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 Energetic Concepts Option to the Professional Master of Engineering (PCC log no. 11006)

At its meeting on September 16, 2011, the Senate Committee on Programs, Curricula and Courses approved your proposal to establish an Energetic Concepts option to the Professional Master of Engineering. A copy of the approved proposal is attached.

The option is effective Spring 2012. The School should ensure that the option is fully described in the Graduate Catalog and in all relevant descriptive materials, and that all advisors are informed.

MDC/

Enclosure

cc: David Salness, Chair, Senate PCC Committee  
Sarah Bauder, Office of Student Financial Aid  
Reka Montfort, University Senate  
Erin Howard, Office of Information Technology  
Donna Williams, Institutional Research & Planning  
Anne Turkos, University Archives  
Linda Yokoi, Office of the Registrar  
Arthur Popper, 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 PROPOSAL

DIRECTIONS:
- Provide one form with original approval signatures in lines 1 - 4 for each proposed action. Keep this form to one page in length.
- Early consultation with the Office of the Associate Provost for Academic Planning & Programs is strongly recommended if there are questions or concerns, particularly with new programs.
- Please submit the signed form to Claudia Rector, Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.
- Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.

DATE SUBMITTED 6/21/11

COLLEGE/SCHOOL ENGR

DEPARTMENT/PROGRAM OAEE

PROPOSED ACTION (A separate form for each) ADD X DELETE CHANGE

DESCRIPTION (Provide a succinct account of the proposed action. Details should be provided in an attachment. Provide old and new sample programs for curriculum changes.)

Creation of an online academic option in Energetic Concepts to the existing Professional Master of Engineering program through the Office of Advanced Engineering Education.

JUSTIFICATION/REASONS/RESOURCES (Briefly explain the reason for the proposed action. Identify the source of new resources that may be required. Details should be provided in an attachment.)

See attached.

APPROVAL SIGNATURES - Please print name, sign, and date

1. Department Committee Chair

2. Department Chair George Symos 6/21/11

3. College/School PCC Chair

4. Dean Mark Shayman, Assoc. Dean for Grad. Programs Mark Shayman 7/20/11 7/27/11

5. Dean of the Graduate School (if required)

6. Chair, Senate PCC

7. Chair of Senate

8. Vice President for Academic Affairs & Provost

VPAAP 8-05
Proposal for a new online academic option in Energetic Concepts under the Professional Master of Engineering Program

Energetics is a branch of the physical science of mechanics, which deals primarily with energy and its transformations. Energetics research is the underpinning of the development of explosives and propellants. Energetics has clear applicability to military R&D, including the development of explosives technology, undersea weapons, and pilot ejection devices. Other applications are in space exploration, fire suppression, anti-terrorism, and cartridge-actuated devices such as door openers and automobile airbags.

This program was developed originally as part of a collaborative research program with the Department of Mechanical Engineering’s Center for Energetic Concepts Development (CECD) and various Department of Defense programs. CECD, established in 1998, is a cooperative research, technology transfer, product development, and science and technology training alliance between the Naval Surface Warfare Center Indian Head Division (IHDIV/NSWC) and The University of Maryland. The Center works in collaboration with the College of Southern Maryland, the Naval Academy at Annapolis, and the Naval Post Graduate School in Monterey, California. The Center is currently funded by the State of Maryland, the Office of Naval Intelligence (ONI), the Office of Naval Research (ONR), and IHDIV/NSWC.

Part of the collaborative program was to create a graduate education program that could be delivered online to the various researchers at the Naval Surface Warfare Center (NSWC) in Indian Head, MD and follow them on their wide-spread duty assignments. The first cohort of students has finished the Professional Master of Engineering program under the Mechanical Engineering academic option and due to the popularity of the program with other government defense researchers and contractors, we are currently offering the curriculum on a continuing basis.

Curriculum
Each student is required to complete thirty credits of approved course work or ten courses where each course represents three credits. Five of these courses must be from the Energetic Concepts core curriculum. Five additional technical electives courses may be taken from Energetic Concepts or through our other distance learning programs (Project Management, Reliability Engineering, Sustainable Energy Engineering, Nuclear Engineering or Fire Protection Engineering) or on campus with the approval of the academic advisor. Two of the elective courses may be taken at the undergraduate (400) level for graduate credit. ENPM 808 Special Projects in Energetics may be repeated for a total of six graduate credits.

Core Courses
ENPM 681 Shockwave Physics I (3) Covers the early history of the field becoming a scientific discipline, conservation equations for one-dimensional plane steady shocks, impedance matching, contact discontinuities, experimental techniques, thermodynamics of steady shocks, equations of state, one dimensional detonation theories, thermal explosions, techniques to measure steady detonation wave properties, sensitivity tests, and error analysis.

ENPM 682 Shockwave Physics II (3) Elastic-plastic solids, phase transitions, porous solids, materials with time-dependent properties, detonation waves in Ideal explosives, detonation waves in cylinders of non-ideal explosives, shock initiation of high explosives, experimental techniques for measuring detonation wave properties, Lagrangian coordinate system, ramp wave and radiation dynamic loading of material.

ENME 672 Composite Materials (3) Focuses on a new Materials by Design approach to creating energetic materials using Functionally Graded Materials (FGMs) concepts. Application of a new process, known as Twin Screw Extrusion (TSE), for continuously manufacturing energetic polymer composites which takes advantage of the continuous nature and superior mixing characteristics of the TSE process to manufacture a new concept for propellants and explosives: Functionally Graded Energetic Materials (FGEMs).

ENME 707 Combustion & Reacting Flows (3) Review of basic chemical thermodynamics principles (1'st, 2'nd law). Students will be introduced to the concepts of mass transfer so that they can eventually solve reaction-diffusion problems later in the term. We will spend considerable time developing the foundations of chemical kinetics and combustion chemistry. Examples of the chemistry of polluting emission will be discussed as well as unusual non-tradition combustion chemistries. We then introduce the concepts of prototype reactors (batch, plug-flow and perfectly stirred reactors) and then develop the theory of laminar premixed and diffusion flames. We will discuss two-phase combustion processes. E.g. Droplet burning and burning of solids. Other special topics will include statistical mechanical description of reaction rate theory.

Technical Electives
ENPM 661 Introduction to the Structure of Materials (3) The basic concepts of crystalline and amorphous materials are introduced. Crystal structure analysis is reviewed. Other topics include: x-ray diffraction, electron energy bands, metallic structure, elastic waves, semiconductors and superconductivity.

ENPM 662 Introductory Thermodynamics of Materials (3) The basic thermodynamic laws are applied to materials science. Phase transformations in materials and thermodynamic properties of polycrystalline and polyphase materials are introduced. Concepts related to phase diagrams are applied to real material systems.

ENPM 808 Special Projects in Energetics (3) Each student will select a special project in energetics of interest to the students. An outline and expected output will be agreed upon by the instructor and students. The student will work independently and submit a midterm progress report and a final report. The final grade will be based upon the final report. This course may be repeated for a total of six credits.

ENPM 808 Introduction to MEMS (3) Introduction to MEMS; Commercial & Military applications/successes; MEMS materials; MEMS fabrication techniques and processes; MEMS design, actuation, and sensing; MEMS packaging; Hermeticity of MEMS; metrology and reliability; and final project.

ENPM 808 Rocket Propulsion (3) Review of basic rocket propulsion principles including performance, design, analysis, nozzle theory, and thermodynamic relationships. Students will conduct performance analyses of solid, liquid, and hybrid rocket motors. Design projects will be focused to allow students to develop a basic understanding for the challenges associated with the design of chemical rocket engines/motors. We will examine the
classification of solid and liquid propellants/fuels/oxidizers and their combustion characteristics.