	*37750*	*37750*
TOTAL NET COST:	*27650*	*-2850*	*-33350*	*-33350*	*-33350*

18. Course Descriptions (*complete for question 11p*)	
18a	**Program Core Courses (includes pre-major and pre-professional courses)**
Prefix & Number	Course Description (from the Bulletin or the most recent new/change course form)
CS570	*Modern Operating Systems* *Brief review of classical operating system concepts (process and memory management, process coordination, device drivers, file systems, starvation/deadlock). Modern topics of files systems (log-structured file systems, distributed file systems, memory-based file systems), operating system design (monolithic, communication-kernel, extensible/adaptable, distributed shared memory), multiprocessor issues (scheduling, synchronization, IPC), security (internet attacks, encryption, defenses). Inspection and modification of actual operating system code (Linux).*
EE580	*Embedded System Design* *Embedded System Design covers the design and implementation of hardware and software for embedded computer systems. Topics include architectural support for embedded systems, power management, analog and digital I/O, real-time processing design constraints and the design of embedded systems using a real-time operating systems. Prereq: EE/CPE 287, EE/CPE 380, and engineering standing or consent of instructor.*
CS541	*Compiler Design* *Intermediate aspects of a compilation process with an emphasis on front-end issues. Practical issues in using compiler writing tools. Code generation for expressions, control statements and procedures (including parameter passing). Symbol tables, runtime organization for simple and structured variables. Using compilers and translators for automation (filters, programs writing programs).*
EE685	*Digital Computer Structure* *Study of fundamental concepts in digital computer system structure and design. Topics include: computer system modeling based on instruction set processor (ISP) and processor-memory-switch (PMS) models, design and algorithms for ALU, processor, control unit and memory system. Special topics include floating-point arithmetic, cache design, pipeline design technologies, and parallel computer architectures. Prereq: EE 380 and EE 581 or consent of instructor.*
18b	**Program Guided Electives Courses (for the major)**
Prefix & Number	Course Description (from the Bulletin or the most recent new/change course form)

18c	**Program Free Electives Courses**
Prefix & Number	Course Description (from the Bulletin or the most recent new/change course form)
	Free electives include all CS, EE, and CPE 500 or 600 level courses. (More than 100 courses.)

18d	**Courses for a Track.** (If multiple tracks are available, click HERE for a template for additional tracks. Append a PDF to the end of this form with each track's courses and descriptions.	
Prefix & Number	Course Type	Course Description (from the Bulletin or the most recent new/change course form)
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	
	☐ Track Core ☐ Track Elective	

19. Specific faculty involved in the degree program. [SACS Faculty Roster]

Fill out the SACS[23]-required faculty roster below, for full-time and part-time faculty teaching in the program. Abbreviations for the NAME and COURSES TAUGHT columns are below the table. *Please contact Institutional Effectiveness for help with this question. (similar to question 4d)*

NAME List name & Identify faculty member as F or P.	COURSES TAUGHT Include term; course prefix, number and title; & credit hours. (D, UN, UT, G)	ACADEMIC DEGREES AND COURSEWORK List relevant courses taught, including institution and major. List specific graduate coursework, if needed	OTHER QUALIFICATIONS AND COMMENTS Note qualifications and comments as they pertain to course taught.	NEW COURSES Include course prefix, number, and title.
Dakshramoorthy Manivannan F	*CS570 Operating Systems G*	*PhD CS Engineering Ohio State 1997*		
Raphael Finkel F	*CS541 Compiler Design G*	*PhD CS Stanford 1976*		
James Lumpp F	*EE585 Fault Tolerant Computing G* *EE580 Advanced Embedded Systems G* *EE588 Realt Time Operating Systems G*	*PhD EE Purdue 1988*		
Himanshu Thapliyal F	*EE599 Nanocomputing Circuits G*	*PhD CS Engineering U of S Florida 2011*		
Henry Dietz F	*EE599 Cameras as a Computing System G* *EE599 Cluster Computing G*	*PhD CS Polytechnic U 1987*		
Sen-ching Cheung F	*EE599 Cybersecurity G*	*PhD EE U Cal Berkeley 2002*		
Victor Marek F	*CS585 Computer Security G*	*PhD Mathematics Warsaw U 1972*		
Kenneth Calvert F	*CS585 Network Security G*	*PhD CS UT Austin 1991*		
Mirek Truszczynski F	*CS515 Algorithm Design G*	*PhD Mathematics Warsaw*		

23 Southern Association of Colleges and Schools Commission on Colleges (SACS).

		U 1980		
Nathan Jacobs F	*CS460G Machine Learning G* *CS636 Computer Vision G*	*PhD CS Washington U 2010*		
Lirong Cui F	*CS585 Advanced Data Science G*	*PHD CS Case Western U 2014*		
Joseph Elias P	*EE584 VLSI Design G* *EE589 Advanced VLSI G*	*PhD EE Rice U 1990*		
(Other CS and ECE faculty)	*(Numerous elective courses)*			
FT = full time PT= part time	D = developmental UN = undergraduate nontransferable		UT = undergraduate transferable G = graduate	

SECTION C – ADVANCE PRACTICE DOCTORATE			
20.* Advance Practice Doctorate New Program Proposal			
	Complete this section only if you answered "YES" to 12i.		
20a*	Does the curriculum include a clinical or experiential component?	Yes ☐	No ☐
	If "Yes," list and discuss the nature and appropriateness of available clinical sites. (*300 word limit*)		
20b*	Describe how the doctorate builds upon the reputation and resources of the existing master's degree program in the field. (*300 word limit*)		
20c*	Explain the new practice or licensure requirements in the profession and/or requirements by specialized accrediting agencies that necessitate a new doctoral program. (*300 word limit*)		
20d*	Explain the impact of the proposed program on undergraduate education at the institution. Within the explanation, note specifically if new undergraduate courses in the field will be needed. (*300 word limit*)		
20e*	Provide evidence that funding for the program will not impair funding of any existing program at any other public university. (*300 word limit*)		

----- End forwarded message -----
----- Forwarded message from "Pearson, RaeAnne" <raeanne.pearson@uky.edu> -----

Date: Mon, 16 Jul 2018 17:29:42 +0000
From: "Pearson, RaeAnne" <raeanne.pearson@uky.edu>
To: Raphael Finkel <raphael@cs.uky.edu>
Subject: substantive Change-Computer Engineering, PhD

Dear Dr. Finkel,

Thank you for submitted a NOI regarding the proposed program, Computer Engineering, PhD (14.0901).

My email will serve 2 purposes: 1.) Next steps for SACSCOC, and 2.) Verification and notification that you have contacted OSPIE-a Senate requirement for proposal approval.

1. Next steps for SACSCOC: None required
2. Verification that OSPIE has reviewed the proposal: Based on the proposed documentation presented and the Substantive Change Checklist, the proposed program does not constitute a substantive change as defined by the University or SACSCOC, the university's regional accreditor. Therefore, no additional information is required by the Office of Strategic Planning & Institutional Effectiveness at this time. The proposed program may move forward in accordance with college and university-level approval processes.

Should you have questions or concerns about UK's substantive change policy and its procedures, please do not hesitate contacting me.

RaeAnne Pearson, PhD
Office of Strategic Planning & Institutional Effectiveness University of Kentucky
Phone: 859-218-4009
Fax: 859-323-8688
Visit the Institutional Effectiveness Website:
https://na01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.uky.edu%2Fie&data=02%7C01%7Cbarbara.brandenburg%40uky.edu%7Cd56491f67b354541a08208d5f7dcd181%7C2b30530b69b64457b818481cb53d42ae%7C0%7C0%7C636687450146311034&sdata=T4Ve%2BVOe5g1q6RP2PXoVtsxwU0WPK478YBpxjn%2BenZg%3D&reserved=0
[eeblue60_100_286]

----- End forwarded message -----

University of Kentucky

24 April 2019

MEMORANDUM OF UNDERSTANDING BETWEEN

The Computer Science Department
and
The Electrical and Computer Engineering Department

Regarding Proposed MS and PhD programs in Computer Engineering

This Memorandum of Understanding (MOU) indicates a voluntary agreement between the Computer Science (CS) Department and the Electrical and Computer Engineering (ECE) Department to assist in the implementation of the proposed new MS and PhD programs in Computer Engineering, which will be housed in the CS department and jointly administered between the two departments.

While the proposal for the new programs in Computer Engineering states that "both departments will work together to make sure the programs are intellectually sound" (RF 3-20-2019), this MOU is intended to make it clear that specific joint conversations about resource-sharing and allocation have occurred between the leadership of the two departments and that a clear arrangement for supporting the proposed MS and PhD programs in Computer Engineering has been agreed upon by both sides. In addition, this MOU specifies agreed-upon arrangements for course-sharing, funding, graduate support, and other material issues related to the resources needed for making the programs work.

Term One: Shared Teaching Responsibilities and Allocation of Faculty to Program Support
Parties agree to shared responsibility for course teaching assignments in collaboration with department chairs and other program DGS/DUS. As outlined in more detail in the program proposals, the MS and PhD programs in Computer Engineering include a substantial number of courses cross-listed with CS and/or EE, which are roughly balanced in terms of number of courses and which will typically be taught by faculty in those home departments. The core courses for the MS Thesis Option and for the PhD include two CS cross-listed courses and two EE cross-listed courses.

Term Two: Teaching Assistant Support
Parties agree to a shared TA allocation mechanism for courses being taught in the proposed Computer Engineering graduate programs. In most cases, TA support for each course in the program will be the responsibility of the home department of the primary instructor for that course.

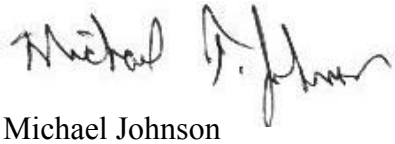
Term Three: Teaching Assistant Recruiting
Parties agree to the development of a recruiting plan for TAs to align with program goals, and with a resource plan for the College of Engineering to recruit TA slots as a percentage of overall departmental TA allocations based on program enrollments and the number of departmental faculty advising students in the program.

Term Four: The Director of Graduate Studies for the Program
Parties agree that the Computer Science department will recruit and support a program DGS and will supply staff support for advising and other duties related to the successful running of the program.

Term Five: Faculty Recruiting and Hiring
Parties agree to coordinate respective faculty searches in order to identify, recruit, and hire qualified faculty for the program as resources become available.

Appendix: Program Administration details
Section 4 of the program proposal as approved by faculty of both CS and ECE departments describes the details of Program Administration and is attached to this MOU as an appendix for reference.

W. Brent Seales
Professor and Chair
Computer Science Department



Michael Johnson
Professor and Chair
Department of Electrical and Computer Engineering