December 18, 2015

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 a Transportation Systems Option for the Master of Engineering Program (PCC log no. 15029)

At its meeting on December 4, 2015, the Senate Committee on Programs, Curricula and Courses approved the proposal to establish a Transportation Systems option for the Master of Engineering program. A copy of the proposal is attached.

The change is effective Spring 2016. Please ensure that the change 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
    Erin Taylor, 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-submit@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://hpapprod.umd.edu/Html_Reports/units.htm

Department/Program: Office of Advanced Engineering Education
Please also add Department/Program Unit Code-Last 7 digits: 1522302

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

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 Transportation Systems to the existing Professional Master of Engineering Program (as METS) through the Office of Advanced Engineering Education.

Departmental/Unit Contact Person for Proposal: Ali Haghani

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

1. Department Committee Chair: Ali Haghani
   
2. Department Chair: George Syrmos
   
3. College/School PCC Chair: Jenna Bucci
   
4. Dean: Peter Katsaounis
   
5. Dean of the Graduate School (if required):
   
6. Chair, Senate PCC:
   
7. University Senate Chair (if required):
   
8. Senior Vice President and Provost:
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 refer to these degree programs as 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 a Transportation Systems academic option in the Professional Master of Engineering Program that will be fully online and will be a complement to the options we currently offer and the research work being done in the Department of Civil and Environmental Engineering, the National Transportation Center, and the Center for Advanced Transportation Technology.

II. Program Audience

Based on our internal review, which included discussions with faculty, research sponsors, experts in industry and government as well as evaluation of competing higher education institutions, we believe there is a high-demand for this academic option. Transportation is an evolving field and most knowledge and expertise required for a successful career in transportation systems engineering is only available through graduate programs. The University of Maryland’s Department of Civil and Environmental Engineering (CEE) has an immensely successful educational and research program in transportation as evidenced by the research activities currently underway in the Center for Advanced Transportation Technology (CATT), the federally-funded National Transportation Center (NTC) and the most recently funded project by ARPA-E entitled “Integrated, Personalized, Real-time Traveler Information and Incentive Technology for Optimizing Energy Efficiency in Multimodal Transportation Systems.” The CEE graduate program in transportation is one of the top three in the nation and very unique in terms of the breadth and depth of the area of transportation that it covers. There is a high demand for employment for transportation professionals in the region, nationwide, and across the globe. Offering an online graduate program will expand our reach and allow us to attract qualified students who demand a high quality graduate education. The target audience is adults who have completed at least a Bachelor’s degree in engineering or science. This program will be of interest to working engineers, technical professionals, as well as recent graduates, who desire a career in transportation systems, as an opportunity to advance their knowledge and careers. We expect that due to the high demand for employment, the strength and reputation of the Clark School of Engineering and the CEE graduate program in transportation, the research activities at the CATT and
the NTC, and our highly effective distance learning capabilities, we will provide an outstanding educational option for engineers and technical professionals regionally, nationwide, and across the globe.

Full admission as a degree seeking student requires the following:

- A bachelor's degree, with a GPA of 3.0 or better, in engineering or science from an accredited institution
- Three letters of recommendation are required for the ENPM Program
- Applicants who have a GPA between 2.7 and 3.0 could be admitted provisionally which requires that they must earn a grade of B or better in their first two to four courses in order to gain full admission. Failure to do so will result in dismissal from the program.

III. Program Administration

OAEE provides administrative oversight to all academic options in the ENPM Program, including student services, faculty support, proctoring, admissions, and academic outreach. In addition, OAEE works with faculty to develop new courses and programs 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 that 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 Civil and Environmental Engineering, more specifically a faculty member in the National Transportation Center group will be the first academic advisor.

Professor Ali Haghani 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 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 Professional Master of Engineering in Transportation Systems Program will complete 10 courses or 30 credits. Students must also meet the prerequisites for any course they wish to take. The curriculum will be designed so that students could complete the curriculum in two academic years if pursuing the degree full-time.

V. Budget Resources

The Office of Advanced Engineering Education is a self-support unit and the Professional Master of Engineering Programs are administered through its resources.

VI. Master of Engineering Courses

Courses have already begun to be webcast through the DETS office in the Clark School of Engineering in preparation for this new offering. We will request the creation of a new online course section to correspond to this new specialization – potentially TSO* – under which students would take these courses.

- Core Courses
ENCE 670 Highway Traffic Characteristics and Measurements (3 credits)
Prerequisite: Permission of Instructor.
The study of the fundamental traits and behavior patterns of road users and their vehicles in traffic. The basic characteristics of the pedestrian, the driver, the vehicle, traffic volume and speed, stream flow and intersection operation, parking, and accidents.

ENCE 672 Regional Transportation Planning (3 credits)
Prerequisite: Permission of Instructor
Factors involved and the components of the process for planning statewide and regional transportation systems, encompassing all modes. Transportation planning studies, statewide traffic models, investment models, programming and scheduling.

ENCE 673 Urban Transportation (3 credits)
Prerequisite: Permission of Instructor.
The contemporary methodology of urban transportation planning. The urban transportation planning process, interdependence between the urban transportation system and the activity system, urban travel demand models, evaluation of urban transportation alternatives and their implementation.

ENCE 677 Transportation Analysis (3 credits)
Prerequisite: Permission of Instructor.
Fundamental skills and concepts of the quantitative techniques of operations research including: mathematical modeling, linear programming, integer programming, network optimization (shortest paths, minimum spanning trees, minimum cost network flows, maximum flows), heuristics, and basics of probabilistic modeling. Emphasis on the application of these techniques to problems arising in transportation.

ENCE 688I Discrete Choice Analysis (3 Credits)
Prerequisite: Permission of Instructor.
Methods and statistics of model estimation; maximum-likelihood estimation; individual choice theory; binary choice models; multi-dimensional choice models; sampling theory and sample design; aggregate prediction with choice models; joint stated preference and revealed preference modeling, and longitudinal choice analysis; review of state-of-the-art and future directions.

ENCE 688T Transportation Network Algorithms and Implementations (3 Credits)
Prerequisite: Permission of Instructor.
This course will focus on network optimization algorithms for transportation and logistics systems. The application of these techniques to the determination of optimal routes and tours for various transportation and logistics applications will be stressed. In addition to introducing a wide variety of network-related problems and existing techniques for solving a number of these problems, one of the goals of the course is to help the class participants to develop skills in creating and evaluating new algorithms and heuristics.

- Technical Elective Courses
  - ENCE 627 Project Risk Management (3 Credits)
    Prerequisite: Permission of Instructor.
    Approaches to identifying, analyzing, assessing, and managing risks inherent to engineering projects. Probability modeling, decision, and value theory. Schedule and cost risk. Risk mitigation and transfer, including insurance. Legal and ethical considerations of project risk. Examples drawn from construction, software development, systems integration, and other large engineering projects.

  - ENCE 666 Cost Engineering & Control (3 Credits)
    Prerequisite: Permission of Instructor.
    This course covers analytical techniques for project estimation and cost control, including site investigation, quantity takeoff, work analysis, and bid preparation, examination of popular software, systematic cost control, the fundamentals of different types of cost estimation, and appropriate applications of each. Case studies on cost engineering and controls during the life cycle of a project using simulation techniques to analyze and prepare the estimate, bid, control budget, change order process, schedule impacts, and cost impacts will also be used to reinforce cost engineering techniques.

  - ENCE 667 Project Performance Measurement (3 Credits)
Prerequisite: Permission of Instructor.
Examination of various techniques and models used to measure the performance of projects. Part I—
Project structuring: Work breakdown structure, project scheduling, project organization, project cost
estimation and budget. Part II—Earned value and earned schedule earned value management: project
control using EVM, earned schedule and resource management, project risk management. Part III—
Quality control and quality assurance: quality management, quality management methods, scope
management, quality assurance, commissioning.

- **ENCE 674 Urban Transit Planning and Rail Transportation Engineering (3 Credits)**
  Prerequisite: Permission of Instructor.
  Basic engineering components of conventional and high speed railroads and of air cushion and other
  high speed new technology. The study of urban rail and bus transit. The characteristics of the vehicle,
  the supporting way, and the terminal requirements will be evaluated with respect to system
  performance, capacity, cost, and level of service.

- **ENCE 688 Applications of OR in Transportation Systems Management (3 Credits)**
  Prerequisite: Permission of Instructor.
  This course covers the application of mathematical optimization in transportation systems
  management. Topics covered include nonlinear programming, traffic equilibrium, traffic assignment,
  transportation network design, location modeling, and vehicle routing and scheduling.

- **ENCE 688Q Transportation Economics (3 Credits)**
  Prerequisite: Permission of Instructor.
  Transportation Economics applies economic theories to transportation engineering and planning.
  Topics include: demand and demand forecasting, cost and cost estimation, externalities pricing,
  investment, regulation, industrial organization, economic impact, equity, and other
  social/environmental issues. Applications and special topics cover urban, intercity, and multimodal
  transportation.
For Time Period: **Academic Year**

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

Date submitted to Academic Unit Head: ____________________________

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<th>Student Learning Outcomes for assessments that will occur during the academic year</th>
<th>Assessment Methods &amp;Criteria</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 Master of Engineering students should have a GPA equal or greater than 3.0  
**Measure:** GPA | | |
| 3. Demonstrate continued retention of students and progress towards degree completion. | **Criterion:** 80% enrollment by existing students each semester.  
**Measure:** Registrar's Enrollment Records. | | |

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| 4. Demonstrate completion of degree program. | **Criterion:** 80% graduation rate of students within the five year limit for Master of Engineering students.  
**Measure:** Registrar's Graduation Records. |   |
| 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 ENPM Program regarding the quality of courses, the general program, faculty, and staff. The survey also collects information on employment (position, salary, etc.) at graduation. | **Criterion:** 50% response rate by graduating students.  
**Measure:** Graduation Survey. |   |