November 9, 2016

MEMORANDUM

TO: Darryll Pines
   Dean, A. James Clark School of Engineering

FROM: Elizabeth Beise
   Associate Provost for Academic Planning and Programs

SUBJECT: Proposal to Establish an Electronic Packaging Option for the Post-Baccalaureate Certificate in Engineering (PCC Log No. 16003)

At its meeting on October 7, 2016, the Senate Committee on Programs, Curricula and Courses approved the proposal to establish an Electronic Packaging Option for the Post-Baccalaureate Certificate in Engineering. This option may be offered online or on campus. A copy of the proposal is attached.

This new option is effective Spring 2017. Please ensure that the option is fully described in the Graduate Catalog and in all relevant descriptive materials.

MDC/
Enclosure

cc: Andrew Harris, Chair, Senate PCC Committee
    Barbara Gill, Office of Enrollment Management
    Reka Montfort, University Senate
    Chip Denman, Division of Information Technology
    Pam Phillips, Institutional Research, Planning & Assessment
    Anne Turkos, University Archives
    Linda Yokoi, Office of the Registrar
    Alex Chen, Graduate School
    William Fourney, A. James Clark School of Engineering
    George Syrmos, Office of Advanced Engineering Education
THE UNIVERSITY OF MARYLAND, COLLEGE PARK
PROGRAM/CURRICULUM/UNIT PROPOSAL

- Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.
- Please submit the signed form to the Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.

College/School: ENGR
Please also add College/School Unit Code-First 8 digits: 01320101
Unit Codes can be found at: https://hypprod.umd.edu/Htm1_Reports/units.htm

Department/Program: Office of Advanced Engineering Education
Please also add Department/Program Unit Code-012032001322701 ENGR-Office of Advanced Engineering Education

Type of Action (choose one):
- Curriculum change (including informal specializations)
- Curriculum change for an LEP Program
- Renaming of program or formal Area of Concentration
- Addition/deletion of formal Area of Concentration
- Suspend/delete program

New academic degree/award program
New Professional Studies award iteration
New Minor
√ Other

Italics indicate that the proposed program action must be presented to the full University Senate for consideration.

Summary of Proposed Action:
Creation of an online academic option in Electronic Packaging to the existing Graduate Certificate in Engineering Program (as Z0##) through the Office of Advanced Engineering Education.

Departmental/Unit Contact Person for Proposal: George Syrmos

APPROVAL SIGNATURES - Please print name, sign, and date. Use additional lines for multi-unit programs.

1. Department Committee Chair: Patrick McCluskey 4/05/16
2. Department Chair: George Syrmos 4/5/16
3. College/School PCC Chair: Jenna Bucci 4/7/16
4. Dean: Peter Kofinas 4/12/2016
5. Dean of the Graduate School (if required):
6. Chair, Senate PCC:
7. University Senate Chair (if required):
8. Senior Vice President and Provost:
Proposal for a New Online Specialization in Electronic Packaging in the Graduate Certificate in Engineering Program

I. Overview and Rationale

Established in 1994, the Office of Advanced Engineering Education (OAEE) in the Clark School of Engineering is responsible for lifelong learning programs designed for working engineers and technical professionals. OAEE offers both credit and non-credit programs, but our primary offerings are the Master of Engineering degree and the Post-Baccalaureate Graduate Certificate in Engineering degree. We offer these degrees through the Professional Master of Engineering (ENPM) Program and the Graduate Certificate in Engineering (GCEN) Program. The Master of Engineering degree is awarded with completion of ten courses (30 credits) and no thesis/research project, scholarly paper, or comprehensive exam are required. Each academic option has its own set of course requirements. The GCEN Program was developed to serve as a more highly focused area of study. It requires the completion of four specific courses (12 credits) by academic option. There are currently over 500 students in our programs with over 2000 graduates. Students take classes on campus, at regional education centers throughout Maryland, and seven programs are offered online. Enrollments have been averaging 55% on campus and 45% distance/online for the past few years.

OAEE currently offers eighteen academic options under these two programs (http://advancedengineering.umd.edu/degrees-certificates). Academic options were originally versions of the Master of Science programs in each academic department (i.e. Aerospace, Mechanical, Electrical, etc.). However, as the need grew for more interdisciplinary programs, we began working with research institutes and centers in the Clark School to develop and offer programs to meet the needs of the engineering/technology community. We have developed niche academic options in Sustainable Energy, Project Management, Robotics, Energetic Concepts, Software, Reliability, Fire Protection, Regulatory Science, and Cybersecurity. In 2003, we began offering our programs online to give national and worldwide access to the outstanding programs available at Maryland.

We propose the creation of an Electronic Packing academic option within the GCEN Program that will be fully online and will be a complement to the academic options we currently offer and the research work being done in the Department of Mechanical Engineering and the Center for Advanced Life Cycle Engineering (CALCE).

II. Program Audience

This certificate is intended for new and established engineers and technical managers in the field of electronic packaging who would like to learn more about the mechanical and thermal issues involved in reliably packaging devices and circuits for a range of applications. Typical participants would include local engineers and managers working in the defense electronics industry (e.g. Northrop Grumman, Lockheed Martin) and in government agencies (e.g. DOD, NIST, NRL, ARL). Online offering of the certificate, however, would extend its reach globally.

Full admission as a degree seeking student requires the following:
- A bachelor's degree, with a GPA of 3.0 or better, in engineering from an accredited institution
- Courses in mathematics (Calculus I, II, III, & Differential Equations) are required to be considered for admission.
- Courses in Thermodynamics, Fluid Mechanics, Heat Transfer, and Structural mechanics (equivalent of ENES220) are recommended to be considered for admission.
• Two letters of recommendation are required for the GCEN Program if the GPA is slightly below 3.0.

III. Program Administration

OAEE provides administrative oversight to all academic options under the ENPM and GCEN programs, including student services, faculty support, proctoring, admissions, and academic outreach. In addition, OAEE works with faculty to develop new courses and options that meet the needs of the engineering/technology communities. OAEE researches industry needs, meets with private and public sector leaders, attends various professional society and technology conferences to learn about possible program development areas. For each academic option there is an identified academic advisor/content matter expert who advises OAEE and our students on curriculum matters. For the traditional academic options (i.e. aerospace, bioengineering, mechanical, etc.) an advisor is assigned by the department Chair. For our interdisciplinary programs, the Chair/Director of the primary department/research center/institute assigns an academic advisor. These interdisciplinary areas also have curriculum committees that review student and faculty performance, course content, and curriculum development. As with all programs in OAEE, curriculum and academic oversight for the core and elective courses will be through a faculty advisory committee that will collaborate with the OAEE Executive Director, making sure that both commitment to support this new specialization and academic excellence are in place. Evaluation and assessment of this option will be performed by the faculty of Mechanical Engineering, more specifically a faculty member in the area of electronic packaging will be the first academic advisor.

Professor F. Patrick McCluskey will be the first academic advisor and will work with the OAEE Executive Director to ensure that academic integrity is met (see the attached Assessment Plan approved for all OAEE academic options). The new specialization will comply with all UMCP policies and requirements for graduate admission, time of study, and graduation requirements.

IV. Curriculum

The curriculum identified below represents the beginning of what will be an evolving program that will continue to offer the latest developments in this rapidly changing and critically important field of study.
Students in the online Graduate Certificate in Engineering in Electronic Packaging Program will complete 4 courses (12 credits). Students must also meet the prerequisites for any course they wish to take.

V. Budget Resources

The Office of Advanced Engineering Education is a self-supporting unit and the Graduate Certificate in Engineering Programs are administered through its resources.

VI. Graduate Certificate in Engineering Courses

The faculty who teach for the campus programs will also teach for the online programs. The standards of good practice observed for the on-campus programs will equally apply to the online versions. In particular, faculty support and resources for learning will be provided by the DETS office in the Clark School of Engineering to our online students.

We will request a new online course section to correspond to this new specialization – potentially EP0* - under which students could take these courses. All of the courses listed below are existing, VPAC approved, courses.

- Students will take:
  - ENME690 – Mechanical Fundamentals of Electronic Systems
  - ENME695 – Failure Mechanisms and Reliability
  - and 2 of the following 6 courses:
    - ENME737 – Prognostics and Health Management
    - ENME770 – Life Cycle Cost and System Sustainment Analysis
    - ENME780 – Mechanical Design of High Temperature and High Power Electronics
    - ENRE600 – Fundamentals of Failure Mechanisms
    - ENRE602 – Reliability Analysis
    - ENRE641 – Probabilistic Physics of Failure and Accelerated Testing
For Time Period: Academic Year

Program Contact: Dr. George Syrmos
Phone: 301-405-3633 E-mail: svrmos@umd.edu

Date submitted to Academic Unit Head: 10/23/2013

<table>
<thead>
<tr>
<th>Student Learning Outcomes for assessments that will occur during the academic year</th>
<th>Assessment Methods &amp; Criteria</th>
<th>Assessment Results</th>
<th>Impact of Results</th>
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| 1. Demonstrate knowledge of advanced principles in engineering. | **Criterion:** All ENPM courses offered during any given semester. The final exam in all these courses will include a question specifically tailored to demonstrate understanding of a fundamental principle in engineering.  
**Measure:** At least 70% of the students in every ENPM course offered during any given semester would be expected to successfully answer this question posed on the final exam. | | |
| 2. Demonstrate knowledge of advanced principles in engineering. | **Criterion:** 90% of the Graduate Certificate in Engineering students should have a GPA equal or greater than 3.0  
**Measure:** GPA | | |
<p>| 3. Demonstrate continued retention of students and progress towards degree completion. | <strong>Criterion:</strong> 80% enrollment by existing students each semester. | | |</p>
<table>
<thead>
<tr>
<th>Measure: Registrar's Enrollment Records</th>
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<td>4. Demonstrate completion of degree program.</td>
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<td>Criterion: 80% graduation rate of students within the five year limit for Graduate Certificate in Engineering students.</td>
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<td>Measure: Registrar's Graduation Records</td>
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<td>5. Point-of-graduation survey. The survey is web based. Graduating students, prior to the end of the semester, are sent the web site in which to fill in the appropriate information and submit the survey electronically. The survey seeks to ascertain a student's experiences in the GCEN Program regarding the quality of courses, the general program, faculty, and staff. The survey also collects information on employment (position, salary, etc.) at graduation.</td>
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<td>Criterion: 50% response rate by graduating students.</td>
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<td>Measure: Graduation Survey</td>
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10/23/2013