Graduate Council Curriculum Report

The Graduate Council Curriculum Report (GCCR), which includes all graduate curricular proposals approved through the Graduate Council curricular review process, is published 12 times each calendar year.

Questions/comments regarding the GCCR or its contents may be directed to the Director of Graduate Education Administration.

December 7, 2016

Graduate Degree Programs

CHANGE

Engineering Leadership and Innovation Management – change to degree requirements (College of Engineering), page 6

Graduate Courses

ADD

ASTRO 577
Exoplanets
EXOPLANETS (3)
Since the early 1990s, thousands of exoplanets have been discovered orbiting other stars beyond our solar system. The properties of these planets have challenged our understanding of how planetary systems form and evolve. This course will cover theories of exoplanets' formation and evolution, the discovery and characterization of exoplanets via exoplanet signals, and the physical properties of exoplanets, including prospects for habitability.
PROPOSED START: SU2017

CI 895
Internship
INTERNSHIP (1-18)
Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.
PROPOSED START: SU2017

C-S 590
Colloquium
C & S COLLOQUIUM (1-3)
Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.
PROPOSED START: SU2017
**MATSE 567**
Additive Manufacturing of Metallic Materials  
ADDITIVE MFG METAL (3-4)  
This course will expose students to the state of the art in understanding processing, structure, and property relationships in materials fabricated using additive manufacturing (AM). There will be a strong focus on metallic alloys, but polymers, ceramics, and advanced materials will also be briefly discussed. The emphasis of the course will be on understanding the links between processing and the resulting structure, as well as the microstructure and the mechanics of the fabricated materials.

Initially, we will discuss the types of AM and the feedstock materials required for these processes. We will then focus on metals, and discuss the energy sources used in AM (lasers, electron beams), and their interactions with the material. We will discuss the molten pool characteristics and the solidification microstructures. We will relate the microstructures seen in AM to the resulting mechanical properties (elastic deformation, plastic deformation, fracture, fatigue performance, and residual stress/distortion). Finally, we will discuss specific case studies for metals, polymers, ceramics, and advanced materials.

PROPOSED START: SU2017

**MKTG 811**
Driving Business Success with Marketing Analytics  
MKTG ANALYTICS (3)  
Data-driven marketing is essential for today’s business success. MKTG 811 prepares students with the fundamental skills to successfully leverage marketing data in business decision making and strategy. Students will learn how to map data to marketing challenges, apply basic statistics to marketing analyses, report results in meaningful ways, and support organizations in effectively leveraging marketing data. Special emphasis is given to translating data into meaningful and actionable business insights. This course does not assume any prior knowledge in statistics.

PROPOSED START: FA2017

**MKTG 813**
Data-Driven Customer Acquisition & Retention  
CUSTMR ACQ RETEN (3)  
MKTG 813 focuses on leveraging marketing data to support acquiring, developing relationships with, and retaining customers. Through the lens of the Customer Lifecycle, students will learn key data analytic techniques for targeting the right customers, engaging them and moving them through the path to purchase, identifying customer profitability and customer lifetime value, managing challenges such as customer churn, and building and managing customer loyalty programs.

PROPOSED START: FA2017

**MKTG 814**
Analytics for Brand Management and Customer Experience
MKT 814 (3)
MKTG 814 prepares students to apply marketing data analytics in support of brand and product success. The course familiarizes students with analytics for brand and product positioning, brand equity and loyalty, price optimization, and enhancing the customer experience. Special emphasis is placed on data visualization and communicating data insights in ways meaningful for strategic business application.
PROPOSED START: FA2017

PHIL 560
Africana Philosophy
AFRICANA PHILOSOPH (3)
This course explores and analyzes existing and emerging dominant themes in Africana philosophical discourse. It examines the construction of the Africana Philosophy canon and dominant themes that emerge within that canon while also identifying new directions for this important area of philosophy. With this in mind students will explore central foundational articles and books that signaled the rise of Africana Philosophy, edited collections and anthologies in Africana Philosophy, existing course syllabi, and more recent trajectories in Africana Philosophy in the 21st Century. Furthermore, the course will make central not only the contributions of early and contemporary male philosophers and activist-intellectuals to this tradition, but also critical women philosophical figures (who have often been marginalized by their male counterparts).
PROPOSED START: SU2017

PHS 590
Colloquium
COLLOQUIUM (1)
Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.
PROPOSED START: SU2017

PHS 805
Public Health Policy Analysis
PH POLICY ANALYSIS (3)
This course takes a pragmatic approach to public health policy analysis that aims to provide an understanding of how to do policy analysis. The course uses a case study format to investigate both historical cases and contemporary issues, in parallel, to understand the real-life complexity and challenges in health policy analysis. Attention will be given to what theoretical, ethical, and analytic frameworks best inform policy analysis, what research designs and methods to use, and the historical, political, and contextual influences. Health policy issues are often high profile and demand a public response. By examining health policy cases, both retrospectively and prospectively, students will develop a thoughtful conceptualization of the policy process and a systematic approach to construct clear and testable propositions about the health policy topic they are studying. The case study approach will provide lessons on the evolution of policy implementation, successes, and failures, and provide tools to assist students, as future policy-makers, in evaluating and planning current and future health policy.
PROPOSED START: SU2017

PHS 806
Public Health Ethics
PUBLIC HLTH ETHICS (3)
Public Health Ethics will familiarize students with the tenets that apply to health care delivery, experimentation, research, and human behavior as guided by principles developed over time to apply to government oversight of public health. Many of these principles are the results of specific cases or phenomena that have arisen over time and led to social interventions as a result. The course will look at several seminal events and the ethical principles derived from them. In many cases, principles are still being debated and the lines between ethical and unethical behavior still being negotiated. We will examine the differences between morals, ethics, and laws. We will explore the consequences of violating them. As scientific research grows in size and complexity, new principles will be needed. Students will also demonstrate a sound sense of scholarship and research integrity (SARI) by participating in ongoing discussions about Responsible Conduct of Research (RCR). How should these be formulated by concerned and caring individuals? The course will give some answers. Major topics will include moral reasoning, ethical decision-making frameworks, research integrity, and numerous case studies that highlight the interplay between ethics, law, and public health issues past, present, and future. The aims of this course include the education of public health leaders in applying ethical principles to public health issues, and enhancing decision making skills and capabilities that are necessary for creating an ethical approach to public health practice and research.

PROPOSED START: SU2017

**SOC 580**  
Social Network Analysis  
SOC NTWRK ANALYSIS (3)  
Methods of social network analysis used to examine patterns of ties among actors in a social system.  
PROPOSED START: SU2017

**SPAN 561**  
The Cinematic Pluriverse of Pedro Almodóvar  
ALMODOVAR (3)  
This seminar will examine the cinematic imagination of Spain’s most internationally celebrated filmmaker, Pedro Almodóvar. Topics to be considered will include Almodóvar’s lensing of gender politics, sexuality, multiculturalism, and national identity in post-dictatorial Spain; his nimble negotiation of the local and the global; his taste for cinephilic self-referentiality and hybridity of genre; and a distinctive tendency toward thematic idiosyncrasy—all of which are signature features of his postmodern “brand.” Significant attention will be devoted to approaches and trends within the vast corpus of scholarly criticism dealing with the filmmaker’s oeuvre, and our engagement with film theory will arise organically out of the references from these texts. Some basic tools, techniques, and language of film analysis will be considered, as will a general understanding of field-specific norms of film studies as practiced in North American and U.K. Hispanism.  
PROPOSED START: SU2017

**CHANGE**

OLD  
**BMS 571**  
Graduate Clinical Rotation  
GRAD CLIN ROTATION (1-3)  
This course allows graduate students at Hershey and University Park to gain experience in the clinical arena.  
APPROVED START: SP2009
NEW

BMS 571
Graduate Clinical Rotation
GRAD CLIN ROTATION (3)
This course allows graduate students at Hershey and University Park to gain experience in the clinical arena. BMS 571 Graduate Clinical Rotation is designed to allow graduate students at Hershey and at University Park to gain intensive experience in the clinical arena in the area of their dissertation research. The site of the clinical rotation and specific responsibilities of the student are determined by the clinical mentor that is matched with the student. Clinical mentors will indicate their willingness to sponsor a student and will outline the associated opportunities and responsibilities of the specific clinical rotation. The specific rotation will be selected by the student and the dissertation mentor to complement the student's graduate studies. Opportunities during the clinical rotation: The rotation typically will last 6 - 8 weeks and the student will be in the clinic and/or engaged in clinical activities for about 4h/week. During this rotation, students will have a range of opportunities including: attending Grand Rounds, attending Resident and Department Seminars and lectures, shadowing physicians, attending clinical research meetings, attending relevant case conferences, and, if appropriate, observing surgery. Students also may engage in a practical hands-on analysis of the subject matter (e.g., via an analysis of data, histology, MRI, etc.) and they will be involved in the discussion of relevant cases and of potential treatment strategies. Requirements: Course-specific policies and expectations for all students (i.e., for all students from Hershey and from the University Park Campus).(1) all students must complete an Infectious Disease Summary; an Insurance Waiver and a Confidentiality form. The forms will be located at the CANVAS course site. All 3 forms must be received by Graduate Education Office before the start of the Graduate Clinical Rotation. (2) Orientation Meeting: All students are required to attend a 2 hour mandatory Orientation Meeting where issues will be discussed related to the course requirements, what to expect in the clinical setting, HIPAA regulations, what is and is not appropriate, how and when to interact with patients, how physicians collect data from patients, terminology, hierarchy, and differences in thinking styles between clinicians and scientists. Students will not be allowed to begin their rotation if they fail to attend this mandatory meeting.
PROPOSED START: SU2017
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Curriculum Coordinator, University Faculty Senate, 101 Kern Graduate Building, University Park. The proposals will be transmitted to the Office of the Dean of the Graduate School for entry into the Graduate Council curricular review process; for more information about the process, see the Overview of the Graduate Council Curricular Review Process.

The Program Proposal Procedures provide guidance for the development of a graduate program proposal. If you have questions regarding the preparation of a graduate program proposal or how to complete this Graduate Council proposal form, contact the Office of the Dean of the Graduate School.

College/School: College of Engineering
Department or Instructional Area: School of Engineering Design, Technology, and Professional Programs

| New Graduate Program, Option, or Minor: | □ Add |
| Classification of Instructional Programs (CIP) Code: |
| Designation of new graduate option: |
| Designation of new graduate minor: |

Indicate effective semester:
□ First semester following approval
□ Second semester following approval

| Existing Graduate Program Option, or Minor: | □ Drop |
| □ Change |
| Current designation of graduate program: Engineering Leadership and Innovation Management |
| Current designation of graduate option: |
| Current designation of graduate minor: Engineering Leadership and Innovation Management |

New designation of existing graduate program (if changing):

New designation of existing graduate option (if changing):

New designation of existing graduate minor (if changing): Adding a prescribed minor to Master's degree. Updating ENGR 408/course information.

Brief description of the change (if not noted above):

Indicate effective semester:
□ First semester following approval
□ Second semester following approval

Submitted by Graduate Program Head

Sven B. Lee
Printed name
Signature
Date: 26 Oct 16

Noted by College/School Representative to Graduate Council Subcommittee on New and Revised Programs and Courses:

Matt Parkinson
Printed name
Signature
Date: 10/26/16

Approved by College/School Dean/Chancellor (or Designee):

Peter Burns
Printed name
Signature
Date: 10/27/16
Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:

On Behalf of C. Andrew Cole

Printed name

Signature

Date: 12/7/2016

Recommended by Chair, Graduate Council Committee on Programs and Courses:

On Behalf of M. Kathleen Heid

Printed name

Signature

Date: 12/7/2016

Noted by Dean of the Graduate School:

On Behalf of Regina Vasilatos-Younken

Printed name

Signature

Date: 12/7/2016
PROPOSAL FOR REVISIONS TO THE
ENGINEERING LEADERSHIP AND INNOVATION MANAGEMENT (ELIM)
PROGRAM (M. ENG. AND MINOR)

THE PENNSYLVANIA STATE UNIVERSITY — COLLEGE OF ENGINEERING
SCHOOL OF ENGINEERING DESIGN, TECHNOLOGY, AND PROFESSIONAL PROGRAMS
DR. SVEN G. BILÉN – PROGRAM HEAD; PROFESSOR-IN-CHARGE
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A. Program Modification Justification

This proposal is for a modification to the Master’s Program in Engineering Leadership and Innovation Management (ELIM). The modifications include a change in the course requirements and the addition of a Minor to the Engineering Leadership and Innovation Management (ELIM). The change in the course requirements is needed due to a change in the restructuring of ENGR 408 and ENGR 493. Previously ENGR 408 (2 credits) and ENGR 493 (1 credit) were companion courses with ENGR 493 serving as the project component for ENGR 408. During the spring of 2016 ENGR 408 was modified to include the project component previously in ENGR 493 and is now a 3 credit course. The proposed change is to drop ENGR 493 and modify ENGR 408 to reflect the 3 credits.

The second modification is to add prescribed requirements for a minor in Engineering Leadership and Innovation Management (ELIM).

B. Proposed Changes

1. Modification to Course Requirements:

The current ELIM Course requirements are shown in Table 1 below and the revised course requirements are shown in Table 2.

<table>
<thead>
<tr>
<th>Table 1: Existing course requirements.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENGR 408</strong>: Leadership Principles</td>
<td>2.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 493</strong>: Individual Leadership Experience</td>
<td>1.0 credit</td>
</tr>
<tr>
<td><strong>ENGR 411</strong>: Business Basics for Entrepreneurs</td>
<td>3.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 501</strong>: Engineering Leadership for Corporate Innovation</td>
<td>3.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 405</strong>: Project Management for Professionals</td>
<td>3.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 802</strong>: Engineering Across Cultures and Nations</td>
<td>3.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 804</strong>: Engineering Product Innovation</td>
<td>3.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 805</strong>: ELIM Capstone Project</td>
<td>3.0 credits</td>
</tr>
<tr>
<td>400-, 500-, or 800-level Elective</td>
<td>3.0 credits</td>
</tr>
<tr>
<td>500- or 800-level Elective</td>
<td>3.0 credits</td>
</tr>
<tr>
<td>500-level Elective</td>
<td>3.0 credits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Proposed course requirements.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENGR 408</strong>: Leadership Principles</td>
<td>3.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 411</strong>: Business Basics for Entrepreneurs</td>
<td>3.0 credits</td>
</tr>
<tr>
<td><strong>ENGR 501</strong>: Engineering Leadership for Corporate Innovation</td>
<td>3.0 credits</td>
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<td><strong>ENGR 405</strong>: Project Management for Professionals</td>
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</tr>
<tr>
<td><strong>ENGR 804</strong>: Engineering Product Innovation</td>
<td>3.0 credits</td>
</tr>
</tbody>
</table>
The electives (3 credits each – course option list available) will be chosen by the student, in consultation with their company (if they are associated with a sponsoring company) and the ELIM program director. The electives will utilize existing courses within the graduate curricula of the College of Engineering, Smeal College of Business, Psychology, or Organization Development and Change and Workforce Education and Development within the College of Education, allowing the student to expand his/her knowledge in either a technical, business, or psychology focus area.

2. Addition of a Prescribed Minor to the ELIM Program:

The ELIM program will offer a minor with prescribed requirements as outlined below:

**Name of the Minor Program:** Engineering Leadership and Innovation Management

Successful engineers and technical experts are expected to be well versed not only in technical skills but also in so-called soft skills such as communication, ethics, entrepreneurial thinking, and professionalism. These areas of leadership and innovation set technical experts apart and prepare them to be future global business leaders. This graduate minor is highly relevant to numerous graduate degrees associated with engineering, business, technical, or science related programs. This graduate minor consists of four 3-credit courses (12 credits) for master’s students and five 3-credit courses (15 credits) for doctoral students.

**List of Courses* Included in the Master’s Minor:**

The Engineering Leadership and Innovation Management (ELIM) minor (12-credits) is comprised of four courses:

- ENGR 501 Engineering Leadership for Corporate Innovation (3 credits-required course)
- ENGR 802 Engineering Across Cultures and Nations (3 credits- required course)
- ENGR 804 Engineering Product Innovation (3 credits- required course)
- ENGR 405 Project Management for Professionals (3 credits-required course)*

*Related courses may be substituted for ENGR 405 per an approved list of courses by the ELD office. Other elective courses outside this list may be petitioned for substitution to meet the ENGR 405 requirement.

**List of Courses* Included in the Doctoral Minor:**

The Engineering Leadership and Innovation Management (ELIM) doctoral minor (15-credits) is comprised of five courses:

- ENGR 501 Engineering Leadership for Corporate Innovation (3 credits-required course)
ENGR 802 Engineering Across Cultures and Nations (3 credits- required course)
ENGR 804 Engineering Product Innovation (3 credits- required course)
ENGR 405 Project Management for Professionals (3 credits-required course)*
500-level elective in a related field

*Related courses may be substituted for ENGR 405 per an approved list of courses by the ELD office. Other elective courses outside this list may be petitioned for substitution to meet the ENGR 405 requirement.

C. Graduate Bulletin Copy

ENGINEERING LEADERSHIP AND INNOVATION MANAGEMENT

Dr. Sven Bilén, Ph.D., P.E., Head of the School of Engineering Design, Technology, and Professional Programs
Department office: 213 Hammond Building
814-865-7589

Degree Conferred:
Master of Engineering (M.Eng.)
Minor (Residential and World Campus)

The Graduate Faculty

Engineering Leadership and Innovation Management

Sven G. Bilén, Ph.D. (Michigan), P.E., Professor of Engineering Design, Electrical Engineering, and Aerospace Engineering

Wesley E. Donahue, Ph.D. (Pennsylvania State University), Director of Technology and Workforce Development Portfolio; Associate Professor of Management Development

Andrew M. Erdman, M.S. (University of Southern California) Director of Engineering Leadership Development

Meredith H. Handley, M.S. (Georgia State University), Associate Director of Engineering Leadership Outreach

Kathryn Jablakow, Ph.D. (Ohio State) Associate Professor of Mechanical Engineering and Engineering Design

Frank Koe, Ph.D. (Pennsylvania State University), Associate Professor of Engineering Entrepreneurship

Teresa (Dena) H. Lang, Ph.D. (Pennsylvania State University), Associate Director of Engineering Leadership Research
Esther Obonyo, Ph.D. (Loughborough University), Associate Professor of Engineering Design and Architectural Engineering.

Conrad Tucker, Ph.D. (Illinois, Urbana - Champaign) Assistant Professor of Engineering Design and Industrial Engineering

Sarah E. Zappe, Ph.D. (Pennsylvania State University), Affiliate- Research Associate/Director of Assessment and Instructional Support

Engineering Leadership and Innovation Management

The program is designed to develop the attributes required by today’s successful engineering executives. Specifically, these include increased technical competency, expanded professional skills, the ability to identify opportunities for improvement, and the ability to work effectively in a globally connected engineering environment. Upon completion of the full one-year program, the successful student will have developed and demonstrated abilities enabling them to:

- establish and ensure team/project alignment with an organization’s mission, vision, strategy, and tactics; identify needs and effectively allocate resources to complete a project; form, lead, and serve effectively on teams (e.g., handling diversity in its many manifestations, negotiating effectively, and resolving personnel conflict or team dysfunction); work with others to identify opportunities for new products and businesses within an existing business structure; develop a product, service, or process from a concept to fielded solution or commercialization; identify personal strengths and workplace trait preferences through self-critical reflection and create a plan that incorporates identified personal strengths to address personal development opportunities; apply these critical skills to develop others in the work group; identify organizational strengths and weaknesses in order to define improvement strategies and plans; and lead cross-cultural and international projects, teaming with engineers and business professionals from around the U.S. and the world. These learning outcomes will be achieved through a combination of lectures by faculty, invited guest lecturers, reading of key literature, individual and team projects (including international virtual-team projects), and practical involvement in an engineering capstone design/market development team. Students enrolled in other M.S., M.Eng., or Ph.D. programs can also build knowledge and competencies in Engineering Leadership and Innovation Management through the minor described below.

Master of Engineering Admission Requirements

Educational Background

Admission requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.
The student cohort should reflect today’s international engineering environment, with selective admittance. The admission requirements include:

- Applicants must hold an undergraduate degree in engineering. Applicants must have a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests at the discretion of the program. Applicants will be accepted up to the number of places available for new students.
- 1 year of professional experience in an engineering position (or equivalent). Students wishing to enter the program directly from an undergraduate degree can fulfill the 1 year requirement for engineering experience through summer internships, summer employment, or co-op experiences plus additional experience within professional societies. Justification for this experience should be included in the Personal Statement during the application process.
- Submission of a completed online Graduate School Application for Admission, including a Personal Statement, resume, and three letters of recommendation. The Personal Statement should include a 2-3 page essay demonstrating your written communication skills with the following information: a) statement of purpose (career and educational goals), b) narrative describing your leadership and innovation experiences through summer internships, summer employment, co-op experiences, community engagement, professional societies, etc., and c) narrative describing your professional experience in an engineering position (or equivalent) to meet the 1 year requirement.
- Submission of official transcripts from all post-secondary institutions attended.
- Submission of official scores from the Graduate Record Examination General Test (GRE) or Graduate Management Admission Test (GMAT).

Applicants who are still completing their baccalaureate requirements at the time of application may be provisionally admitted to the Graduate School conditional on the awarding of the baccalaureate degree.

Core Application Packet

- Completed official online Graduate School application and payment of nonrefundable application fee.
- Statement of purpose: a 2-3 page essay articulating career and educational goals that demonstrates your written communication skills.
- Vita or Résumé.
- Three letters of recommendation that attest to your readiness for graduate study and document the requisite minimum of one year of work experience. Letters must be submitted through the online application. Within the online application you will be
asked to enter the names and email addresses of three individuals who will be providing your recommendation. Those individuals will receive a note via email asking them to complete a brief form that will serve as your recommendation. Please inform all recommenders they must submit the form in order for your application to be complete.

- Official transcripts from all post-secondary institutions attended.

Master of Engineering Degree Requirements
Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.

Total required credits for the ELIM program is 30 credits.

REQUIRED COURSES: (18 credits, plus the 3-credit capstone course described below)
- ENGR 408: Leadership Principles*
- ENGR 411: Business Basics for Entrepreneurs*
- ENGR 501: Engineering Leadership for Corporate Innovation
- ENGR 802: Engineering Across Cultures and Nations
- ENGR 405: Project Management for Professionals
- ENGR 804: Engineering Product Innovation

ELECTIVE COURSES: 9 credits
- 500-level elective (3 credits)
- 500- or 800-level elective (3 credits)
- 400-, 500-, or 800-level elective (3 credits)

These electives (course options list available) will be chosen by the student, in consultation with their company (if they are associated with a sponsoring company) and the ELIM program director. Electives should be chosen to meet the needs and interests of the student and can be selected from across the university. The electives can utilize existing courses within the graduate curricula of the College of Engineering, Smeal College of Business, Psychology, or Organization Development and Change and Workforce Education and Development within the College of Education, allowing the student to expand his/her knowledge in a technical, business or psychology focus area. Students may also pursue a concentration in a specific related domain by completing the 9 elective credits in one of the following core areas: Psychology of Work, Leadership and Decision Making, Organization Development and Change, or Work Force Education and Development. In addition, there are two Graduate Minor Programs and one Certificate Program at the University that can be completed through the 9 elective credits: Electrochemical Science and Engineering Master’s Minor, Computational Science Graduate Minor, and Human Factors Engineering and Ergonomics Graduate Certificate Program.

CULMINATING EXPERIENCE: 3 credits
- ENGR 805: ELIM Capstone Project
The Capstone course provides an opportunity to apply and integrate the knowledge and skills that were gained throughout the ELIM program with strategic management concepts. Capstone projects will target real-world opportunities, problems, and challenges of an existing organization. Students who successfully complete this course will be able to: identify and assess the impact of opportunities and threats in a company’s external environment, including its industry and its set of competitors; identify and assess a company’s internal strengths and weaknesses, and match them with its opportunities and threats to suggest alternative strategies; define the business-level strategies of a company; define competitors, competitive rivalry, competitive behavior, and competitive dynamics; and describe corporate-level strategy of the company as it relates to the capstone project.

*Students entering the program who have previously taken ENGR 405, ENGR 408 or ENGR 411 will be required to substitute alternate courses under the direction of the program director.

**Engineering Leadership and Innovation Management Minor**

Successful engineers and technical experts are expected to be well versed not only in technical skills but also in so-called soft skills such as communication, ethics, entrepreneurial thinking, and professionalism. These areas of leadership and innovation set technical experts apart and prepare them to be future global business leaders. This graduate minor is highly relevant to numerous graduate degrees associated with engineering, business, technical, or science related programs. This graduate minor consists of four 3-credit courses (12 credits) for master’s students and five 3-credit courses (15 credits) for doctoral students.

**Minor Admission Requirements:**

- Applicants must hold an **undergraduate degree** in engineering, science, or relevant discipline.
- Applicants must have a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.
- Applicants must be accepted and/or currently enrolled in a graduate program at Penn State. Official requests to add a minor to a doctoral candidate’s academic record must be submitted to Graduate Enrollment Services prior to establishment of the doctoral committee and prior to scheduling the comprehensive examination.
- Applicants to the Engineering Leadership and Innovation Management (ELIM) minor must submit a minor program application (see website for details).

**Other Program Requirements:**

In accordance with **Graduate Council policy**, a representative from the Graduate Faculty in Engineering Leadership and Innovation Management must be appointed to the doctoral
committee of each student enrolled in the doctoral minor in Engineering Leadership and Innovation Management (ELIM).

**List of Courses Included in the Master’s Minor:**

The Engineering Leadership and Innovation Management (ELIM) minor (12-credits) is comprised of four courses:

- ENGR 501 Engineering Leadership for Corporate Innovation (3 credits-required course)
- ENGR 802 Engineering Across Cultures and Nations (3 credits- required course)
- ENGR 804 Engineering Product Innovation (3 credits-required course)
- ENGR 405 Project Management for Professionals (3 credits-required course)*

*Related courses may be substituted for ENGR 405 from an approved list of courses maintained by the ELD office. Other elective courses outside this list may be petitioned for substitution to meet the ENGR 405 requirement.

**List of Courses Included in the Doctoral Minor:**

The Engineering Leadership and Innovation Management (ELIM) doctoral minor (15-credits) is comprised of five courses:

- ENGR 501 Engineering Leadership for Corporate Innovation (3 credits-required course)
- ENGR 802 Engineering Across Cultures and Nations (3 credits- required course)
- ENGR 804 Engineering Product Innovation (3 credits-required course)
- ENGR 405 Project Management for Professionals (3 credits-required course)*
- 500-level elective in a related field**

*Related courses may be substituted for ENGR 405 from an approved list of courses maintained by the ELD office. Other elective courses outside this list may be petitioned for substitution to meet the ENGR 405 requirement.

**For a doctoral minor a 500-level elective in a related field is required. Students must obtain approval for the elective course from their ELIM advisor in advance of registering.

**Other Relevant Information**

All graduate students must participate in Scholarship and Research Integrity (SARI) training by completing the online University module offered through the Office of Research Protections (ORP) during their first year of study and 5 hours of discussion-based training. The 5-hour discipline-specific discussion-based training may be obtained through participation in classroom discussions as part of ENGR 408 (5 hours) and ENGR 501 (5 hours), required courses within the
ELIM program. If students are unable to attend the specific lectures that include the SARI training, students will be able to attend seminars hosted by the College of Engineering that include professional development. These requirements must be met before graduation.

**Student Aid**

Refer to the Student Aid section of the Graduate Bulletin. Students in this program are not eligible for graduate assistantships.

**Courses**

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

**D. Consultation Responses for Revised Program**