Georgia Institute of Technology
Graduate Curriculum Committee
Minutes
March 5, 2015

Present: Breedveld (ChBE), Jagoda (AE), Pikowsky (Registrar), Flowers (ARCH), Macrakis (HTS), Schmidt-Krey (BIOL), Bamburowski for Dr. Cozzens (Vice Provost), Ayhan (ISyE), Foley (CoC-IC)

Visitors: Laros (Registrar), Hodges (Registrar), Mark (PE), Castro (BC), Williams (ECE), Jacobs (CoE), Pishdad-Bozorgi (BC)

N**ote:** All action items in these minutes require approval by the Academic Senate. In some instances, items may require further approval by the Board of Regents or the University System of Georgia. If the Regents' approval is required, the change is not official until notification is received from the Board to that effect. Academic units should take no action on these items until USG and/or BOR approval is secured. In addition, units should take no action on any of the items below until these minutes have been approved by the Academic Senate or the Executive Board.

19 Voting members/10 required for a quorum.

There was no quorum. The voting process will therefore be to approve the actions of those Committee members who were present at the meeting and to approve the Minutes themselves.

Academic Matters

1. A motion was made to *approve* a request from the School of Chemical and Biomolecular Engineering for new course. The motion was seconded and approved.

   New Course – Approved
   CHBE 6050: The Science and Engineering of Microelectronic Fabrication
   3-0-3

2. A motion was made to *approve* a request from the School of Building Construction for a new course. The motion was seconded and approved.

   New Course – Approved
   BC 6050: Building Information Modeling for Multi-disciplinary Integration
   2-3-3

   Note: It was suggested that page 5 of the syllabus be revised to provide a Link to the grievance policy in the Catalog since this syllabus addresses grade issues. The following link should be added to the syllabus: http://www.catalog.gatech.edu/rules/20a.php

3. A motion was made to approve a request from the School of Electrical and Computer Engineering for a new subject code, new courses, and a new degree. The motion was seconded and approved.

New Subject Code – Approved
ECEP – ECE-Professional

In conjunction with its proposal for a new professional master's degree, the School of Electrical and Computer Engineering is requesting a new subject code. The proposed subject code would be ECEP, which is short for ECE-Professional. When granting school-level approval for this degree program, the ECE faculty expressed a desire to maintain separation between the existing graduate program, consisting of the MSECE and PhD degrees, and courses offered as part of a professional master's degree. A new subject code would make the distinction between the Programs very clear. There have been some initial discussions of ECE participating in other potential professional master's degrees, and, if those degrees are created in the future, this subject code could be used to support those programs, too.

Note: The Committee raised the question of cross-listing. There is no intent at present to cross-list the ECEP courses with ECE courses. Committee members noted that should the desire arise to do so, there would have to be a clear explanation from ECE as to why that would be allowed, given the reason for the creation of this new subject code.

New Courses – Approved

ECEP 6301: Power System Control and Operation	3-0-3
ECEP 6304: Power System Economics	3-0-3
ECEP 6305: Power System Planning & Reliability	3-0-3
ECEP 6310: Capstone Project	1-6-3
ECEP 6351: Power System Protection	3-0-3

These courses will be taught as Special Topics and brought back for approval. The proposals are tabled for now.

ECEP 6302: Conventional Generation	3-0-3
ECEP 6303: Renewable Energy Systems	3-0-3

Some of these courses have been taught as Special Topics or may have been taught through GTPE as short courses. ECE will review and come back to the next meeting with more information on where these courses stand in regard to the content having been taught. The proposals are tabled for now.

ECEP 6352: Advanced Power Electronics	3-0-3
ECEP 6353: Smart Grids	3-0-3
ECEP 6354: Computational Intelligence in Power	3-0-3
ECEP 6355: Solar Energy	3-0-3
ECEP 6356: Engineering Economics & Risk Management for Energy	3-0-3
ECEP 6357: Demand Response	3-0-3

Information Item: New Special Topics courses to be requested. This is an information item since the ECEP subject code was approved in a prior motion.

ECEP 8803: Special Topics	3-0-3
ECEP 8813: Special Topics	3-0-3
ECEP 8823: Special Topics	3-0-3

New Degree – Approved
Distance Learning Delivery – Approved

Professional Master's in Sustainable Electrical Energy

Overview

The electric power industry in Georgia and the U.S. is undergoing two simultaneous transformations. The basic technology of the electric grid is being modernized to incorporate modern sensing and data processing technology, while the power industry is about to see the retirement and replacement of unprecedented numbers of employees. In response to this industry's need for engineers trained in the latest electric power technology, Georgia Tech's School of Electrical and Computer Engineering (ECE) is proposing the development of a new degree program – the Professional Master's in Sustainable Electrical Energy (PMSEE).

Today, the penetration of renewable energy resources on the grid—such as wind, solar, and the energy storage often combined with these resources—is rapidly growing, and the technologies associated with these devices are becoming smarter and more complex. The electric utility industry needs a reliable engineering workforce to manage these grid-connected renewable resources. However, there is currently a gap between the knowledge of professional engineers entering the workforce and the knowledge required to master current and future renewable technologies. The breadth of expertise necessary to design this new network, from power generation to embedded computing systems to data analytics, is beyond what can be covered sufficiently in an undergraduate program. A Professional Master's would be an ideal means of broadening engineers' backgrounds, developing their professional skills, and fully informing them on the state-of-the-art in sustainable electricity systems.

To earn the PMSEE degree, students must complete ten courses. The PMSEE curriculum consists of six core (i.e., required) courses: five at the beginning of the program and one capstone course at the end. There are four elective courses selected out of a pool of elective courses. The elective courses are selected and fixed per cohort, and the choice is made before the cohort begins its studies. The elective selections are made by the cohorts and/or their employers based on their professional interests and goals.

Because the admissions standards for this proposed degree (see below) are different from those of our current MSECE and these courses, even if the subject matter is similar in some cases to existing ECE courses, will be developed for the

professional needs of practicing engineers, we are requesting a new subject code: ECEP for Electrical and Computer Engineering-Professional. This difference will help to maintain the distinction between this Professional Master's and our existing MSECE and PhD degree programs. Georgia Tech Professional Education has recently begun examining other potential Professional Master's degrees that could include ECE content, and this new subject code was chosen to allow for the creation of future Professional Master's courses in other areas of ECE.

Description

As described in the University System's online profile of Georgia Tech, "[t]he university is a national and international leader in scientific and technological research and education." Georgia Tech's stated vision includes that the school "will define the technological research university of the twenty-first century." The PMSEE program would help Georgia Tech to meet this mission and achieve its vision by producing graduates who would be prepared for influential engineering design and commercial development positions in the electrical energy field in Georgia, nationally, and internationally.

Existing degrees and majors at Georgia Tech

Georgia Tech's School of ECE is currently home to four degree programs: B.S. in Computer Engineering, B.S. in Electrical Engineering, M.S. in Electrical and Computer Engineering, and Ph.D. with a major in Electrical and Computer Engineering. ECE is also a partner in multidisciplinary graduate programs in bioengineering and robotics. In 2013-14, the school awarded more than 750 degrees, including 317 at the undergraduate level, 336 MSECE degrees, and 103 doctorates. None of these degrees, or any other degrees offered by Georgia Tech, duplicates what would be offered in the PMSEE program.

In the last two years, ECE has also terminated four degree programs. Two of these (BSCmpE-Regional Engineering Program and BSEE-Regional Engineering Program) were discontinued when undergraduate programs were removed from the GT-Savannah campus. The other two were undesignated degrees (B.S. with a major in Electrical Engineering and M.S. with a major in Electrical and Computer Engineering) that were rarely awarded and largely mirrored the designated BSEE and MSECE degrees. Again, all of these degree programs were significantly different from the PMSEE program.

The Professional Master's in Sustainable Electrical Energy (PMSEE) would be targeted to working engineers in the electrical energy and power industry. Professional Master's degrees, in general, are designed to be terminal degrees that provide applied, practical training for industry professionals with a focus on projects, teamwork, and leadership. A Master of Science degree, by comparison, typically has a research focus and often serves as a gateway to a PhD program.

Existing degrees and majors in the state of Georgia

There are no other professional master's degrees in the state in the area of sustainable electrical energy systems or within the broader area of electrical engineering. The most closely related degree at Georgia Tech is the MS in Electrical and Computer Engineering that

serves a different population of students as described above. The University of Georgia offers a broader, research-based MS in Engineering, which also is not designed for practicing engineers.

Institutional Priority

In 2010, Georgia Tech published a new strategic vision and plan to define the technological university of the 21st century. The goals and strategies outlined in this plan are the guiding principles for transformational new programs for the Institute. The proposed PMSEE directly supports Goals 1 and 2.

Goal 1: Be Among the Most Highly Respected Technology-Focused Learning Institutions in the World

The PMSEE program will provide enriching student experiences in teamwork, leadership opportunities, the development of professional skills, and exposure to cutting edge technology. At a time when the electrical utility infrastructure is undergoing a transformational change as a large percentage of the current electric power workforce is retiring, such a program will enable Georgia Tech to train the next generation of leaders in this industry.

Goal 2: Sustain and Enhance Excellence in Scholarship and Research

Georgia Tech's School of Electrical and Computer Engineering (ECE) is the largest electrical and computer engineering program in the country and is also very highly ranked with all current ECE undergraduate and graduate programs in the top seven of their respective current rankings by *U.S. News & World Report*. The PMSEE program will build upon the strengths and global reputation of these existing, traditional programs.

The proposed PMSEE can be seen as part of a new model for master degrees at Georgia Tech where students are trained to bridge the outstanding scholarship and research achievements of our disciplines to translational and commercial development to further economic development. It is expected that this new model for professional master's degrees at Georgia Tech may also be used in educating "translational engineers" in other key areas of research strength such as manufacturing and electronics. The strategic goal for Georgia Tech is to become a leader in this type of education.

Program Description and Delivery Methods

A Professional Master's in Sustainable Electrical Energy (PMSEE) would be targeted to working engineers in the electrical energy and power industry. The PMSEE program would be structured to bring in students in specific cohorts. The degree would feature six required courses, including a culminating capstone project course, and four elective courses taken by all students in a given cohort and chosen from a selection of ten or more elective courses. Courses would be organized in a sequential manner to cover in a comprehensive way the engineering content and industry emerging technologies in sustainable electrical energy. The required core for the PMSEE would include courses on power system operation and control, conventional generation, renewable energy sources, power systems economics, power system

planning and reliability, and a capstone project course. Elective courses would be chosen from subjects such as power system protection, power electronics, wind energy, smart grids, high voltage engineering, computational intelligence in power, solar energy, nuclear engineering and reactor engineering, fuel cell systems, and energy engineering economics and risk management.

Enrollment in the PMSEE program would be cohort-based, and two delivery methods are envisioned. In the first, a company would contract for a cohort composed entirely of its employees, and instruction would be delivered through a combination of onsite lectures and synchronous, online delivery. Alternatively, students would apply for the PMSEE program independently, and a cohort would be formed from those that are accepted. These students are likely to have different employers and to be widely distributed geographically. For this type of student cohort instruction would be through asynchronous, online lectures.

Program Goals and Objectives

Upon completion of the master's program, PMSEE graduates will be:

a) Fully informed on the state-of-the-art in sustainable electricity systems
b) Equipped with a wealth of critical knowledge and skills
c) Able to immediately apply this new knowledge and skills to real-world problems in their engineering or management activities, and
d) Capable of facing the complex emerging challenges of the industry.

Location of the Program

Administration of the PMSEE program will be based on Georgia Tech's main campus in Atlanta. Instructional delivery will be coordinated with Georgia Tech Professional Education and will occur both online and onsite at participating companies.

Curriculum

Note: See prior section on new courses. Until the issues with the new courses that are proposed are resolved, this description of the curriculum is not accurate.

To earn the PMSEE degree, students must complete ten courses. The PMSEE curriculum consists of six core (i.e., required) courses: five at the beginning of the program and one capstone course at the end. There are four elective courses selected out of a pool of elective courses. The elective courses are selected and fixed per cohort, and the choice is made before the cohort begins its studies. The elective selections are made by the cohorts and/or their employers based on their professional interests and goals.

Core/Required Courses:

1. ECEP 6301 - Power System Control and Operation (3-0-3)
   Prerequisites: none

   Existing course: substantially equivalent to ECE 6320

Catalog description: Introduction to methods for the real time operation and control of power systems; to study the hardware and software technologies of modern energy management systems.

2. ECEP 6302 - Conventional Generation (3-0-3)
   Prerequisites: none

   New course

   Catalog description: Consists of three parts: mechanical (conversion of energy from fuel to turbine to generator), electrical (turbine to generator to power grid), and special applications.
3. ECEP 6303 - Renewable Energy Sources (3-0-3)
   Prerequisites: none

   New course

   Catalog description: To analyze the physics, engineering, environmental impacts, and economics of available and some emerging technologies for renewable energy supplies.
4. ECEP 6304 - Power Systems Economics (3-0-3)

   Prerequisites: none

   Existing course: offered three times previously as a special topics class with an ECE subject code.

   Catalog description: Comprehensive introduction to electricity economics, including economic theory, markets, and policy. Renewable energy, information systems, smart grid, and consumers examined as drivers for market architecture.
5. ECEP 6305 - Power System Planning and Reliability (3-0-3)
   Prerequisites: none

   Existing course: substantially equivalent to ECE 6322

   Catalog description: To introduce basic concepts as well as analysis and optimization techniques underlying reliability assessment of electric power systems and planning techniques.
6. ECEP 6310 - Capstone Project (1-6-3)
   Prerequisites: none

   New course

   Catalog description: Apply methods and techniques learned throughout the program to conduct energy system design. Students prepare a project proposal leading to a final report and presentation.

<u>The four elective courses will be selected from the following:</u>

Courses approved by the School of ECE:

A. ECEP 6351 - Power System Protection (3-0-3)
   Prerequisites: none

   Existing course: substantially equivalent to ECE 6323

Catalog description: The theory and practice of modern power system protection techniques.

B. ECEP 6352 - Advanced Power Electronics (3-0-3)
Prerequisites: none

New course

Catalog description: Analysis, design, and control of modern, solid-state, high power, static, ac-to-dc, dc-to-ac and ac-to-ac power converters.

C. ECEP 6353 - Smart Grids (3-0-3)
Prerequisites: ECEP 6301

New course

Catalog description: Provides a comprehensive description of smart electric grids from intelligent devices to business applications.

D. ECEP 6354 - Computational Intelligence In Power (3-0-3)
Prerequisites: none

New course

Catalog description: Introduction to computational intelligence (e.g., neural networks, genetic algorithms, swarm intelligence, and fuzzy logic) and its application in power systems.

E. ECEP 6355 - Solar Energy (3-0-3)
Prerequisites: none

New course

Catalog description: Introduction to solar cells, including properties of photovoltaic materials, operating principles, fabrication, design and application of photovoltaic systems. Covers issues of operation, economics, and integration.

F. ECEP 6356 - Energy Engineering Economics and Risk Management (3-0-3)
Prerequisites: none

New course

Catalog description: Covers core concepts and advanced techniques for economic decision analysis and risk management in energy engineering systems.

G. ECEP 6357 - Demand Response (3-0-3)
Prerequisites: ECEP 6301

New course

Catalog description: Provides a comprehensive description of demand response programs. Discusses lessons learned and covers technological, operational, and economic evaluation aspects of demand response.

<u>Courses under development that are not yet approved by the appropriate school(s):</u>

H. ECEP 6358 - Wind Energy (3-0-3)
Prerequisites: none

New course

Catalog description: Analysis, control, and protection of mechanical and electrical subsystems of wind turbines and wind energy conversion systems.

I. ECEP 6359 - Nuclear Engineering (3-0-3)
Prerequisites: none
New course
Catalog description: Introduction to nuclear engineering including basic concepts and an overview of nuclear power technology. Fundamentals of reactor analysis including diffusion theory are discussed.

J. ECEP 6360 - Introduction to Fuel-Cell Systems (3-0-3)
Prerequisites: none
Existing course: Substantially equivalent to ME 4325 □
Catalog description: Fuel cell systems are explained and analyzed, including single cells and stacks, and balance-of-plant fundamentals, with emphasis upon prevalent fuel cell types and their applications.

Because the admissions standards for this proposed degree (see below) are different from those of our current MSECE and these courses, even if the subject matter is similar in some cases to existing ECE courses, will be developed for the professional needs of practicing engineers, we are requesting a new subject code: ECEP for Electrical and Computer Engineering-Professional. This difference will help to maintain the distinction between this Professional Master's and our existing MSECE and PhD degree programs. Georgia Tech Professional Education has recently begun examining other potential Professional Master's degrees that could include ECE content, and this new subject code was chosen to allow for the creation of future Professional Master's courses in other areas of ECE.

Sample Program of Study
A given student cohort would all take the same classes together, including preselected elective courses that are common across the cohort and chosen by a vote of the cohort. Program faculty may propose electives based on student backgrounds and interests. Electives may also be subject to instructor availability.

This schedule assumes classes are offered sequentially one at a time at the rate of two courses per semester. That is, none of the courses would overlap in time and each would take about 8 weeks to complete.

Year 1:
- ECEP 6301 - Power System Control and Operation (required)
- ECEP 6302 - Conventional Generation (required)
- ECEP 6303 - Renewable Energy Sources (required)
- ECEP 6304 - Power Systems Economics (required)
- ECEP 6305 - Power System Planning and Reliability (required)

Year 2:
- ECEP 6353 - Smart Grids (elective)
- ECEP 6356 - Energy Engineering Economics and Risk Management (elective)
- ECEP 6355 - Solar Energy (elective)

- ECEP 6357 - Demand Response (elective)
- ECEP 6310 - Capstone Project (required)

Admissions criteria

The program will have an Admissions Committee within ECE in charge of all admission decisions on all applicants.

Students to be admitted to the program must satisfy the following conditions:

1. An earned bachelor's degree in engineering or physical sciences with a competitive GPA of at least 3.0. The admission committee will have the final decision on rejecting the application, admitting the student, or conditionally admitting the student. In the case of conditional admission, the student is given the opportunity to take two courses and prove he or she can do well in the two courses, so that he or she can continue in the degree program.
2. Proof of English Proficiency (i.e., TOEFL). The minimum TOEFL score for graduate admission required by Georgia Tech is 550 paper-based, 213 computer-based, or 79 internet-based. TOEFL requirements will be exempted if the applicant earned his or her degree from a university where English is the language of instruction.
3. At least three years of professional work experience in an engineering field with a support letter from a current supervisor.
4. Three descriptive letters of recommendation. Letters are expected from the applicant's past and current supervisors who can evaluate the applicant's skills and capabilities and describe why the individual should be considered for admission.
5. A required essay/statement of purpose (no more than one page). The essay/statement of purpose should include: why the applicant should be considered, what experience the applicant can bring to the program, and what the applicant expects to take away from the program to enhance his or her professional career.
6. A resume, including work and educational experience.
7. An official transcript from each school from which the applicant has received credit toward a degree.

In some cases, the committee might request to interview an applicant.

Students will be admitted in cohorts, and all members of a cohort will take the same 10 courses leading to the PMSEE degree.

Evaluation and Assessment

Review of the PMSEE program will be incorporated into the School of Electrical and Computer Engineering's well-established assessment and evaluation process. A framework for the assessment of each of the School of ECE's bachelor's, master's, and doctoral degree programs provides on-going review and procedures that ensure the inclusion of the School's faculty to implement those processes. At all three levels, the School utilizes the Institute online assessment tracking system (OATS), which is managed by Georgia Tech's Office of Assessment, to catalog assessment methods, data, and follow-up actions. Assessment data is organized in OATS by student outcomes.

The School has defined educational objectives that structure much of the assessment practices at the graduate level. The School's program educational objectives for non-thesis master's-level programs are:

A. Graduates will be capable of integrating undergraduate fundamentals and advanced knowledge to solve complex electrical/computer engineering problems. They will have knowledge of advanced topics in two or more areas, with depth in at least one area, from within the field of electrical and computer engineering.
B. Graduates will be prepared for professional advancement in engineering. They will have the ability to engage in perpetual learning in order to identify and understand new knowledge within the field and to apply this knowledge in an appropriate context, including multi-disciplinary situations.

Student achievement of program educational objectives is, in part, evaluated through the assessment of the following student outcomes. Graduates of the School's non-thesis master's programs are expected to be able to demonstrate:

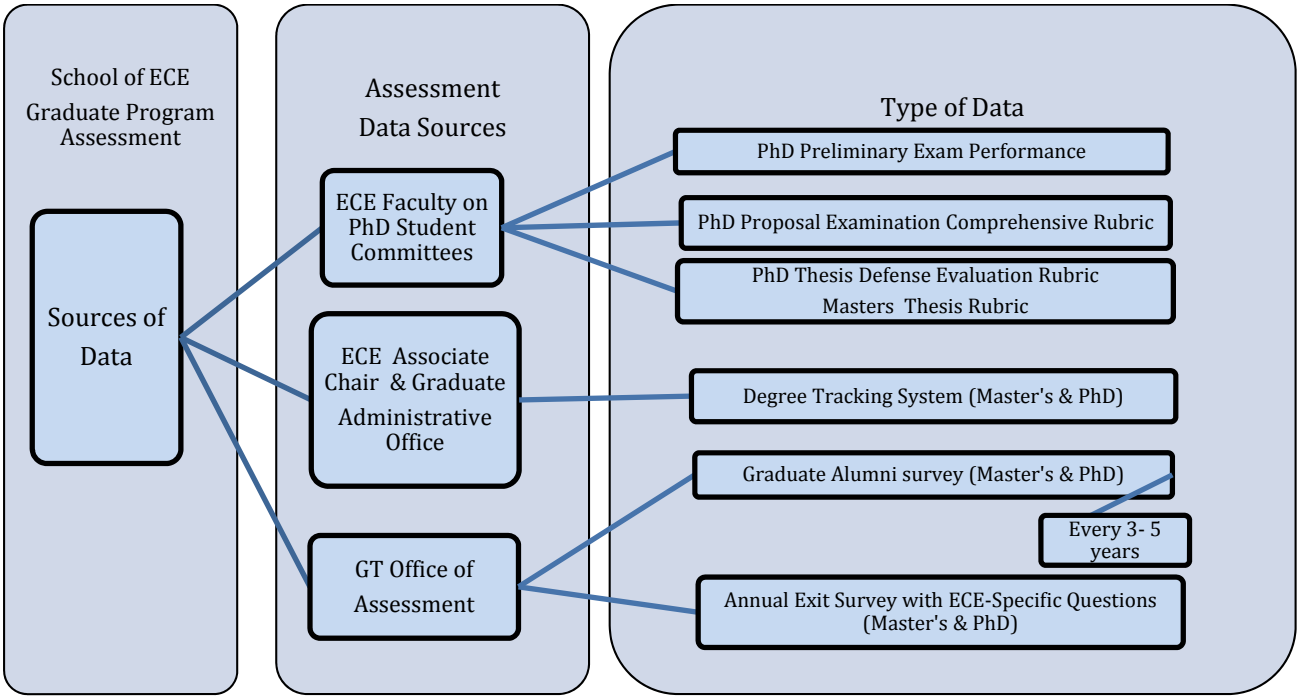
1. an ability to apply knowledge from undergraduate and graduate engineering and other disciplines to identify, formulate, and solve novel and complex electrical/computer engineering problems that require advanced knowledge within the field;
2. knowledge of advanced topics within at least two subdisciplines of electrical and computer engineering;
3. the ability to understand and integrate new knowledge within the field;
4. the ability to apply advanced technical knowledge in multiple contexts; and
5. a recognition of the need for, and an ability to engage in, life-long learning.

The following table depicts the association between the ECE master's programs' educational objectives and student outcomes. Numbered outcomes refer to the above list.

Contribution of Master's Student Outcomes to Achievement of Program Educational Objectives Using High-Medium-Low Rating Scale

Objectives	Student Outcomes				
	1	2	3	4	5
A. Advanced Knowledge	H	H	M	L	--
B. Professional Advancement	L	M	H	H	H

In the figure below, sources of data used by the School of ECE for graduate assessment and the type of data collected are illustrated. The Institute Office of Assessment collects, analyzes, and distributes two surveys that are regularly used for both master's level and PhD program assessments. ECE faculty members play a central role in the review and assessment of individual student performance, especially for the PhD program. The ECE Graduate Committee, with oversight responsibility for curriculum, operational procedures, and graduate program policies, is the primary source for review of assessment and other relevant data and determines appropriate follow-up actions.



Overview of the School of ECE Graduate Program Assessments

The list below provides specific information about whom within the School reviews the assessment data and determines if, and what, actions should be considered in response to the analysis of that data.

- The ECE Graduate Committee, appointed by the School Chair, has primary decision-making and oversight responsibility for ECE graduate degree programs. The committee meets monthly during fall and spring semesters. Together with the Associate Chair for Graduate Affairs, decisions about graduate program curriculum, goals and standards, and other policy-driven issues are made and forwarded to the School Chair. When appropriate, decisions are approved by the full-faculty body and forwarded to the Dean of the College of Engineering.
- The ECE Graduate Office, under the direction of the Associate Chair for Graduate Affairs, oversees the systematic review of programs of study by the processing of degree petitions.
- The ECE Faculty meets approximately three times per semester. The full faculty reviews, discusses and votes on changes to the graduate curriculum, course modifications and proposals, and policies related to academic standards, requirements, and expected outcomes.
- The ECE Assessment Coordinator works with the Senior Associate Chair, Associate Chair for Graduate Affairs and the Chair of the Graduate Committee to advise, implement, and review various aspects of the assessment process.
- The ECE Student Advisory Council meets at least once per semester and is comprised of both undergraduate and graduate students.
- The ECE External Advisory Board meets twice per year and typically provides feedback that is relevant to the graduate programs.

Administration of the program

The PMSEE program will have an academic home within the School of Electrical and Computer Engineering (ECE) and will receive administrative and technological support from Georgia Tech Professional Education (GTPE).

Administrative structure of the program:
ECE's Associate Chair for Graduate Affairs will have primary administrative responsibility for the PMSEE program with day-to-day operations handled by a program manager. ECE's Senior Associate Chair will also provide a support role in matters related to faculty workload and the scheduling of classes. Below, we list the anticipated administrative structure along with responsibilities, which are modeled on existing ECE graduate degree programs.

Associate Chair for Graduate Affairs
The Associate Chair for Graduate Affairs is responsible for the management and administration of the ECE graduate program. Specific functions and responsibilities related to the PMSEE include:

- Graduate student recruitment and admissions, including evaluation and follow-up of applications, targeted student recruitment, visa applications, and final student admissions decisions.
- Serves as Chair of the Graduate Student Recruitment Committee
- Coordination, establishment, and promulgation of academic policies, serving as ex-officio member of the ECE Graduate Committee, and advising students regarding such matters as degree policies and M.S. and Ph.D. examinations
- Supervision of Graduate Affairs office staff in providing student advisement on such matters as coursework planning, fulfilling degree requirements, and submission of degree petitions
- Supervision of Graduate Affairs office staff in maintaining graduate student files and ECE's electronic graduate student database

Program Manager
The Program Manager handles most routine administrative aspects of the program (such as anything involving submitting a form or requesting approval) and coordinates admissions. The Program Manager will work closely with both ECE and GTPE to coordinate administration of the PMSEE degree program.

Senior Associate Chair
The Senior Associate Chair is responsible for the management and coordination of operational issues associated with the School's academic programs. Specific functions and responsibilities related to the PMSEE include:

- Coordination with the Associate Chair for Graduate Affairs on operational issues affecting academic programs
- Leadership on matters relating to the School's accreditation and assessment process
- Management of the course planning and faculty workload processes
- Scheduling and classroom assignments for all undergraduate and graduate courses and laboratories; teaching assignments for faculty and non-faculty instructors;
- Collection and dissemination of academic program data, including instructional

plans and budget projections, student course evaluations (CIOS), and textbook information for ECE courses

ECE Graduate Committee
Faculty committee that promotes and conducts graduate classroom instruction. Specific duties include the consideration of all proposed new courses, texts, curricular modifications, and program activities. Also responsible for the continuing development and monitoring of outcome assessment measures of graduate courses, curricula, and programs.

Professional Education
Georgia Tech Professional Education (GTPE) is an academic division of Georgia Tech providing innovative, comprehensive education and training, both onsite and via distance learning. GTPE delivers an ongoing array of educational courses, professional master's degree programs, and industry partnerships, allowing working professionals and industry partners to access the expertise of Georgia Tech faculty and staff.

Support from GTPE for the PMSEE program will include:

- Assistance with credit program development (contract and public), to include academic program approval documentation, assessment documentation, proposal preparation, and budget preparation.
- Provide student services support for distance delivery, exam/homework/project submission, and administration.
- Provide instructional design support - development, structure, and delivery of curriculum for face-to-face, online, and blended learning environments.
- Provide full–service studios for capture of audio/video content for asynchronous and synchronous instructional delivery.
- World-wide cloud-based media delivery systems
- Administer financial aspects of the PMSEE program from collecting student tuition either by contract with the students' employers or directly from the students; payment of faculty, travel, and facility expenses; and other necessary costs.
- Market research
- Marketing plan development and execution, including messaging development, copywriting, graphic design, digital marketing, campaign measurement, and reporting.
- Provide distance learning facilities for classroom capture and face-to-face classroom sessions, when needed.
- Work with industry and government for support and advice.
- Provide resources and guidance to the faculty leading the PMSEE program.
- Provide recruiting resources for prospective students (e.g., brochure, on-demand videos, information sessions)
- Provide financial, recruitment, and enrollment details to ECE quarterly.
- Assist ECE with course and faculty scheduling.

Enrollment Projections and Monitoring

Enrollment for the PMSEE program will be done in cohorts of 20 to 30 students. Designed for practicing engineers, two models are anticipated for these cohorts. In the first instance, Georgia Tech Professional Education (GTPE) and ECE would contract with a company to provide all of the students for a targeted cohort of its employees. Alternatively, a cohort might be constructed from a variety of students from across the nation or, even, the world.

Georgia Tech has already contracted with a major energy company to deliver this program to a group of their employees. These students have been enrolled in our graduate program as non-degree-seeking students. If the PMSEE degree is approved, then they will be transferred into that degree program. The first courses planned for the PMSEE have already been delivered to them at their workplace through a combination of synchronous, live distance learning and on-site delivery. This cohort began with 30 students and currently stands at 28. (Two students have dropped because of personal conflicts.) The contract includes support for not just course delivery, but creation and design of the new courses for this program. This first cohort is scheduled to take approximately two years to finish the PMSEE program (i.e., the first and second fiscal years for this program).

This same corporation has shown interest in additional student cohorts. After the PMSEE is approved, they will be approached about a second cohort of 20-30 students. Because the required courses for the PMSEE will now have been created and taught at least once, the plan is for the second cohort's contract to include faculty support for the creation of distance learning content for those courses. That will enable Georgia Tech to market this degree program to a third cohort of distance learning students to begin in year four.

In summary, the enrollment projections reflect plans for the first three cohorts with each group taking two years to graduate. The first cohort spans years one and two beginning with 30 students and shrinking to 28. The second cohort will span years three and four and is projected to have 30 students. The third cohort will begin in year four with at least 20 students. In steady-state there will be one new cohort per year with at least 20 students.

	First FY	Second FY	Third FY	Fourth FY
I. ENROLLMENT PROJECTIONS				
Student Majors				
Shifted from other programs	0	0	0	0
New to the institution	30	0	30	20
Total Majors	30	28	30	50
Course Sections Satisfying Program Requirements				
Previously existing	0	0	0	0
New	5	5	5	10
Total Program Course Sections	5	5	5	10

Credit Hours Generated by Those Courses				
Existing enrollments	0	0	0	0
New enrollments	450	420	450	750
Total Credit Hours	450	420	450	750

The PMSEE program will be reviewed during the next Academic Program Review (APR) for the School of ECE. Every school at Georgia is subject to the Institute's APR process every five years. ECE was last reviewed during the 2013-14 academic year, so the next review will be 2018-19.

With a required minimum enrollment of 20, cohorts will not proceed with fewer students. No new faculty will be hired for the proposed program, and the existing Georgia Tech ECE academic program is of sufficient size to compensate for any shifts in faculty workload caused by a canceled cohort. If a planned cohort fails to meet the minimum enrollment, PMSEE administration in ECE and GTPE will examine the program's marketing and recruitment to avoid future canceled cohorts.

Faculty Qualifications & Capacity:

Faculty Name	**Rank**	**Highest Degree**	**Degrees Earned**	**Academic Discipline**	**Area of Specialization**	**Current Workload**
Godfried Augenbroe	Professor	M.Sc., TU Delft	M.Sc.	Building Technology	building performance concepts and simulation, large building energy simulation	100% FTE
Shijie Deng	Associate Professor	Ph.D., Univ. of California at Berkeley	Ph.D., M.S., B.Sc.	Industrial Engineering	Financial asset pricing and real options valuation, financial engineering applications in energy commodity markets, transmission pricing in electric power systems	100% FTE
Santiago Grijalva	Associate Professor	Ph.D., Univ. of Illinois at Urbana-Champaign	Ph.D., M.S., B.S.	Electrical Power and Energy Systems	Electrical power system control, intelligent grids, power system economics	100% FTE
Thomas G. Habetler	Professor	Ph.D., Univ of Wisconsin	Ph.D, M.S., B.S.E.E.	Power Electronics	Electric machines, power electronics	100% FTE
Comas Haynes	Principal Research Engineer	Ph.D., Georgia Tech	Ph.D., M.S.M.E., B.S.M.E.	Heat Transfer	Fuel cell and battery technologies	100% FTE
Ronald G. Harley	Regents' Professor	Ph.D., Univ. of London	Ph.D., D.I.C.,	Electrical Energy	Power system stability and control, power	100% FTE

			M.Sc.Eng., B.Sc.Eng.		electronics, motor drives and electric vehicles	
J. Rhett Mayor	Associate Professor	Ph.D., Univ. of Natal	Ph.D., M.Sc.Eng., B.Sc.Eng.	Manufacturing	Heat transfer, combustion and energy systems	100% FTE
Athanasios P. Meliopoulos	Georgia Power Distinguished Professor	Ph.D., Georgia Tech	Ph.D., M.S.E.E., B.S.	Electric Power Systems	Power system reliability and risk assessment, power systems operations planning, power quality	100% FTE
Bojan Petrovic	Professor	Ph.D., Penn State Univ.	Ph.D., M.S., B.S.	Nuclear Engineering	Reactor physics, advanced reactor design, modeling and simulation of nuclear systems	100% FTE
Ajeet Rohatgi	Regents' Professor	Ph.D., Lehigh University	Ph.D., M.S., B.S.	Photovoltaics	Modeling and fabrication of low-cost high-efficiency silicon solar cells, growth and characterization of low-temperature and high-performance dielectrics	100% FTE
Maryam Saeedifard	Assistant Professor	Ph.D., Univ. of Toronto	Ph.D., M.S., B.S.	Power Electronics	High voltage direct current (HVDC) transmission, high-power energy conversion, grid integration of renewable energy resources, hybrid electric vehicles and transportation systems	100% FTE
Note 1:						
Note 2:						

Total Number of Faculty: ____11_____

There are no plans to hire additional faculty for the proposed program.

Instruction will be coordinated through Georgia Tech Professional Education and will occur off-campus, both through distance learning and on-site at companies that have contracted to have the PMSEE program taught to their employees. Program faculty are

currently teaching full loads, but instruction for the PMSEE will be done in addition to their usual duties. This work will meet the Board of Regents, Georgia Institute of Technology, and College of Engineering policies to be eligible for extra compensation. As indicated in the budget below, the projected income is expected to be sufficient to make this program self-supporting. Instructional faculty will be paid extra compensation that is in line with compensation they receive in performance of their normal duties.

Budget

Assumptions:

Years 1 and 2 are based on the previously mentioned, existing energy company contract for delivery of this program. Years 3 and 4 assume that the contract is renewed for a second cohort of students. Additionally, Year 4 assumes that a third cohort of distance learning students will begin. Because instruction would be via online education to a widely distributed set of students, the faculty would not be traveling for any of the instruction and no travel budget is needed. All cohorts are assumed to be finishing the program in two years with five courses being taught per year.

In creating this budget no attempt has been made to adjust for inflation, raises, increasing tuition, or other annual cost changes.

a. Expenditures
    i. Institutional resources required
    Library and Learning Resources: All the resources of the Georgia Tech Library that can be accessed remotely will be available to these graduate students. The current ECE program is exceptionally large and broad, and existing library resources will be sufficient for the new program.

    Information and Educational Technology: No new resources for classrooms or teaching technology are anticipated for this program. The technologies required for online and distance learning will be coordinated through Georgia Tech Professional Education, whose existing facilities will be sufficient to develop and offer this program.

    Personnel: Staffing for the PMSEE program consists of instructional faculty (5 courses/year/cohort), a Graduate Teaching Assistant, and a Program Manager.

    Travel: For the first two cohorts a portion of the instruction will occur on-site at the contracting company. Travel support is included in the budget for two trips per course.

    ii. Reassignment of existing faculty/staff
    See comments under section 14c.

b. Revenue:
    i. *Existing funds:* This budget assumes that no existing funds will be redirected to this program.

ii. *New Tuition:* GTPE receives part of the tuition paid for professional education courses. The budgeted new tuition amounts are based on the portion of that tuition that is passed through to the academic unit. The portion that is retained by GTPE is not indicated in this budget but would be available to support GTPE's distance learning capabilities for this project.

iii. *Student Fees:* No new student fees will be requested to support the PMSEE. Student fees are the standard Georgia Tech fees for graduate students.

iv. *Grant Revenue:* The line for "Other grants" for Years 1 and 2 is based on the budget for the existing contract for delivery of the PMSEE program to the first cohort of students. A projected subsequent contract for a second cohort is reflected in the budget for Years 3 and 4. A smaller contract amount is estimated for the third cohort of distance learning students that would begin in Year 4.

c. When Grand Total Revenue is not equal to Grand Total Costs:

Any shortfall would be guaranteed to be covered by the School of ECE. The minimum enrollment necessary for a cohort to be created has been chosen so that shortfalls are not expected.

I. EXPENDITURES	First FY Dollars	Second FY Dollars	Third FY Dollars	Fourth FY Dollars
Personnel – reassigned or existing positions				
Faculty **(see 15.a.ii)**	100,000	100,000	100,000	200,000
Part-time Faculty **(see 15 a.ii)**				
Graduate Assistants **(see 15 a.ii)**				
Administrators**(see 15 a.ii)**				
Support Staff **(see 15 a.ii)**				
Fringe Benefits	1,500	1,500	1,500	3,000
Other Personnel Costs				
Total Existing Personnel Costs	101,500	101,500	101,500	203,000

EXPENDITURES (Continued)				
Personnel – new positions (see 15 a.i)				
Faculty				
Part-time Faculty				
Graduate Assistants	27,000	27,000	27,000	54,000
Administrators	80,000	80,000	80,000	80,000
Support Staff				
Fringe Benefits	22,806	22,806	22,806	23,292
Other personnel costs (GTA tuition)	14,602	14,602	14,602	29,204
Total New Personnel Costs	144,408	144,408	144,408	186,496

Start-up Costs (one-time expenses) (see 15 a.i)				
Library/learning resources				
Equipment				
Other				
Physical Facilities: construction or renovation (see section on Facilities)				
Total One-time Costs	0	0	0	0
Operating Costs (recurring costs – base budget) (see 15 a.i)				
Supplies/Expenses				
Travel	159,333	159,333	159,333	159,333
Equipment				
Library/learning resources				
Other				
Total Recurring Costs	159,333	159,333	159,333	159,333
GRAND TOTAL COSTS	405,241	405,241	405,241	548,829
III. REVENUE SOURCES				
Source of Funds				
Reallocation of existing funds **(see 15 b.i)**	0	0	0	0
New student workload				
New Tuition **(see 15 b.ii)**	136,163	127,085	136,163	226,938
Federal funds				
Other grants **(see 15 b.iv)**	406,766	406,766	406,766	654,199
Student fees **(see 15 b.iii)** Exclude mandatory fees (i.e., activity, health, athletic, etc.).				
Other **(see 15 b.v)**				
New state allocation requested for budget hearing				
GRAND TOTAL REVENUES	542,929	533,851	542,929	921,137
Nature of Revenues				
Recurring/Permanent Funds				
One-time funds	542,929	533,851	542,929	921,137
Projected Surplus/Deficit (Grand Total Revenue – Grand Total Costs) (see 15 c)	137,688	128,610	137,688	392,308

Facilities

			Total GSF
a.	**Indicate the floor area required for the program in gross square feet (gsf). When addressing space needs, please take into account the projected enrollment growth in the program over the next 10 years.**		100-200
b.	**Indicate if the new program will require new space or use existing space. (Place an "x" beside the appropriate selection.)**		
	Type of Space		**Comments**
i.	Construction of new space is required		
ii.	Existing space will require modification		
iii.	If new construction or renovation of existing space is anticipated, provide the justification for the need.		
iv.	Are there any accreditation standards or guidelines that will impact facilities/space needs in the future? If so, please describe what the impact will be.		No
v.	Will this program cause any impacts on the campus infrastructure, such as parking, power, HVAC, etc. If so, indicate the nature of the impact, estimated cost and source of funding.		No
vi.	Existing space will be used as is	X	
c.	**If new space is anticipated, provide information in space below.**		
i.	Estimated construction cost		
ii.	Estimated total project budget cost		
iii.	Proposed source of funding		
iv.	Availability of funds		
v.	When will the construction be completed and ready for occupancy? (Indicate semester and year).		
vi.	How will the construction be funded for the new space/facility?		
vii.	Indicate the status of the Project Concept Proposal submitted for consideration of project authorization to the Office of Facilities at the BOR. Has the project been authorized by the BOR or appropriate approving authority?		
d.	**If existing space will be used, provide information in space below.**		

	Provide the building name(s) and floor(s) that will house or support the program. Indicate the campus, if part of a multi-campus institution and not on the main campus. Please do not simply list all possible space that could be used for the program. We are interested in the actual space that will be used for the program and its availability for use.			
	Office space for a single program manager located in the Global Learning Center.			
e.	**List the specific type(s) and number of spaces that will be utilized (e.g. classrooms, labs, offices, etc.)**			
i.	**No. of Spaces**	**Type of Space**	**Number of Seats**	**Assignable Square Feet (ASF)**
		Classrooms		
		Labs (dry)		
		Labs (wet)		
		Meeting/Seminar Rooms		
	1	Offices		150
		Other (specify)		
			Total Assignable Square Feet (ASF)	**150**
ii.	If the program will be housed at a temporary location, please provide the information above for both the temporary space and the permanent space. Include a time frame for having the program in its permanent location.			

Chief Business Officer or Chief Facilities Officer Name & Title	**Phone No.**	**Email Address**
	Signature	
Note: A Program Manager from the Office of Facilities at the System Office may contact you with further questions separate from the review of the new academic program.		

Online Format and Institutional Delivery Questions

The past century has seen electricity become widely available almost everywhere in developed nations to virtually all of their citizens. In the U.S. alone the transmission network for commercial electricity covers over 300,000 km of lines and is served by 500 electric utilities. To support this infrastructure, engineers working for these companies are similarly widely distributed. In order to reach these potential students, educational delivery for the PMSEE program will go to them largely via online education. The target market for the PMSEE consists of these practicing engineers working in the electrical energy/power sector.

Remote delivery of courses will be a good match to the work schedules of these students who are not generally able to leave work, move to Atlanta, and attend school full-time.

Curriculum and Instruction

Compatibility of selected delivery with the nature and objectives of the program and courses.

As described in section 2, two delivery methods are planned for teaching student cohorts in the PMSEE program. The first option would be for cohorts composed of students employed and sponsored by a single company that contracts for instruction of that cohort. Courses would be delivered through a combination of onsite lectures and synchronous, online delivery. Alternatively, a second option is designed for students who would apply for the PMSEE program independently with a cohort being formed from those that are accepted. These students are anticipated to have different employers and to be widely distributed geographically.

For this type of cohort instruction would be through semi-synchronous, online lectures (i.e., pre-prepared, online lectures with a clearly defined schedule for viewing). However, there would also be an on-campus orientation at the beginning of the degree program and on-campus presentations of capstone projects at the end of their studies. Thus, during the two-year program, students would be expected to come together with their cohort twice, for a 4-day visit each time. These campus visits would allow students to form strong relationships with both peers and program faculty, yet time away from the office would be minimal so that students could maintain their professional responsibilities. Options for remote participation in those two activities would be available (for instance, joining through teleconference), but students would be strongly encouraged to attend in person.

Thus, the PMSEE program will be marketed both to corporations with significant numbers of prospective students and to individuals in the electrical energy industry. These delivery approaches have been designed to match both the availability of the students and the goals of the PMSEE program.

The unique, hybrid formats of these two approaches offer both face-to-face instruction and online learning. This flexibility allows working students in both varieties of cohorts to fit a master's degree into their busy schedules with no need to interrupt their careers. Course websites would be utilized to encourage and support online interaction between students and with faculty. These sites would also be repositories of course content. Course materials, including live-captured and pre-recorded lectures, assignments, solutions, and some notes would be accessible to students 24 hours a day, 7 days a week via the internet.

As described in the previous section, both instructional models will feature blended instruction.

Cohorts sponsored by a single employer will feature a combination of on-site, live lectures and off-site, synchronous, online live lectures. Both types of lectures will be captured and made available to students for later review.

Cohorts composed of students working for different employers in different locations will primarily have online lectures. Some of these lectures will be captured during live presentations and others will be pre-recorded in a studio. Lectures will be viewed in a "semi-synchronous" manner with students accessing them at their convenience but within a clearly defined time interval. This lecture content will then be available throughout the rest of the course, but the schedule will ensure that students stay on-track for assignments and tests. These cohorts will also be expected to visit campus twice during their two years in the degree program. The first visit will be at the beginning when the cohort begins its studies, and the second will be at the end for presentation of capstone projects.

Academically, the PMSEE program will be housed and administered by the School of ECE.

The PMSEE will not be a collaborative program. All academic matters will be the responsibility of the School of ECE.

The School of ECE will be the sole academic unit with responsibility for managing the PMSEE program. GTPE will partner with ECE and will assist with execution and administration, as described in section 7. A few of the participating faculty listed in section 14 are from other Georgia Tech academic units. ECE will arrange with their home units for their participation.

No additional infrastructure will be needed in ECE. GTPE's infrastructure has ample facilities and resources to handle this additional program.

Faculty

Georgia Tech has offered online master's-level education for over 30 years, and ECE faculty have participated from the beginning. Within ECE the faculty of the Electrical Energy Technical Interest Group, which forms the core of the faculty connected to the PMSEE program, typically offer 5 to 6 distance learning courses per year within the online MSECE degree program. Thus, these faculty members have significant experience with online teaching that is offered on a regular basis.

The Georgia Tech model for training and supporting faculty who are teaching courses with distance sections has evolved over the course of thirty plus years. Every faculty member teaching in the program is provided with a handbook that covers operational procedures, best practices for communication flow, classroom technology, copyright laws, and export control. Additionally, all "first time" faculty are personally contacted by the Distance Learning (DL) office and extended an invitation to meet in the classroom where they will be teaching the distance learning section. During this session, DL staff addresses

all of the questions and concerns of the faculty member and discusses options for instruction available using the multimedia equipment found in the DL classrooms. GTPE also provides facilities and support for faculty members who are recording lecture content for asynchronous, online delivery. A DL technician is assigned to work with each faculty member during every class meeting time to assist in effectively capturing the total classroom experience and lecture content for delivery both synchronously and asynchronously.

Course Descriptions

Course descriptions, including prerequisites are listed in Appendix A of the proposal itself.

Note: There are outstanding issues with regard to the new courses proposed for this program. Until those issues are resolved, the proposal itself and this appendix are inaccurate.

Adjourned,

Reta Pikowsky
Registrar