

Brothers, Sheila

From: Soult, Allison
Sent: Sunday, April 21, 2019 9:33 PM
To: Bird-Pollan, Jennifer; Brothers, Sheila; Ett-Mims, Joanie
Cc: Liao, Yuan; Cramer, Aaron
Subject: New Graduate Certificate: Power Systems
Attachments: NewGraduateCertificateApp_PwrSys_Revised (1).pdf

Proposed New Graduate Certificate: Power Systems

This is a recommendation that the University Senate approve the establishment of a new Graduate Certificate: Power Systems, in the Department of Electrical and Computer Engineering within the College of Engineering.

Rationale: There is a strong need for power systems professionals in the workforce. This certificate will target those in industry, government, and academia with the flexibility of an online program. This certificate takes advantage of existing courses and expertise among faculty at UK and will help those working in the field the opportunity to learn and master the latest information in this area. Several courses are available online now and additional courses are planned that would also support this certificate. Initial enrollment is expected to be 5 students with growth to 10 students per year.

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NEW GRADUATE CERTIFICATE

Certificate Description. A graduate certificate shall have a clear and focused academic topic or competency as its subject, meet a clearly defined educational need of a constituency group, such as required continuing-education or accreditation for a particular profession, respond to a specific state mandate or provide a basic competency in an emerging (preferably interdisciplinary) topic. Certificates are minimally nine graduate credit hours but typically no more than 15.

Approval process. Once approved at the college level, your college will send the proposal to the appropriate Senate academic council (possibly HCCC and/or UC) 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 SC and University Senate. (The contact person listed on the form will be informed when the proposal has been sent to committee and other times as appropriate.) The last step in the process is Senate approval; upon Senate approval, students can enroll in the new certificate.

By default, graduate certificates shall be approved for a period of six (6) years. Re-approvals are also for six years.

1. GENERAL INFORMATION			
1a	Home college: <i>College of Engineering</i>		
1b	Home educational unit (department, school, college ¹): <i>Department of Electrical and Computer Engineering</i>		
1c	Office of Strategic Planning and Institutional Effectiveness (OSPIE) (Please contact OSPIE (OSPIE@L.uky.edu) for help with questions in this section.)		
	Date of contact with OSPIE: 12/7/18		
	<input checked="" type="checkbox"/> Appended to the end of this form is a PDF of the reply from OSPIE.		
	<input checked="" type="checkbox"/> Appended to the end of this form is a letter(s) of administrative feasibility from the dean(s) of the college(s) offering the certificate.		
	CIP Code (confirmed by OSPIE): 14.1001		
1d	Proposed certificate name: <i>Graduate Certificate in Power Systems</i>		
1e	Requested effective date:	<input checked="" type="checkbox"/> Fall semester following approval.	OR <input type="checkbox"/> Specific Date ² : <i>Fall 20</i>
1f	Contact person name: <i>Yuan Liao</i>	Email: <i>yuan.liao@uky.edu</i>	Phone: <i>8592576064</i>
2. OVERVIEW			
2a	Provide a brief description of the proposed new graduate certificate. (300 word limit)		
	<i>The proposed online Graduate Certificate in Power Systems is designed to provide students with the core knowledge and latest advancements in power systems analysis, modeling, operation, control, optimization, and integration of renewable energies, and produce well trained graduates in this specialty. Students will learn the theory in various aspects of power systems and master the tools and techniques for planning and operating power systems and solving real-world problems.</i>		

¹ Only cross-disciplinary graduate certificates may be homed at the college level.

² Certificates are typically made effective for the semester following approval. No program will be made effective unless all approvals, up through and including University Senate approval, are received.

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	<i>With increasing deployment of advanced technologies in power system including power generation, transmission and distribution sectors, there is a strong need for upgrading the expertise of power engineers. With increasing opportunities in power engineering workforce, there is also ample incentive for non-power engineers to quickly learn and master the latest knowledge in power systems, and find a promising pathway into the power engineering workforce. This new certificate will target professionals in government, private industry and academia.</i>		
2b	This proposed graduate certificate (check all that apply):		
	<input checked="" type="checkbox"/>	Has a clear and focused academic competency as its subject.	
	<input type="checkbox"/>	Meets a clearly defined educational need of a constituency group (e.g. continuing education or licensing)	
	<input type="checkbox"/>	Responds to a specific state mandate.	
	<input type="checkbox"/>	Provides a basic competency in an emerging, preferably interdisciplinary, topic.	
2c	Affiliation. Is the graduate certificate affiliated with a degree program? (related to 3c)	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
	If "yes," include a brief statement of how it will complement the program. If "no," incorporate a statement as to how it will provide an opportunity for a student to gain knowledge or skills not already available at UK. (300 word limit)		
	<i>This certificate provides an opportunity for professionals in industry to learn the latest developments in power systems by taking online courses that will easily suit their busy working schedules.</i>		
2d	Duplication. Are there similar regional or national offerings?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
	If "Yes," explain how the proposed certificate will or will not compete with similar regional or national offerings.		
	<i>Yes, there are similar national offerings. One example is Iowa State University's Power Systems Engineering Graduate Certificate Online Program. They offer two regular and two special topic courses. We plan to offer more online courses to meet student needs, which will include more state-of-the-art topics and contents. University of Kentucky is flagship university in Kentucky and has a strong interest in power systems. By developing state-of-the-art course material and employing innovative online course delivery method, we expect it to be very competitive to other offerings.</i>		
2e	Rationale and Demand. State the rationale for the new graduate certificate and explain the need for it (e.g. market demand, student requests, state mandate, interdisciplinary topic). (400 word limit)		
	<i>There is a strong need for power system professionals in the national labor force. This new certificate will provide the opportunities for non-power professionals to gain a solid foundation in power systems and provide them a promising pathway into the power engineering workforce.</i>		
	<i>In addition, there have been significant developments in power systems recently including smart grid and integration of renewable energies. This new certificate will enable existing power professionals to become informed of and master the latest developments in this specialty, and help them excel and move up in their career.</i>		
	<i>University of Kentucky is the flagship university in Kentucky that has a strong team of power faculty and power systems curricula. There are various power engineering companies and utilities in Kentucky and neighboring states. The online program will attract both non-power and power system engineers from these companies, by offering curricula of rigorous quality and with flexible class schedules, where they take the classes asynchronously. This certificate will also target professionals working in government and academia who want to earn an attractive power credential and keep abreast of the latest advancements in power systems.</i>		

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	<i>The credits earned through this certificate will count towards the MS or PhD degree in Electrical Engineering if the students decide to continue their graduate studies at UK. This certificate program is also expected to help bring more degree-seeking graduate students into UK, because it provides the students the flexibility to complete the course requirements of the degree program.</i>			
2f	Target student population. Check the box(es) that apply to the target student population.			
	<input checked="" type="checkbox"/> Currently enrolled graduate students.			
	<input checked="" type="checkbox"/> Post-baccalaureate students.			
2g	Describe the demographics of the intended audience. (150 word limit)			
	<i>Potential students include power professionals who want to enhance their credentials, and non-power professionals who want to gain more knowledge in power systems. They can be from local, regional or national organizations.</i>			
2h	Projected enrollment. What are the enrollment projections for the first three years?			
		Year 1	Year 2 (Yr. 1 continuing + new entering)	Year 3 (Yrs. 1 and 2 continuing + new entering)
	Number of Students	5	10	15
2i	Distance learning (DL). Initially, will any portion of the graduate certificate be offered via DL?			Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
	If "Yes," please indicate below the percentage of the certificate that will be offered via DL.			
	1% - 24% <input type="checkbox"/>	25% - 49% <input type="checkbox"/>	50% - 74% <input type="checkbox"/>	75 - 99% <input type="checkbox"/> 100% <input checked="" type="checkbox"/>
	If "Yes," describe the DL course(s) in detail, including the number of required DL courses. (300 word limit)			
	<p><i>This is an online graduate certificate. All the courses will be online courses. Existing online courses include:</i></p> <p><i>EE 537 Electric Power Systems I : Basic concepts relating to electric power systems, with emphasis on the determination of transmission line parameters, representations of components of a power system, and generalized network analysis techniques.</i></p> <p><i>EE 536: Power System Fault Analysis and Protection : This course teaches computer based methods for performing balanced and unbalanced fault analysis of power systems, and principles for protecting power systems.</i></p> <p><i>EE 532: Smart Grid: Automation and Control of Power System: This course covers introduction to smart grid, key technologies in transmission and distribution systems that enable smart grid, power market structure, and real time pricing.</i></p> <p><i>EE 535: Power Systems: Generation, Operation and Control. This course covers essential aspects of the energy management system of power systems. Will cover topics: power system economics, state estimation, power system stability, power quality, and fault location.</i></p> <p><i>EE 641 Advanced Power Systems: This course covers advanced topics on electric power systems including power system analysis, operation, monitoring, protection, optimization and control.</i></p> <p><i>EE 643 Integration of Distributed Energy Resources: This course covers characteristics of distributed energy resources, the challenges and methods for integrating them into the power grid.</i></p> <p><i>Additional online courses will be developed.</i></p>			

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3. ADMINISTRATION AND RESOURCES		
3a	<p>Administration. Describe how the proposed graduate certificate will be administered, including admissions, student advising, retention, etc. <i>(150 word limit)</i></p>	
	<p><i>The Director for the Certificate will be Dr. Yuan Liao. Dr. Liao is a member of the College of Engineering faculty who has graduate faculty status in the University. The Faculty of Record will be responsible for the certificate curriculum and matters such as: admissions, student advising, retention, etc.</i></p> <p><i>The future certificate director will be recommended by the chair of the Department of Electrical and Computer engineering and appointed by the graduate school.</i></p>	
3b	<p>Faculty of Record and Certificate Director. <i>(related to 2c)</i> The faculty of record consists of the graduate certificate director and other faculty who will be responsible for planning and participating in the certificate program. The director must be a member of the Graduate Faculty of the University and is appointed by the dean of the Graduate School. The faculty of record must be comprised of three or more faculty. At least three members of the graduate certificate’s faculty of record must be members of the Graduate Faculty.</p>	
	<p>The graduate certificate is affiliated with a degree program.</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>
	<p>If “Yes,” list the name of the affiliated degree program below. If “No,” describe below the process for identifying the faculty of record and the certificate director, including selection criteria, term of service, and method for adding and removing members. <i>(150 word limit)</i></p>	
	<p>The faculty of record consists of the faculty members whose teaching and research is in the power and energy area, and who is interested in serving the group. When a member leaves, the body of the faculty of record will consider adding a new member who has relevant teaching and research interests and who is interested in serving the group. The current Faculty of Record is:</p> <p>Dr. Yuan Liao - Certificate Director and Main Contact (Electrical and Computer Engineering): Power transmission and distribution, system protection and fault monitoring, power market, power system optimization and economics.</p> <p>Dr. Aaron Cramer (Electrical and Computer Engineering): Power system analysis and power electronics.</p> <p>Dr. Paul Dolloff (Electrical and Computer Engineering): Power delivery (transmission and distribution) and distributed generation. Teaching includes Power Distribution Systems, System Protection, and Renewable/Alternative Energy Systems. Senior Engineer in the R&D Department of East Kentucky Power Cooperative, an electric utility.</p> <p>Dr. Dan M. Ionel (Electrical and Computer Engineering): Alternative and renewable energy technologies, electric machines and power electronic drives, electromagnetic devices, electric power systems, smart grids and buildings.</p> <p>Dr. Joseph Sottile (Electrical and Computer Engineering): Electrical system protection and safety, detection of electrical component incipient failure, and electrical energy management.</p> <p>Dr. Larry Holloway (Electrical and Computer Engineering): Control, smart grid, engineering education.</p>	
3c	<p>Course utilization. Will this graduate certificate include courses from another unit(s)?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>
	<p>If “Yes,” two pieces of supporting documentation are required.</p>	

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	<input type="checkbox"/> Check to confirm that appended to the end of this form is a letter of support from the other units' chair/director ³ from which individual courses will be used. The letter must include demonstration of true collaboration between multiple units ⁴ and impact on the course's use on the home educational unit. <input type="checkbox"/> Check to confirm that appended to the end of this form is verification that the chair/director of the other unit has consent from the faculty members of the unit. This typically takes the form of meeting minutes.
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3d	Financial Resources. What are the (non-course) resource implications for the proposed graduate certificate, including any projected budget needs? (300 word limit)
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3e	Other Resources. Will the proposed certificate utilize resources (e.g. departmentally controlled equipment or lab space) from additional units/programs?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
	If "Yes," identify the other resources that will be shared. (150 word limit)		

	If "Yes," two pieces of supporting documentation are required. <input type="checkbox"/> Check to confirm that appended to the end of this form is a letter of support from the appropriate chair/director ⁴ of the unit whose "other resources" will be used. <input type="checkbox"/> Check to confirm that appended to the end of this form is verification that the chair/director of the other unit has consent from the faculty members of the unit. This typically takes the form of meeting minutes.
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4. IMPACT

4a	Other related programs. Are there any related UK programs and certificates?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
	If "Yes," describe how the new certificate will complement these existing UK offerings. (250 word limit)		

	If "Yes," two pieces of supporting documentation are required. <input type="checkbox"/> Check to confirm that appended to the end of this form is a letter of support from each potentially-affected academic unit administrators. <input type="checkbox"/> Check to confirm that appended to the end of this form is verification that the chair/director has input from the faculty members of the unit. This typically takes the form of meeting minutes.
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5. ADMISSIONS CRITERIA AND CURRICULUM STRUCTURE

5a	Admissions criteria. List the admissions criteria for the proposed graduate certificate. (150 word limit)
	<i>Students who already are or will be enrolled in a graduate degree program, or those who simply apply for Postbaccalaureate (non-degree) status in order to complete the certificate, are eligible to apply for admission. The certificate director may limit admissions so that faculty and other resources available are not overwhelmed.</i>

³ A dean may submit a letter only when there is no educational unit below the college level, i.e. there is no department/school.

⁴ Show evidence of detailed collaborative consultation with such units early in the process.

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The minimum requirements for admission to the graduate certificate curriculum are the same as those for post-baccalaureate status. Applications for admission to the Graduate Certificate will be reviewed by the faculty of record and the certificate director will notify the Graduate School of the student's admission. A student is encouraged to apply and be admitted to the certificate curriculum prior to taking any classes that will be counted towards completion of the certificate.

5b **Core courses.** List the required core courses below.

Prefix & Number	Course Title	Credit Hrs	Course Status ⁵
EE641	Advanced Power Systems	3	No Change
EE535	Power Systems: Generation, Operation, and Control	3	No Change
			Select one....
			Select one....
			Select one....
<i>Total Credit Hours of Core Courses:</i>			

5c **Elective courses.** List the electives below.

Prefix & Number	Course Title	Credit Hrs	Course Status ⁶
EE537	Power System Analysis I	3	No Change
EE536	Power System Fault Analysis and Protection	3	No Change
EE532	Smart Grid: Automation and Control of Power System	3	No Change
EE643	Integration of Distributed Energy Resources	3	No Change
			Select one....
			Select one....

5d Are there any other requirements for the graduate certificate? If "Yes," note below. (150 word limit) Yes No

Additional elective courses (all are 3 credit hours) are listed here due to limited space in 5c

EE 698 Spec. Topics Multi-Inst, no change
EE 546: Electric Power System Fundamentals, change
EE 531 Alternative and Renewable Energy Systems, change
EE 539 Power Distribution Systems, change
EE 538 Electric Power System II, change

The list of acceptable elective courses will be maintained by the Certificate Director, because it is expected to evolve as new online courses in power systems are developed.

⁵ 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").

⁶ 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").

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5e	Is there any other narrative about the graduate certificate that should be included in the Bulletin? If “Yes,” please note below. (300 word limit)	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<p><i>This is a completely online graduate certificate.</i></p> <p><i>As required by the Graduate School, a student must maintain a minimum GPA of 3.0 in the set of courses required for completion of the graduate certificate.</i></p> <p><i>Certificate curriculum courses taken at graduate level by a student (undergraduate or graduate) before being admitted to the certificate curriculum will count toward the completion of the certificate.</i></p> <p><i>Graduate courses taken at other universities that are transferrable to UK may be counted toward the completion of the certificate at the discretion of the Certificate Director.</i></p> <p><i>The curriculum of the certificate will consist of 12 credit hours, including two core courses and two courses elected from a list of specified courses. The certificate curriculum is designed to permit completion within two academic years. Students can take appropriate substitute courses for the required courses at the discretion of the Certificate Director to fulfill the certificate requirements.</i></p>			
6. ASSESSMENT			
6a	<p>Student learning outcomes. Please provide the student learning outcomes for the graduate certificate. List the knowledge, competencies, and skills (learning outcomes) students will be able to do upon completion. (Use action verbs, not simply “understand.”) (250 word limit)</p>		
<p><i>Upon completion of the certificate, students should be able to</i></p> <ol style="list-style-type: none"> <i>1. Select appropriate techniques to analyze power systems under normal and abnormal operating conditions</i> <i>2. Assess and apply optimization techniques for optimal operation of power systems</i> <i>3. Understand and evaluate the latest smart grid technologies for efficient and reliable operation of power systems</i> 			
6b	<p>Student learning outcome (SLO) assessment. How and when will student learning outcomes be assessed? Please map proposed measures to the SLOs they are intended to assess. Do not use grades or indirect measures (e.g. focus groups, surveys) as the sole method. Measures likely include artifacts such as course-embedded assessment (e.g., portfolios, research papers or oral presentations); and course-embedded test items (embedded test questions, licensure/certification testing, nationally or state-normed exams). (300 word limit)</p>		
<p><i>We will follow the annual program SLO assessment requirement of the University of Kentucky.</i></p> <p><i>We will use grades, term papers, projects, oral presentations, exams to assess SLO. Mapping between SLO and term papers, projects, oral presentations and exams of courses are shown below.</i></p> <p><i>SLO1: EE641, EE535, EE536, EE546, EE641, EE539, EE538, EE698</i></p> <p><i>SLO2: EE535, EE532, EE641, EE698</i></p> <p><i>SLO3: EE532, EE531, EE641, EE643, EE698</i></p>			
6c	<p>Certificate outcome assessment⁷. Describe evaluation procedures for the proposed graduate certificate. 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)</p>		

⁷ This is a plan of how the certificate will be assessed, which is different from assessing student learning outcomes.

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The number of certificate awardees and completion rate will be used to determine whether the program is a success. We expect the completion rate to be no less than 80%. If the rate is lower than 80%, we will identify the reasons the students do not complete the certificate and work with College of Engineering's recruitment and retention office to resolve any potential root causes.

7. OTHER INFORMATION

7a Is there any other information about the graduate certificate to add? (150 word limit)

None

8. APPROVALS/REVIEWS

Information below does not supersede the requirement for individual letters of support from educational unit administrators and verification of faculty support (typically takes the form of meeting minutes).

	Reviewing Group Name	Date Approved	Contact Person Name/Phone/Email
8a	<i>(Within College) In addition to the information below, attach documentation of department and college approval. This typically takes the form of meeting minutes but may also be an email from the unit head reporting department- and college-level votes.</i>		
	<i>ECE faculty at dept. meeting</i>	<i>Nov. 9, 2018</i>	<i>Cassie Rogers / 2571834 / cassandra.rogers@uky.edu</i>
			/ /
			/ /
			/ /

8b (Collaborating and/or Affected Units)

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8c (Senate Academic Council) **Date Approved** **Contact Person Name**

Health Care Colleges Council (if applicable)

Graduate Council

2/22/19

Roshan Nikou

From: [Liao, Yuan](#)
To: [Brandenburg, Barbara](#)
Cc: [Pearson, RaeAnne](#)
Subject: Re: Graduate Certificate in Power Systems
Date: Friday, December 7, 2018 2:34:06 PM
Attachments: [Outlook-csimmrk.png](#)

BJ,

RaeAnne has sent me the required email to move our proposal forward. Thank you RaeAnne!

Thanks!

Yuan

From: Pearson, RaeAnne
Sent: Friday, December 7, 2018 2:19 PM
To: Liao, Yuan
Cc: Office of Strategic Planning and Institutional Effectiveness
Subject: Graduate Certificate in Power Systems

Dear Dr. Liao

Thank you for your NOI submission and the supplemental substantive change form regarding the proposed new **Graduate Certificate in Power Systems (14.1001)**

My email will serve 2 purposes: 1.) Next steps for SACSCOC, and 2.) Verification and notification that you have contacted the Office of Strategic Planning and Institutional Effectiveness (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 proposal documentation presented and Substantive Change Checklist, the proposed program changes (refer to list below) are not substantive changes as defined by 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 change(s) 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 to contact me.

RaeAnne Pearson , Ph.D.
Planning and Accreditation Coordinator



University of Kentucky
Office of Planning and Institutional
Effectiveness
Patterson Office Tower #555
Lexington, KY 40506
859-218-4009

Subject: FW: Application for Online Graduate Certificate in Power Systems

From: Johnson, Michael <mike.johnson@uky.edu>

Sent: Wednesday, December 5, 2018 10:47 AM

To: Brandenburg, Barbara <barbara.brandenburg@uky.edu>; Liao, Yuan <yuan.liao@uky.edu>

Subject: RE: Application for Online Graduate Certificate in Power Systems

Hi BJ,

The ECE faculty met and voted unanimously to approve this graduate certificate in Power Systems, on November 9, 2018.

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/>



University of Kentucky
College of Engineering
Office of the Dean

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January 18, 2019

To Whom It May Concern:

This letter is to confirm that the faculty of the College of Engineering has reviewed and approved the attached proposal for a graduate certificate in Power Systems in Engineering. The faculty reviewed the proposal documents via email and there were no concerns raised.

If you have any questions, please contact me.

Sincerely,

A handwritten signature in black ink that reads "Kimberly Anderson".

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

see blue.

An Equal Opportunity University



University of Kentucky
College of Engineering

Office of the Dean

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April 10, 2019

Re: Letter of support for proposed online graduate certificate in Power Systems

To Whom It May Concern:

The College of Engineering has reviewed the proposal for the online graduate certificate in Power Systems. 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,

A handwritten signature in black ink that reads "Rudy Buchheit".

Rudy Buchheit
Dean, College of Engineering

Proposal for Online Graduate Certificate in Power Systems

College of Engineering

December 3, 2018

Proposal Contact: Dr. Yuan Liao

453 F Paul Anderson Tower

Department of Electrical & Computer Engineering

Phone: 859-257-6064

Email: yuan.liao@uky.edu

Purpose

The proposed online Graduate Certificate in Power Systems is designed to provide students with the core knowledge and latest advancements in power systems analysis, modeling, operation, control, optimization, and integration of renewable energies, and produce well trained graduates in this specialty. Students will learn the theory in various aspects of power systems and master the tools and techniques for planning and operating power systems and solving real-world problems.

With increasing deployment of advanced technologies in power system including power generation, transmission and distribution sectors, there is a strong need for upgrading the expertise of power engineers. With increasing opportunities in power engineering workforce, there is also ample incentive for non-power engineers to quickly learn and master the latest knowledge in power systems, and find a promising pathway into the power engineering workforce. This new certificate will target professionals in government, private industry and academia.

Graduate Certificate Director

The Director for the Certificate will be Dr. Yuan Liao. Dr. Liao is a member of the College of Engineering faculty who has graduate faculty status in the University. The Certificate academic unit will be the Department of Electrical and Computer Engineering.

Admission Requirements

The Certificate Director will be responsible for the certificate curriculum and matters such as: admission to and successful completion of the graduate certificate by students, enforcement of certificate requirements, maintenance of records, advising students on electives, and so forth.

Students who already are or will be enrolled in a graduate degree program, or those who simply apply for Postbaccalaureate (non-degree) status in order to complete the certificate, are eligible

to apply for admission. The certificate director may limit admissions so that faculty and other resources available are not overwhelmed.

The minimum requirements for admission to the graduate certificate curriculum are the same as those for post-baccalaureate status. Applications for admission to the Graduate Certificate will be reviewed by the certificate director, who will notify the Graduate School of the student's admission. A student is encouraged to apply and be admitted to the certificate curriculum prior to taking any classes that will be counted towards completion of the certificate.

Certificate Requirements

As required by the Graduate School, a student must maintain a minimum GPA of 3.0 in the set of courses required for completion of the graduate certificate.

Certificate curriculum courses taken at graduate level by a student (undergraduate or graduate) before being admitted to the certificate curriculum will count toward the completion of the certificate.

Graduate courses taken at other universities that are transferrable to UK may be counted toward the completion of the certificate at the discretion of the Certificate Director.

The curriculum of the certificate will consist of 12 credit hours, including four courses elected from a list of specified courses. The certificate curriculum is designed to permit completion within two academic years. Students can take appropriate substitute courses for the required courses at the discretion of the Certificate Director to fulfill the certificate requirements.

Certificate curriculum courses taken at undergraduate level can satisfy the requirement for course work in particular topics but do not count toward the completion of the certificate. The student still needs to take appropriate power system courses as suggested by the Certificate Director, a total of four courses (12 credits) in order to complete the certificate.

Required courses

Students are required to take four courses from the following list of courses, a total of 12 credit hours. All courses are 3 credit hours.

EE 537 Power System Analysis I * : Basic concepts relating to electric power systems, with emphasis on the determination of transmission line parameters, representations of components of a power system, and generalized network analysis techniques.
EE 536: Power System Fault Analysis and Protection * : This course teaches computer based methods for performing balanced and unbalanced fault analysis of power systems, and principles for protecting power systems.
EE 532: Smart Grid: Automation and Control of Power System * This course covers introduction to smart grid, key technologies in transmission and distribution systems that enable smart grid, power market structure, and real time pricing.
EE 535: Power system generation, operation and control. This course covers essential aspects of the energy management system of power systems. Will cover topics: power system economics, state estimation, power system stability, power quality, and fault location.

EE 698 Spec. Topics Multi-Inst: This course covers advanced topics on various aspects of electrical engineering, and is a template for courses to be shared among multi-institutions via distance learning technologies. Repeatable and may be used towards the certificate more than once depending on the actual topics covered.
EE 641 Advanced Power Systems: This course covers advanced topics on electric power systems including power system analysis, operation, monitoring, protection, optimization and control.
EE 643 Integration of Distributed Energy Resources: This course covers characteristics of distributed energy resources, the challenges and methods for integrating them into the power grid.
EE 546: Electric Power System Fundamentals: Introduction to power transmission basics, power system components, power flow, fault analysis and protection, control, stability, and economic operation of the power grid.
EE 531 Alternative and Renewable Energy Systems: Study of non-traditional, electric generating systems, and the use of renewable energy sources. Energy sources include solar, wind, hydro, and biomass/biogas. Generating technologies include both inverter based equipment and rotating machinery.
EE 539 Power Distribution Systems: Electric utility distribution power systems, addressing topics such as configuration, equation, customer class data, phase balancing, distributed generation, etc.
EE 538 Power System Analysis II: Introduction to modern power system practices, basic transient and steady-state stability analysis with emphasis on digital techniques.

*: Existing online course.

The list of acceptable elective courses will be maintained by the Certificate Director, because it is expected to evolve as new online courses in power systems are developed.

Certificate Outcomes

Upon completion of the certificate, students should be able to

1. Understand and apply the techniques to analyze power systems under normal and abnormal operating conditions
2. Apply optimization techniques for optimal operation of power systems
3. Understand the latest smart grid technologies for efficient and reliable operation of power systems

Award of the Certificate in Power Systems

When the student has successfully completed the last course required for the Graduate Certificate, the student shall notify the Director. The Director shall submit the Graduate Certificate Completion Form to the Dean of the Graduate School verifying that the student has fulfilled all the requirements for the certificate and requesting award of the certificate. The form requires a listing of the courses completed by the student for the certificate and the grades earned therein. The Graduate School shall officially notify the University Registrar of the award of the certificate for posting to the permanent transcript.

The Associated Faculty for the Certificate

The list below shows the associated faculty for the certificate, all of whom are members of the Graduate Faculty.

Dr. Yuan Liao - Certificate Director and Main Contact (Electrical and Computer Engineering): Power transmission and distribution, system protection and fault monitoring, power market, power system optimization and economics.
Dr. Aaron Cramer (Electrical and Computer Engineering): Power system analysis and power electronics.
Dr. Paul Dolloff (Electrical and Computer Engineering): Power delivery (transmission and distribution) and distributed generation. Teaching includes Power Distribution Systems, System Protection, and Renewable/Alternative Energy Systems. Senior Engineer in the R&D Department of East Kentucky Power Cooperative, an electric utility.
Dr. Dan M. Ionel (Electrical and Computer Engineering): Alternative and renewable energy technologies, electric machines and power electronic drives, electromagnetic devices, electric power systems, smart grids and buildings.
Dr. Joseph Sottile (Electrical and Computer Engineering): Electrical system protection and safety, detection of electrical component incipient failure, and electrical energy management.
Dr. Larry Holloway (Electrical and Computer Engineering): Control, smart grid, engineering education.

As members of this group depart, the remaining members will recommend replacements to the Dean of the College of Engineering, who will make the appointment.

Assessment for the Certificate Program

Assessment for instructors and courses within the Certificate Program will be performed in standard university fashion via regular teaching and course evaluations. Assessment for students in the program will be through course grades in the program, with a minimum GPA requirement as discussed above.

The overall Certificate Program will be assessed through university Kentucky's periodical certificate assessment process.