Graduate Council Curriculum Report

The Graduate Council Curriculum Report (GCCR), which includes all graduate program 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.

April 6, 2016

1. **New Program:** Engineering Leadership and Innovation Management – new M.Eng. degree program (College of Engineering), page 2

2. **Program Change:** Data Analytics – begin offering base program in residence at Great Valley in addition to the current World Campus offering (Penn State Great Valley), page 51

3. **Program Change:** Kinesiology—adoption of the dual-title graduate degree program in Clinical and Translational Sciences, offering the Doctor of Philosophy (Ph.D.) degree (College of Health and Human Development), page 78

4. **Program Change:** Nursing – discontinue resident offering of two options (College of Nursing), page 94

5. **Program Change:** Statistics – adopt dual title in Social Data Analytics (Eberly College of Science), page 98

Note: Graduate course proposals approved through the Graduate Council curricular review process, as well as information about postbaccalaureate/graduate credit certificates approved by college/school administrators for graduate education, are published in the Senate Curriculum Report.
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

Designation of new graduate program: M. Eng. Engineering Leadership and Innovation Management
Classification of Instructional Programs (CIP) Code: __ 14,99 __

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: □ Change □ Drop

Current designation of graduate program:
Current designation of graduate option:
Current designation of graduate minor:

New designation of existing graduate program (if changing):
New designation of existing graduate option (if changing):
New designation of existing graduate minor (if changing):

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 G. Bilen
Printed name
Date: 13 Nov 15
Signature

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

All Berhan
Printed name
Date: 11/19/15
Signature

Erik Dornell
Approved by College/School Dean/Chancellor (or Designee):
Printed name
Date: 12/19/15
Signature

Pierluigi Burotta
Date: 11/23/15
<table>
<thead>
<tr>
<th>Role</th>
<th>Printed name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:</td>
<td>On Behalf of Luis Ayala</td>
<td>4/15/2016</td>
</tr>
<tr>
<td></td>
<td>Signature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Date: 4/15/2016</td>
<td></td>
</tr>
<tr>
<td>Recommended by Chair, Graduate Council Committee on Programs and Courses:</td>
<td>On Behalf of Andris Freivalds</td>
<td>4/15/2016</td>
</tr>
<tr>
<td></td>
<td>Signature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Date: 4/15/2016</td>
<td></td>
</tr>
<tr>
<td>Noted by Dean of the Graduate School:</td>
<td>On Behalf of Regina Vasilatos-Younken</td>
<td>4/15/2016</td>
</tr>
<tr>
<td></td>
<td>Signature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Date: 4/15/2016</td>
<td></td>
</tr>
</tbody>
</table>
PROPOSAL — MASTER OF ENGINEERING IN
ENGINEERING LEADERSHIP AND INNOVATION MANAGEMENT (ELIM)

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

The School of Engineering Design, Technology, and Professional Programs (SEDTAPP) in the College of Engineering is proposing a Master’s Program in Engineering Leadership and Innovation Management. Penn State is a pioneer in establishing interdisciplinary Engineering Leadership and Entrepreneurship minors for undergraduate students, with the programs formed in 1995 and 2002, respectively. A recent global evaluation (Graham, 2009)\(^1\) chartered by MIT highlighted Penn State as the first of four case studies of top leadership programs. Graduates from these minors have been vigorously recruited by recruiters from start-up companies to large multi-nationals. However, there is a need for more comprehensive leadership training and development at the graduate level, primarily among the individuals with a high potential for future leadership positions.

This proposal defines the motivation, target audience, approach, and viability of developing a new Master’s Program in Engineering Leadership and Innovation Management (ELIM). The program’s focus will be on providing motivated graduate engineers with the education that will enable them to become globally-aware innovation leaders in industry who are able to develop innovative solutions and new products within an existing business. The program will be an intensive, residential, one-year program that will continue the Penn State tradition of excellence in leadership education while meeting the need for leadership training and development at the graduate level. The program is designed to provide training and experience in the key aspects of engineering business: leading teams, identifying new business opportunities, working across international and cultural boundaries, effectively managing projects, and promoting internal innovation.

A. Program Justification

A recent report by the National Academy of Engineering\(^2\) highlights the importance of leadership training for engineers in the new century: “To enhance the nation’s economic productivity and improve the quality of life worldwide, engineering education in the United States must anticipate and adapt to the dramatic changes of engineering practice. The Engineer of 2020 urges the engineering profession to recognize what engineers can build for the future through a wide range of leadership roles in industry, government, and academia not just through technical jobs. Engineering schools should attract the best and brightest students and be open to new teaching and training approaches. With the appropriate education and training, the engineer of the future will be called upon to become a leader not only in business but also in nonprofit and government sectors.” (Engineer of 2020, National Academy of Engineering). In response to this need, there has been an emergence of leadership education over the past decade. A recent benchmarking study identified 29 leadership programs (both undergraduate and graduate) across the US and Canada, with formation dates available for 21 programs. Of the 21 programs, 15 were established in the last decade. In addition, there has been amazing growth of the American Society of Engineering Education’s Engineering Leadership Division from a handful of members a year ago to over 600 current members.

The following provides additional support and justification for the need of the graduate program in Engineering Leadership and Innovation Management:

Market Analysis

- A market analysis was performed by the Penn State Smeal College of Business, in the spring of 2015, to assess student interest from engineering juniors (N=146) in pursuing a post-graduate master’s program in leadership and management. The results of this analysis showed that, of engineering juniors, 29% of the students surveyed were very interested in a program that gives them the solid foundation in business-related areas needed to more rapidly advance in their chosen career field. An additional 49% were interested but needed more information. Students were asked to rate the level of importance of aspects of the graduate program on a scale of 1 to 10 with 10 being very important and 1 being not at all important. Students rated the following as important: communication and other ‘soft’ skills (6.7), teamwork (6.7), personal assessment of strengths and weaknesses (7.7), and development of business foundation (8.1). Aspects of the Smeal program are provided in our ELIM program, with the ELIM program focused on engineering applications and innovation in an engineering environment. As such, the findings of the Smeal study are likely applicable to our program as well. In addition, students were asked what other master’s programs they were considering and

\(^2\) National Academy of Engineering (2004),
http://www.nae.edu/Programs/Education/Activities10374/Engineerof2020.aspx
engineering students indicated: Engineering (58%) and MBA (33%) as the primary programs of interest.

Engineering employers have reported workforce needs related to competencies in initiative/confidence, communication, interpersonal interaction, teamwork, and engagement\(^3\) supporting our target market and aligned with students’ interests.

University Benchmarking

- We have a number of benchmarking sources that support the need for this program:

  - Our internal review of Engineering Leadership, Management, and Entrepreneurship programs identified nearly 80 programs across the globe, 67 of which were at the graduate level. Our review concluded that the program we are proposing was unique in its focus on engineering leadership, innovation management, and engineering across cultures. Specifically, the study found that graduate level programs in the areas of ‘engineering leadership’, ‘engineering entrepreneurship’, and ‘engineering management’ were well represented domestically and abroad, the area of ‘engineering intrapreneurship’ (which we refer in the program’s title as ‘innovation management’) combined with ‘engineering leadership’ and ‘engineering across cultures’ would be exclusive to Penn State.

  - A review performed in 2014 at the University of Toronto with detailed interviews of 21 Engineering Leadership program directors indicated that 7 schools had engineering graduate programs or courses in either leadership, management, or innovation, but none had a concentration in leadership, innovation, and global engineering.

  - A review performed by the Management Division of ASEE of nearly 100 universities in the US with graduate programs in Engineering Management identified only one program that mentioned Leadership as part of the degree title.

  - A review performed by BYU of 20 universities with Engineering Leadership programs identified one university (Michigan) as providing a graduate certificate in Engineering Global Leadership. Another, Valparaiso, offers a Master in Engineering Management with an emphasis on leadership.

\(^3\) Hartmann BL, Stephens C., Jahren CT. (2015) Surveying industry needs for leadership in entry-level engineering positions. 122\(^{nd}\) ASEE Annual Conference & Exposition, Seattle, WA (paper ID#12326).
Industry Benchmarking

- Results of two meetings with our Advisory Board (members include representatives from GM, GE, GKN, Merck, Bechtel, ArcelorMittal, Rockwell Automation, Lockheed Martin, and Walt Robb, past head of the Research and Development Center at GE) indicated unanimous agreement that the program was needed and appropriate, and that the companies would both support and hire graduates from the program. Similarly, the review by the SEDTAPP Industrial and Professional Advisory Council (IPAC) was fully supportive of the program, indicating strong support from industry.

Of course, this does not mean the Penn State program will not face competition. Due to geographic proximity, the program’s primary competition would come from schools in the northeast offering related programs such as Northeastern and the University of Toronto, which offer graduate programs in Engineering Management with an available emphasis on engineering leadership, primarily through complimentary certificates. Northeastern’s program requires 16 credits in leadership coursework and 16 credits of technical management coursework. Students graduate with an MS in Engineering Management and a certificate in Engineering Leadership. Since 2007, the program has had an average of 11 students per year. The University of Toronto offered its first graduate course in Leadership and Leading in Groups and Organizations in 2007 and instantly exceeded available space. In 2012, their program awarded 57 co-curricular certificates in either Organizational Leadership or Team Skills. They are also launching a new graduate certificate in Entrepreneurship, Leadership, Innovation and Technology in Engineering for Master of Engineering students in the fall of 2015.

Programs with an engineering entrepreneurship focus are offered by Carnegie Mellon and Johns Hopkins, and general engineering management programs can be found at Tufts and Drexel. Lehigh University offers a one-year master’s degree in Technology Entrepreneurship, but there are few connections with existing companies. Based on our internal review, our program’s focus on ‘engineering intrapreneurship’ (promoting and managing innovation within an existing company) combined with ‘engineering leadership’ and ‘engineering across cultures’ will provide a competitive advantage to Penn State.

The Program’s emphasis on Engineering Leadership and Innovation Management will develop leadership, intrapreneurship, and inter-cultural competencies in high-potential employees at small and large technical firms as well as the top echelon of students with undergraduate degrees and significant co-op, internship, or summer work experience. All firms need to provide professional development opportunities for their best young employees—employees who often expect that the company will help them obtain an advanced degree. Our program has been designed to allow for either fall or spring semester admittance. Entrance to the program in the spring semester may be more attractive to students that are sponsored by their employer. Starting in the spring semester enables students to build knowledge and skills
foundational to leadership and innovation management across one semester and then apply those skills for a summer with their employer or as an intern in a company. Students would return to Penn State in the fall semester, where they complete additional course work and apply their knowledge in a capstone project of interest to the summer employer. We believe this plan is one of the factors that make the program uniquely valuable to the target audience. The inclusion of a spring entry followed by a return to the student’s employer/internship for the summer provides an opportunity that also benefits the company sponsoring the student/employee. During the student’s summer work experience, the sponsoring company has the opportunity to advance important new product and process improvement initiatives that can be continued as part of the student’s capstone project.

Further, graduating engineering students, both from Penn State, as well as other universities, here and abroad, may wish to participate in this program. A fall semester entrance may be preferable to students coming directly from an undergraduate program. Based on numerous interactions with our students over several years, we believe that the program will also be highly attractive to graduating seniors, and recent graduates with only a few years of work experience. Many of these individuals did not take advantage of undergraduate leadership or entrepreneurship minors or have limited work experience, and are looking for “something more” to distinguish their academic and professional credentials. In addition, this program may be attractive to international students, and this would add a valuable dimension of multicultural exposure and awareness to the student cohort. Taibah University (Medinah, KSA) has stated that they desire enrolling several students annually, and we anticipate interest from other foreign universities.

We believe that the ELIM program will become a highly attractive opportunity for companies seeking to strengthen their leadership abilities and to build the intrapreneurial capacity of their teams. By providing training and experience in the key aspects of engineering business—leading teams, identifying new business opportunities, working across international and cultural boundaries, effectively managing projects and promoting internal innovation—we have set ourselves apart. In addition, the program benefits from the inherent, demonstrated strengths of Penn State’s College of Engineering and programs in Leadership, Entrepreneurship, the new M.S./M.Eng. in Engineering Design, and the Learning Factory.

SEDTAPP currently has ten faculty members engaged with the Engineering Leadership and Entrepreneurship programs. The School has hired a full-time Associate Director of Engineering Leadership Research who will assist with the implementation, teaching, and student advising within the graduate program, as well as a full-time Associate Director of Engineering Leadership Outreach who will assist in teaching and providing on-line options beyond the initial resident program. Both are faculty appointments.

Required courses in the master’s program will include ENGR 405, ENGR 408, ENGR 411, and ENGR 493, currently part of the Engineering Leadership Development and Entrepreneurship
minor programs. This will increase the demand for these courses by 20 students per year. The program plans to hire additional faculty as course demand warrants.

**Faculty Members**

**CVs are available for all faculty**

**Program Head and Professor-In-Charge**

**Sven G. Bilén**, Ph.D., P.E., Head of the School of Engineering Design, Technology, and Professional Programs; Professor of Engineering Design, Electrical Engineering, and Aerospace Engineering

**Co-Directors (program oversight and student selection)**

**Teresa (Dena) Lang**, Ph.D., Associate Director of Engineering Leadership Research

**Andrew M. Erdman**, Walter L. Robb Director of Engineering Leadership Development and Instructor of Engineering Science and Mechanics

**Liz Kisenwether**, Director of Intercollege Minor in Entrepreneurship and Innovation

**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

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

**Gül E. Okudan Kremer**, Ph.D. (Missouri - Rolla) Professor of Engineering Design and Industrial Engineering

**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), Educational Psychology Affiliate-Research Associate/Director of Assessment and Instructional Support

**Requesting Nominations for Graduate Faculty ‘R’ Status:**

**Teresa (Dena) Lang**, Ph.D. (Pennsylvania State University), Associate Director of Engineering Leadership Research
Frank Koe, Ph.D. (Pennsylvania State University), Associate Professor, Engineering Entrepreneurship

Requesting Nominations for Graduate Faculty ‘P’ Status:

Andrew M. Erdman, Walter L. Robb Director of Engineering Leadership Development and Instructor of Engineering Science and Mechanics

B. Program Objectives

The ELIM program will be aimed at enhancing the key attributes of a “World-Class Engineer”: solidly grounded, technically broad, globally engaged, ethical, innovative, excellent collaborators, and visionary leaders. 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 this one-year program, the successful student will have developed and demonstrated abilities in the following areas:

1. Establish and ensure team/project alignment with an organization’s mission, vision, strategy, and tactics.
2. 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.
3. Apply critical skills in reflection and identification of strengths and opportunities to develop others in the work group.
4. Form, lead, and serve effectively on engineering teams (e.g., handling diversity in its many manifestations, negotiating effectively, and resolving personnel conflict or team dysfunction).
5. Identify organizational strengths and weaknesses in order to identify new product opportunities and define improvement strategies and plans.
6. Identify opportunities for new engineering products and businesses within an existing business structure.
7. Develop a product, service, or process from a concept to fielded solution or commercialization.
8. Identify needs and effectively allocate resources to complete a project.
9. 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.

**Non-duplication of Other Degree Programs**

SEDTAPP and College of Engineering do not currently offer a master’s degree with a focus on Engineering Leadership and Innovation Management. The closest connections are with Penn State Great Valley, which offers a Master of Engineering Management (MEM), and with Penn State Harrisburg, which offers a Master of Professional Studies in Engineering Management integrating engineering with business and management principles. The MEM at Penn State Great Valley is designed to address the needs of engineers in coordinating and developing large interdisciplinary engineering projects in addition to the leadership of technical staff. Its focus is on engineering management (e.g., managing projects and people with a focus on economics, finance, risk analysis, and problem solving), whereas the ELIM program proposed here concentrates on leadership, corporate innovation, and working across international and cultural boundaries (e.g., leading teams, developing new products and services, and driving innovation in existing companies). Although there are similarities, the Great Valley MEM program focuses more on how to get tasks accomplished within an engineering/technical environment, whereas the ELIM program focuses more on how to align people to a vision within engineering/technology-based corporations. Penn State Great Valley also offers a Master in Leadership Development (MLD), designed to meet the educational needs of professionals at the middle to senior levels of management who are predominantly full time professionals living in the Great Valley area. In contrast, the ELIM program proposed here targets high-potential, early-career employees and returning students. At University Park, program connections exist with the Smeal College of Business, which offers various management and business degrees, the Psychology Department, which offers a MPS in Psychology of Leadership at Work (with a disciplinary focus in Industrial/Organizational Psychology and Applied Social Psychology), and the College of Education, which offers graduate degrees in Workforce Education and Development. In all of these cases, what distinguishes the ELIM program is the focus on ‘engineering intrapreneurship’ (corporate innovation) combined with ‘engineering leadership’, emphasizing ‘international and cross-cultural engagement’. Within the ELIM program, leadership and innovation management will be taught through courses, case studies, guest speakers, and projects within the context of a globally-diverse technical environment.

The new ELIM program will continue the Penn State tradition of excellence in leadership education by extending its reach to meet the need for more comprehensive engineering leadership training and abilities development at the graduate level, primarily among individuals with a high potential for future technical leadership positions.
Inclusion of Leadership and Innovation within the College of Engineering

Six of the seven attributes of a world-class engineer (technically broad, globally engaged, ethical, innovative, excellent collaborators, and visionary leaders) are key elements of the ELIM proposed program. Based on our benchmarking with industry partners, there is a desire and need for programs focused on Engineering Leadership and Innovation or Intrapreneurship. Some large companies offer engineering leadership programs for their high-potential, early-career employees (e.g., the Engineering Leadership Development Program at LMCO, the Edison Engineering Program at GE), but others may not have the resources to do so. These leadership programs train early-career employees to lead (e.g., set a vision and strategy, garner support from the organization, work well in and lead teams), and our program would provide this type of training, but with an additional focus on innovation and a cross-cultural dimension. Our industrial partners see the hiring of a graduate of the ELIM program as highly attractive.

Further, there is a growing constituency of Engineering Leadership programs around the US and Canada. The Engineering Leadership Development Division of ASEE (formed in 2014) has already recorded over 600 members. Both undergraduate and graduate programs are growing in universities from the east coast to the west. Such programs exist within top Engineering Schools such as: Carnegie Mellon University - MS in Engineering & Technology Innovation Management, Purdue University - MS in Engineering w/ Concentration in Engineering Management and Leadership, University of Wisconsin - ME in Engineering in Professional Practice with a Technical Leadership Certificate, and Northeastern University - Graduate program in Engineering Leadership. In addition, we have identified 67 Engineering Schools with graduate programs in Engineering Management with courses in leadership or entrepreneurship including: Massachusetts Institute of Technology, University of Michigan, Cornell, University of Maryland-Baltimore County, Northwestern University, University of North Carolina-Charlotte, and the University of Colorado-Boulder, all with leadership courses. What distinguishes our program is that it combines both Leadership and Innovation. Equally important are the recommendations found in “The Path Forward – The Future of Graduate Education in the United States (2010, Educational Testing Service)” related to encouraging the development of abilities that enhance research impact for graduate students, including communications, teamwork, relating work to a broader context and application of research to larger corporate or social purposes, all hallmarks of this proposed ELIM program.

C. New Courses

The course offerings will include 4 new graduate-level courses (draft syllabi available):

- **Engineering Leadership for Corporate Innovation (ENGR 501 ENGR CORP LDRSHP):** This course focuses on concepts and theory related to the study of leadership in an engineering context. Traditional and contemporary leadership theory will be analyzed to determine effective strategies for leading technical projects and innovation. Based on current literature and research into effective engineering leadership, students will focus on understanding concepts related to: technical communication, optimization of engineering teams, and diffusion of innovation. Financial concepts and Lean Sigma practices will be assessed for effective engineering leadership decision-making. Students that successfully complete this course will be able to: distinguish leadership theory relevant to an engineering context; recognize commonalities of leaders in successful organizations; explain concepts for how innovation is diffused throughout a corporate culture; define communication concepts relevant for leading change in a diverse technical environment; and recognize the ethical and social implications of engineering work in a global environment.

- **Engineering Across Cultures and Nations (ENGR 802 ENGR CULTURE NATION):** This course focuses on the primary knowledge areas and essential competencies required for successful engineers to live and work in today’s global marketplace. The course will examine individual and cultural differences and how they impact communication and team dynamics. These topics are central to international and multicultural engineering teams. Students that complete the course will be able to understand sources of conflict that can arise in multicultural teams and effectively use the tools and resources learned in class to manage individual and team motivation and minimize or effectively deal with conflict, while harvesting the benefits of diversity as they work on a real world virtual team project, producing effective solutions to challenging engineering problems.

- **Engineering Product Innovation (ENGR 804 ENGR PROD INNOVAT):** This course focuses on the primary knowledge areas and essential competencies required to be entrepreneurial within an existing venture, such as leading a new product/process development or participating in a corporate spin-out. The course includes the following topics: identification and development of the knowledge, skills, and attitudes of entrepreneurial leaders; understanding fundamentals of corporate entrepreneurship; participating in live cases around product innovation; leveraging intellectual property (IP); development and use of the Business Model Canvas (BMC) for product development and commercialization; and assignment and activity reflections, critiques, and discussions of lessons learned. These topics are central to leading new product/process development within an existing venture. Upon completion of this course, students will be prepared to actively participate in a new product development team, from ideation through commercialization.
**ELIM Capstone Project (ENGR 805 ELIM CAPSTONE PROJ):** 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 opportunities, problems, and challenges of an existing organization. Students that complete this course will be able to: identify and assess opportunities and threats in a company; identify and assess a company’s internal strengths and weaknesses and 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 a company.

See Table 1 below for an overview of the topics/competencies covered in each of the program courses as well as the corresponding program objectives supported by each topic.

<table>
<thead>
<tr>
<th>Content Topics</th>
<th>Lead Principles</th>
<th>Entre Business Basics</th>
<th>Lead Corp Innov</th>
<th>Across Cult</th>
<th>Proj Mgmt</th>
<th>Prod Innov</th>
<th>Program Objectives (pg. 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding Yourself and Others</td>
<td>H*</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>2, 3, 4, 9</td>
</tr>
<tr>
<td>Developing Effective Teams</td>
<td>H*</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>1, 2, 3, 4, 8, 9</td>
</tr>
<tr>
<td>Communication</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>2, 3, 4, 5, 7, 9</td>
</tr>
<tr>
<td>Solving Problems</td>
<td>H*</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>4, 5, 8, 9</td>
</tr>
<tr>
<td>Ethics/Making Ethical Decisions/Judgment</td>
<td>H* - SARI (5 hours)</td>
<td>L</td>
<td>H - SARI (5 hours)</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>1, 2, 3, 4, 5, 8</td>
</tr>
<tr>
<td>Creativity</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>6, 7</td>
</tr>
<tr>
<td><strong>Program Core Competencies (common to all courses)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership Concepts</td>
<td>H*</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 5</td>
</tr>
<tr>
<td>Leadership in Organizations</td>
<td>L</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 5, 6, 7, 8</td>
</tr>
<tr>
<td>Workforce Focus in Organizations</td>
<td></td>
<td></td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Financial Knowledge</td>
<td>H*</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6, 7, 8</td>
</tr>
<tr>
<td>Marketing</td>
<td>H*</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td></td>
<td></td>
<td>6, 7, 8</td>
</tr>
<tr>
<td>Dealing with Conflict</td>
<td>H*</td>
<td>L</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>2, 3, 4, 9</td>
</tr>
<tr>
<td>Applying Lean-Sigma</td>
<td></td>
<td></td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>5, 6</td>
</tr>
<tr>
<td>Project Management</td>
<td>L</td>
<td></td>
<td>L</td>
<td>H</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Intrapreneurship</td>
<td>H*</td>
<td></td>
<td></td>
<td>H</td>
<td></td>
<td></td>
<td>1, 6, 7</td>
</tr>
<tr>
<td>Intellectual Property</td>
<td>H*</td>
<td></td>
<td></td>
<td>M</td>
<td>H</td>
<td></td>
<td>6, 7</td>
</tr>
<tr>
<td>Cultural Differences</td>
<td>H*</td>
<td>L</td>
<td></td>
<td>H</td>
<td></td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

Legend: H*: Foundation course - high coverage; H: high coverage; M: medium coverage; L: low coverage.
D. Program Statement

The ELIM Course Plan has two possible paths, described below:

**Path 1/Fall Semester Start:** This is an entry path that accommodates top students who desire to continue with their education and are not yet employed. Option 1 forms a unique (4 years plus 1) program, where the ELIM program adds valuable leadership and intrapreneurial skills to a BS-Engineering degree. 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. Table 2 presents a program plan with a fall semester entry. Students may take courses in the fall, spring, and summer semester provided that they complete the program within 1 year of entry.

<table>
<thead>
<tr>
<th>Fall Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENGR 408:</strong> Leadership Principles</td>
</tr>
<tr>
<td><strong>ENGR 493:</strong> Individual Leadership Experience</td>
</tr>
<tr>
<td><strong>ENGR 411:</strong> Business Basics for Entrepreneurs</td>
</tr>
<tr>
<td><strong>ENGR 501:</strong> Engineering Leadership for Corporate Innovation</td>
</tr>
<tr>
<td><strong>ENGR 405:</strong> Project Management for Professionals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>500- or 800-level Elective</td>
</tr>
<tr>
<td><strong>ENGR 802:</strong> Engineering Across Cultures and Nations</td>
</tr>
<tr>
<td><strong>ENGR 804:</strong> Engineering Product Innovation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summer Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENGR 805:</strong> ELIM Capstone Project</td>
</tr>
<tr>
<td>500-level Elective</td>
</tr>
<tr>
<td>400-, 500-, or 800-level Elective</td>
</tr>
</tbody>
</table>

Table 2: Program path with fall semester entry.

**Path 2/Spring Semester Start:** This might be a preferred entry path for high-potential engineers selected by their employers. Starting in spring semester enables students to build foundational Leadership and Innovation Management abilities and knowledge across one semester and then apply those abilities for a summer with their employer or as an intern in a company. Finally, students return to Penn State in the fall, where they complete additional course work and use their abilities to work on a project of interest to the summer employer. Table 3 presents a program plan with a spring semester entry. Students may take courses over the spring, summer, and fall semesters provided that they complete the program within 1 year of entry.
<table>
<thead>
<tr>
<th><strong>Spring Semester</strong></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>400-, 500-, or 800-level Elective</td>
<td>3.0 credits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Summer Semester</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>500- or 800-level Elective</strong></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>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Fall Semester</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENGR 405</strong>: Project Management for Professionals</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>500-level Elective</td>
<td>3.0 credits</td>
</tr>
</tbody>
</table>

Table 3: Program path for spring semester entry.

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.

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.)

**The Graduate Faculty**
Engineering Leadership and Innovation Management
Master of Engineering in Engineering Leadership and Innovation Management

The ELIM program is aimed at enhancing the key attributes of a “World-Class Engineer”: solidly grounded, technically broad, globally engaged, ethical, innovative, excellent collaborators, and visionary leaders. 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 this 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.

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:

- B.S. degree in an Engineering field with 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. 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 Leadership and Innovation Portfolio during the application process.

- Submission of a completed online Graduate School Application for Admission, including a Statement of Purpose, Leadership and Innovation Portfolio, resume, and three letters of recommendation.

- Submission of official transcripts from all post-secondary institutions attended.

- Submission of official scores from the Graduate Record Examination General Test (GRE)

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.**

### 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.

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 599 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.

E. Admission Requirements

The student cohort should reflect today’s international engineering environment, with selective admittance. With this in mind, the following admission requirements are proposed:
- B.S. degree in an Engineering field with 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. 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 Leadership and Innovation Portfolio during the application process.

- Submission of a completed online Graduate School Application for Admission, including a Statement of Purpose, Leadership and Innovation Portfolio, resume, and three letters of recommendation.

- Submission of official transcripts from all post-secondary institutions attended.

- Submission of official scores from the Graduate Record Examination General Test (GRE).

- A $65 non-refundable application fee.

F. Degree Title Justification

The degree conferred by the ELIM program will be a Master of Engineering (M.Eng.) degree. This type of professional degree was chosen for the following reasons:

- Rather than training students to conduct research to generate new knowledge, the ELIM program trains students to apply existing knowledge to practical problems

- The ELIM program contains no research requirement; instead, there is a Capstone Design Project

- The ELIM program has a strong focus on interdisciplinary learning and cross-training rather than a specific disciplinary core

- The ELIM program focuses on professional development for advancement in the student’s specific career

Examples of Existing Programs using the M.Eng.:

- Duke
- Massachusetts Institute of Technology
- North Carolina State University
- Texas Tech University
- University of Illinois
G. Accreditation

At this point in time, there is no known accreditation or licensing process for programs like the ELIM program. It is possible that this will be a consideration in the future and should be closely monitored.

H. Consultation Responses

Consultation Summaries (full consultation documentation follows these summaries):

Consultation with Engineering Management, Penn State Harrisburg
Dr. Sedig Agili, Engineering Management Program Coordinator, indicated that although there is some overlap with MPS EM at Penn State Harrisburg, our program’s focus on leadership and innovation specific for engineers provides uniqueness. Dr. Agili provided support for the proposal.

Consultation with Engineering Management, Penn State Great Valley
Dr. Colin J. Neill, Director of Engineering Programs, indicated that while there is overlap in the intent of the two programs, the target demographic and new product development focus of the ELIM program distinguishes the two programs sufficiently. Dr. Neill provided support for the proposal.

Consultation with Leadership Development, Penn State Great Valley
Dr. John J. Sosik, Professor of Management and Organization, suggested edits for improvement to the program and course proposals to more clearly distinguish the two programs and was happy with our revisions and fully supports the program proposal.

Consultation with Smeal College of Business Administration
Brian H. Cameron, Associate Dean for Professional Master’s Programs, and Denny Gioia, reviewed this proposal and did not have any concerns with the proposal.

Consultation with Psychology Department, Psychology of Leadership at Work, College of Liberal Arts
Dr. Douglas Lindsay, Professor of Practice & Director of Masters of Professional Studies reviewed our program and course proposals and indicated that there was not significant overlap with the MPS in the Psychology of Leadership at Work program. While there is some content overlap, it is significantly different (with the application to the field of engineering and its focus on "developing innovative solutions and new products within an existing business") enough that it does not overlap with the objectives and outcomes of the courses in the MPS. Dr. Lindsay also offered several courses in their program as electives that might be of interest to our students. In addition, Dr. Avis Kunz, Assistant Dean for Online Education and Outreach, has also supported offering seats for students in their courses as elective credits.
Consultation with Workforce Education and Development Department, College of Education
Dr. William Rothwell indicated that Workforce Education and Development reviewed the program and course proposals and support them. He also indicated that they are supportive of including WFED courses as potential electives in our program.

Consultation with College of Engineering Department Heads
Agricultural and Biological Engineering Department, College of Engineering:
Dr. Paul Heinemann indicated that the ABE department has no issues with this new program and supports it.

Engineering Science and Mechanics Department, College of Engineering:
Dr. Judith Todd provided comments from the ESM Graduate Officer regarding the number of 400-level courses that count toward a graduate degree. We provided clarification that our program only includes 6 required credits at the 400 level (ENGR 408-2 credits, 493 – 1 credit, and 411 – 3 credits) and 18 credits at the 500 level: [5 core classes (15 credits) and one 3 credit elective] and 6 credits of additional electives. ESM also provided contacts for several local experts that could provide guidance on ENGR 502.

Industrial & Manufacturing Engineering Department, College of Engineering:
Dr. Paul Humphreys provided feedback from Dr. Robert Voigt who supported the program in general but thought that it could benefit greatly from an 'applied engineering statistical methods course'. We indicated that we would provide students with a ‘suggested’ electives list with courses from Psychology, Smeal, and Workforce Development and will include a course on applied engineering statistical methods as suggested.

Mechanical and Nuclear Engineering Department, College of Engineering:
Dr. Karen Thole had the following concerns: regarding the program name, whether innovation can be managed, the inclusion of the program in the College of Engineering, the inclusion of several faculty who are not tenured nor on the tenure-track, the need for such a program, industry’s recognition of the degree, and questioned why we were not working with Smeal and Psychology on this effort. We provided support for the name and the existence of other graduate programs at top engineering schools that include innovation management coursework. A clarification was made regarding the original list of graduate faculty mistakenly excluded from a portion of the original proposal. We provided evidence of industry support from the IPAC and our Industry Advisory Board for graduates from a leadership program. We have also had discussions with faculty from Psychology, Workforce Development and Smeal and have obtained support and plan to collaborate on shared offerings of electives between programs. We also provided support for the equal recognition of both a Master of Science and Master of Engineering degrees as well as support for a graduate program in leadership within the College of Engineering, given that 6 of the 7 attributes of a world-class engineer include technically broad, globally engaged, ethical, innovative, excellent collaborators, and visionary leaders, attributes that are key elements of the proposed master program, and the inclusion of
leadership programs in top Engineering Schools such as: Carnegie Mellon University, Purdue University, University of Wisconsin, and Northeastern University.

**Electrical Engineering Department, College of Engineering:**
Dr. Kultegin Aydin also expressed concern that the program was not a technical program that resembles any of our other degree programs in the college. We provided a similar justification as above and indicated that a section was added to our proposal that supports the inclusion of a graduate program in leadership and innovation within the College of Engineering based on benchmarking with our industry partners as well as a survey of over 100 graduate engineering programs.

**Consultation with Penn State Library**
Linda Musser, Acting Head of the Engineering Library, indicated that the Libraries will be able to support this program.

---

**Full Consultation Documentation**

**Consultation with Engineering Management, Penn State Harrisburg**
From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Wednesday, April 22, 2015 9:25 AM
To: ssa10@psu.edu
Subject: M.Eng. Leadership and Innovation Management new program consult

Dear Sedig,

We are in the process of submitting a new graduate program (M. Eng. Leadership and Innovation Management) and graduate course proposals for review and were hoping to consult with someone in Engineering Management at Penn State Harrisburg. Would you be available for a conference call to meet with Mike Erdman, Director of Engineering Leadership Development at UP, and me in the next week or so to discuss our proposals?

Regards,
Dena Lang

Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

-----Original Message-----
From: SEDIG SALEM AGILI [mailto:ssa10@psu.edu]
Sent: Friday, August 21, 2015 10:21 AM
To: Dena Lang <tcl133@psu.edu>
Subject: Re: M.Eng. Leadership and Innovation Management new program consult
Hi Dr. Lang
Although there is some overlap with MPS EM at Penn State Harrisburg, it has some uniqueness - focusing only on leadership and innovation and courses specific for engineers. Therefore, I support the proposal. Sorry about the delay. Thanks.
Best.
SA

Consultation with Engineering Management, Penn State Great Valley

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Wednesday, April 22, 2015 9:27 AM
To: 'cjneill@psu.edu'
Subject: M.Eng. Leadership and Innovation Management new program consult
Dear Dr. Neill,
We are in the process of submitting a new graduate program (M. Eng. Leadership and Innovation Management) and graduate course proposals for review and were hoping to consult with someone in Engineering Management and Systems Engineering at Penn State Great Valley. Would you be available for a conference call to meet with Mike Erdman, Director of Engineering Leadership Development at UP, and me in the next week or so to discuss our proposals?
Regards,
Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Thursday, April 30, 2015 1:20 PM
To: cjneill@psu.edu
Subject: RE: M.Eng. Leadership and Innovation Management new program consult
Hi Dr. Neill,
Mike Erdman and I are reaching out for consultation on a new graduate program (M. Eng. Leadership and Innovation Management) and graduate course proposals. We spoke with your colleague, John Sosik, yesterday and he gave us feedback on our leadership and innovation courses and suggested that we talk to you regarding our project management course. Would you have any time for a phone call this week or next?
Sincerely,
Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu
From: Colin J. Neill [mailto:cjn6@psu.edu]
Sent: Monday, May 04, 2015 9:33 AM
To: Dena Lang
Subject: RE: M.Eng. Leadership and Innovation Management new program consult

Hi Dena:
I’d be happy to speak with you and Mike. When is convenient for you guys?
Cheers,
Colin
Dr. Colin J. Neill
Director of Engineering Programs
Associate Professor of Software & Systems Engineering
School of Graduate Professional Studies
Penn State University
www.personal.psu.edu/cjn6

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Tuesday, May 05, 2015 12:48 PM
To: Colin J. Neill
Cc: Andrew M. Erdman
Subject: RE: M.Eng. Leadership and Innovation Management new program consult

Hi Colin,
I am attaching our program and course proposals for our phone meeting tomorrow. We look forward to discussing them with you.
Dena
Dena Lang, PhD

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Tuesday, May 19, 2015 4:46 PM
To: Colin J. Neill
Cc: Andrew M. Erdman
Subject: RE: M.Eng. Leadership and Innovation Management new program consult

Hi Colin,
Thank you for meeting with us to discuss our graduate program and course proposals. We have revised our program proposal to more clearly distinguish our program from the MEM program at Great Valley as well as other programs at Penn State. Please let us know if you have any further concerns. If there are no further concerns, would it be possible for you to provide your support via email for consultation on the graduate program and course proposals?
Also, I will be following up in the next day or so to provide more information regarding the Leaders of the Future conference planned for October that we mentioned on our conference call.
Thank you again for taking the time to meet with us and provide feedback.
I will be in touch soon,
Dena Lang
Dena Lang, PhD

From: Colin J. Neill [mailto:cjn6@psu.edu]
Sent: Wednesday, June 24, 2015 1:43 PM
To: Dena Lang
Cc: Andrew M. Erdman

Subject: Re: M.Eng. Leadership and Innovation Management new program consult

Dear Dena:

Thank you for the opportunity to review the proposal for the M.Eng in Engineering Leadership and Innovation Management. The Engineering Division at Penn State Great Valley is home to the Master of Engineering Management program, both in resident and online through the World Campus. While there is overlap in the intent of the two programs, the target demographic and new product development focus of your program distinguishes the two programs sufficiently. We support your proposal and wish you the best of luck.

Kinds regards,

Colin

Dr. Colin J. Neill
Director of Engineering Programs
Associate Professor of Software & Systems Engineering
School of Graduate Professional Studies
Penn State University

www.personal.psu.edu/cjn6

Consultation with Leadership Development, Penn State Great Valley

From: "Dena Lang" <tcl133@psu.edu>
To: jjs20@psu.edu
Sent: Thursday, April 23, 2015 8:19:32 AM
Subject: M.Eng. Leadership and Innovation Management new program consult

Dear Dr. Sosik,

We are in the process of submitting a new graduate program (M. Eng. Leadership and Innovation Management) and graduate course proposals for review and were hoping to consult with someone in Leadership Development at Penn State Great Valley. Would you be available for a conference call to meet with Mike Erdman, Director of Engineering Leadership Development at UP, and me in the next week or so to discuss our proposals?

Regards,

Dena Lang

Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

From: JOHN JOSEPH SOSIK [mailto:jjs20@psu.edu]
Sent: Thursday, April 23, 2015 8:44 AM
To: Dena Lang
Subject: Re: M.Eng. Leadership and Innovation Management new program consult

Dear Dr. Lang,

I am able to provide consultation up until May 8, afterwards I am not available throughout the summer. Let's try to set up a mutually agreeable time before then.

Best,

John

John J. Sosik, Ph.D., CPA, CMA
From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Friday, May 08, 2015 3:33 PM
To: jjs20@psu.edu
Subject: Fwd: M.Eng. Leadership and Innovation Management new program consult

Hi John,

Thanks again for talking with Mike and I on the phone regarding our graduate program. I am attaching updated versions of our proposal. Would it be possible for you to give us your support via email for consultation on the graduate program proposal?

Thank you again,

Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

From: JOHN JOSEPH SOSIK
Date: 05/08/2015 11:14 PM (GMT+01:00)
To: Dena Lang
Subject: Re: M.Eng. Leadership and Innovation Management new program consult

Dear Dr. Lang,

I have reviewed the M.Eng. Leadership and Innovation Management new program proposal and supporting new course proposals prior to providing my comments for their improvement during an hour-long conference call with you and your colleague on 29 April 2015. Your team have done a fine job addressing my comments in the revised proposal and course proposal forms. As such, I fully support your graduate program proposal and wish you all the best with this new program.

Best wishes,

John
John J. Sosik, Ph.D., CPA, CMA
Professor of Management and Organization
Professor-in-Charge, Master of Leadership Development program
Research Fellow, Consortium for Sustainable Business Development
The Pennsylvania State University
School of Graduate Professional Studies at Great Valley
Consultation with Smeal College of Business Administration

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Wednesday, May 6, 2015 4:29 PM
To: Brian Cameron
Cc: 'Andrew M. Erdman'
Subject: Consult for MELIM Graduate Program and Course Proposals

Hi Brian,
Thank you again for meeting with Mike Erdman and me last week. We appreciate your feedback regarding our graduate program and course proposals for the Engineering Leadership and Innovation Management graduate program.
I am attaching revised proposals. Please let us know if you have any further questions/feedback or if you can provide support for our proposals at this time. Please forward these to anyone in your college that you feel is appropriate.
Thanks again,
Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

From: Brian Cameron [mailto:bcameron@smeal.psu.edu]
Sent: Thursday, June 04, 2015 11:39 AM
To: Dena Lang
Cc: Andrew M. Erdman; Denny Gioia
Subject: RE: Consult for MELIM Graduate Program and Course Proposals

Hi Dena
Denny and I spoke yesterday and we don’t have any concerns with your proposal. Please let me know if you need anything more from me at this time.
Thanks
Brian

Brian H. Cameron | Associate Dean for Professional Master's Programs | The Mary Jean and Frank P. Smeal College of Business Administration | The Pennsylvania State University | University Park, PA 16802 | Phone: 814-863-1460 | Email: bcameron@smeal.psu.edu
Consultation with Psychology Department, Psychology of Leadership at Work, College of Liberal Arts

From: "Dena Lang" <tcl133@psu.edu>
To: DRL192@psu.edu
Sent: Wednesday, April 22, 2015 9:58:28 AM
Subject: M.Eng. Leadership and Innovation Management new program consult

Hi Dr. Lindsay,

I work with Mike Erdman in the Engineering Leadership Development Program and we are in the process of submitting a new graduate program (M. Eng. Leadership and Innovation Management) and graduate course proposals for review and were hoping to consult with someone in Psychology of Leadership at Work. Would you be available to meet with Mike and me in the next week or so to discuss our proposals?

Regards,
Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

-----

From: DOUGLAS RAY LINDSAY [mailto:drl192@psu.edu]
Sent: Tuesday, April 28, 2015 8:30 AM
To: Dena Lang
Cc: DOUGLAS RAY LINDSAY
Subject: Re: M.Eng. Leadership and Innovation Management new program consult

Dena,

Sorry for the delay in getting back to you. I was out of town at a conference last week. I would be happy to sit down to chat about your proposal. My schedule is pretty flexible this week as I am catching up. Please let me know what time works for you.

Thanks.
Doug

Douglas R. Lindsay, PhD
Professor of Practice & Director of Masters of Professional Studies
The Pennsylvania State University
631 Moore Building
814-867-6164
Dr Lindsay's Webpage
E-mail: drl192@psu.edu

-----

From: DOUGLAS RAY LINDSAY [mailto:drl192@psu.edu]
Sent: Tuesday, May 05, 2015 8:49 AM
To: Dena Lang
Cc: DOUGLAS RAY LINDSAY
Subject: Re: M.Eng. Leadership and Innovation Management new program consult

Dena,
I have reviewed your Proposal for the Master of Engineering Leadership & Innovation Management. Specifically, I looked at the Course Proposals for ENGR 501, 502, 503, 504, and 505. After this review, I feel that there is not significant overlap between the 501, 503, 504, and 505 courses and the courses in the MPS in the Psychology of Leadership at work. ENGR 502, does have more overlap with different courses in the MPS program. Several of the blocks in 502 (developing effective teams, individual and team motivation, diversity), overlap with specific courses in the MPS. However, while there is some content overlap, it is significantly different (with the application to the field of engineering and its focus on "developing innovative solutions and new products within an existing business") enough that it does not overlap with the objectives and outcomes of the courses in the MPS.

On a related note, I would like to offer that there are several courses in the MPS that may be of interest to your students if they wish to obtain further coursework in leadership (would fall under the 9 credits of elective courses in your program).

Please let me know if you have any additional questions.

Doug

Douglas R. Lindsay, PhD
Professor of Practice & Director of Masters of Professional Studies
The Pennsylvania State University
631 Moore Building
814-867-6164
Dr Lindsay's Webpage
E-mail: drl192@psu.edu

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Tuesday, May 05, 2015 12:45 PM
To: DOUGLAS RAY LINDSAY
Cc: Andrew M. Erdman
Subject: RE: M.Eng. Leadership and Innovation Management new program consult

Hi Doug,
Thank you again for meeting with us and providing your feedback on our graduate program and proposals. I am attaching updated proposals. Thanks again for offering several of your courses as elective options for our program. We believe they would be a nice fit with our curriculum.
Thanks again,
Dena

Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

Additional support for offering Psychology courses as electives in the ELIM graduate program:

From: "Andrew M. Erdman" <ame17@engr.psu.edu>
To: "Avis Kunz" <alm2@psu.edu>
Cc: "Renata S. Engel" <rengel@engr.psu.edu>
Sent: Wednesday, February 26, 2014 9:36:01 AM
Subject: RE: Consultation for MPS Psychology of Leadership at Work by Feb. 26

Dear Avis,
Thank you for the opportunity to review your proposal for a MPS in Psychology of Leadership at Work. I believe this will be a valuable addition to the University’s offerings, and I fully support your efforts. Your proposal is well conceived, staffed and documented.

As you are aware, we have a long-standing undergraduate minor in Engineering Leadership, and, in fact, we are considering a proposal to create an MS in Engineering Leadership and Entrepreneurship that would be offered on-campus, with a possibility of extending it in the future to on-line. As such, it would be very helpful if we could plan on using some of your courses as electives in our program as we develop it.

Further, it would be appropriate to recognize that the College of Engineering offers courses and programs in leadership (such as the last paragraph of page 7).

I would ask that you keep us in mind as you develop syllabi for any new course offerings. I would be most appreciative if you would forward them, for information.

Mike Erdman
Andrew M. (Mike) Erdman
Walter L. Robb Director of Engineering Leadership Development
Instructor, Engineering Science and Mechanics
213E Hammond Building
University Park, PA 16802
Office: 814-863-9074
Cell: 814-404-3588
Fax: 814-863-7229
Email: ame17@psu.edu
Web: www.eldm.psu.edu

From: Avis Kunz [mailto:alm2@psu.edu]
Sent: Wednesday, February 26, 2014 10:04 AM
To: Andrew M. Erdman
Cc: Renata S. Engel; James L. Farr; MELVIN MICHAEL MARK
Subject: Re: Consultation for MPS Psychology of Leadership at Work by Feb. 26

Hello Mike:
Thank you so much for your support.
I have added the College of Engineering to the list of academic units offering courses in leadership on page 7. May I assume at this time that the courses are all undergraduate?
I see no problem in offering seats for students in other programs who want elective credits.
Jim Farr is copied here and will respond directly.
Best Regards,
Avis

Consultation with Workforce Education and Development Department, College of Education

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Tuesday, April 21, 2015 4:23 PM
To: William Rothwell
Cc: Wesley Donahue
Subject: RE: program and course consultation

Hi William,
We are in the process of submitting our new graduate program and graduate course proposals for review and were hoping to consult with someone in Workforce Education. Would you be available to meet with Mike Erdman and me in the next week or so to discuss our proposals? Wes, thanks for putting us in touch with William, would you also be interested in sitting in on our meeting?

Regards,
Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

At 05:23 PM 4/28/2015, Dena Lang wrote:
Hi Bill,
I am attaching our graduate program and course proposals for our discussion tomorrow. I will print copies and bring along.
See you tomorrow.
Dena
Dena Lang, PhD

From: William J. Rothwell [mailto:wjr9@psu.edu]
Sent: Tuesday, April 28, 2015 7:07 PM
To: Dena Lang; JAE YOUNG LEE
Cc: Wesley Donahue; Andrew M. Erdman
Subject: RE: RE: program and course consultation

Dena:
Many thanks. I will review before our meeting.
Bill R.
May 1, 2015

Dear Dr. Lang:

Workforce Education and Development have discussed the Master of Engineering Leadership and Innovation Management program and new course proposals and support them. We are also supportive of including WFED courses as potential electives in your graduate program.

Sincerely,

[Signature]

William J. Rothwell
Professor of Education

Consultation with Department Heads, College of Engineering

Email sent to College of Engineering Departments:

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Friday, April 24, 2015 12:27 PM
To: 'L-COE_DEPT_HEADS@engr.psu.edu'
Subject: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Dear COE Department Heads,

The Engineering Leadership Program is seeking input from you regarding consultation for our proposed M.Eng. Leadership and Innovation Management program and course proposals (attached).

Please provide feedback by May 8th to: Dena Lang (tcl133@psu.edu). You may also contact Dena Lang to setup a meeting to discuss your concerns or comments.

Thank you,

Dena Lang
Responses from College of Engineering Departments:

Agricultural and Biological Engineering Department, College of Engineering:

From: Lynn Tressler [mailto:lxt3@engr.psu.edu]
Sent: Monday, April 27, 2015 1:22 PM
To: Dena Lang
Subject: FW: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals
FYI...

Lynn Tressler
From: Paul Heinemann
Sent: Monday, April 27, 2015 1:03 PM
To: Lynn Tressler
Subject: Re: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Lynn,
The ABE department has no issues with this new program and supports it.
Thanks
Paul

Engineering Science and Mechanics Department, College of Engineering:

From: Judith Todd [mailto:JTodd@engr.psu.edu]
Sent: Saturday, May 02, 2015 1:20 PM
To: Dena Lang
Subject: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals
Importance: High

Dena:
Here are some comments from the ESM Graduate Officer.
1) I thought that only two 400-level courses count toward a graduate degree. It appears that at least three 400-level courses are required. This item should be addressed.
2) For the 502 course entitled "Engineering Across Cultures" there are several local experts that could provide guidance on business cultures in Asia and Europe.
   a) Jerry Koble (PSU EE alum) is very active in PSEAS and is our local link to Murata Corporation. He could provide invaluable insight in the Japanese Industry
b) The Center for Dielectrics and Piezoelectrics hosts visiting engineers for 2-year sabbaticals from Japan, Taiwan and China. Sometimes visitors are also from German companies.

c) Melik has been working with companies from Turkey.

I will forward any additional comments that I receive.

Judy

Professor Judith A. Todd, Department Head
P. B. Breneman Chair and Professor of Engineering Science and Mechanics
Department of Engineering Science and Mechanics
The Pennsylvania State University
212 Earth and Engineering Sciences Building
University Park, PA 16802-6812
(814) 863-0771
(814) 865-9974
jtodd@psu.edu
www.esm.psu.edu

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Tuesday, May 05, 2015 8:56 AM
To: Judith Todd
Cc: Andrew M. Erdman
Subject: RE: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Hi Judy,

Thank you very much for the feedback. Regarding the required 400 level classes, two of them are paired courses, one at 2 credits and the other at 1 credit. Our new program only includes 6 required credits at the 400 level (ENGR 408-2 credits, 493 – 1 credit, and 411 – 3 credits). It was our understanding that the requirement for the M.Eng. was that 18 credits had to be at the 500 level. Our program does require 18 credits at the 500 level: [5 core classes (15 credits) and one 3 credit elective], as well as the 6 credits at the 400 level (ENGR 408, 493, 411), and 6 credits of additional electives. Do you see any concerns with that breakdown?

We also wanted to thank you for sending the contacts and potential resources for our "Engineering Across Cultures" course. They are very much appreciated!

Thanks again for your timely feedback.

Dena Lang
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

From: Judith Todd [mailto:JTodd@engr.psu.edu]
Sent: Tuesday, May 05, 2015 9:58 AM
To: Dena Lang
Cc: Mike lanagan; Al Segall
Subject: RE: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Dena
Thank you for your clarification.
Judy
Professor Judith A. Todd, Department Head
P. B. Breneman Chair and Professor of Engineering Science and Mechanics
Department of Engineering Science and Mechanics
The Pennsylvania State University
212 Earth and Engineering Sciences Building
University Park, PA 16802-6812
(814) 863-0771
(814) 865-9974
jtodd@psu.edu
www.esm.psu.edu

Industrial & Manufacturing Engineering Department, College of Engineering:

From: Paul Humphreys [mailto:plh153@engr.psu.edu]
Sent: Friday, May 08, 2015 7:20 PM
To: Dena Lang
Subject: FW: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Hello, Dr. Lang,
Please find the following input, respectfully forwarded.
Best regards,
Paul

Paul Humphreys
Assistant to Dr. Harriet Nembhard, Professor and Interim Department Head
Harold and Inge Marcus Department of Industrial & Manufacturing Engineering
The Pennsylvania State University
310 Leonhard Building
University Park, PA  16802
814-863-6407
plh153@psu.edu

From: Robert C. Voigt
Sent: Wednesday, May 06, 2015 4:50 AM
To: Paul Humphreys
Subject: RE: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

My Comments:
I support the program in general but think that it could benefit greatly from an ‘applied engineering statistical methods course’. Any competent manager/leader must be able to have a good understanding of statistical methods and data analysis methods.......Bob Voigt
Robert C. Voigt
Professor, Industrial Engineering
Penn State University
On sabbatical leave through June 15
Department of Materials Science and Metallurgy
University of Cambridge
M +44 (0) 79032 14168
rcv2@psu.edu
Skype: bobvoigt

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Wednesday, May 20, 2015 9:34 AM
To: Paul Humphreys
Cc: Andrew M. Erdman
Subject: RE: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Hi Paul,
Thank you for forwarding the feedback from Dr. Voigt on our graduate program and course proposals. Our program allows for 9 elective credits and we plan to provide students with a ‘suggested’ electives list with courses from Psychology, Smeal, and Workforce Development and will include a course on applied engineering statistical methods as suggested below.
Thank you again for the feedback.
Dena Lang

Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

Mechanical and Nuclear Engineering Department, College of Engineering:

From: Karen Thole [mailto:kthole@engr.psu.edu]
Sent: Sunday, April 26, 2015 2:46 PM
To: Dena Lang
Cc: Dan Haworth; kthole@psu.edu
Subject: FW: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

The MNE Department raises the following concerns about this proposed program:
1) We suggest considering changing the name as this is quite confusing. How does one “manage innovation”? From the very definition of innovation, it is unclear whether it can really be managed.
2) The overwhelming concern of this program is that it is not clear it belongs in a College of Engineering. There is probably a reason why a program with any similarities does not exist in top engineering programs. Rather than making use of the rich technical expertise in our college to form disciplinary or even technical interdisciplinary programs, the proposed M-ELIM program is “soft”. There is concern that this may dilute PSU’s College of Engineering’s reputation for producing technically strong engineers at the graduate level. Two of the world class engineering attributes include being technically broad and solidly grounded. Where are these most important attributes?
3) The proposed M-ELIM program is built on several faculty who are not tenured nor on the tenure-track. While each of these individuals are extremely talented and bring excellent expertise, it is of concern as to whether they will even be accepted by the Graduate School as graduate faculty. It mentions some other faculty who are being considered for the Graduate Faculty, but it seems that should be concluded prior to offering a graduate degree program.

4) Programs on Engineering Management are quite clear and it is of our opinion that those are what are needed for the industry, as offered by the schools mentioned in the proposal. It would be helpful to understand the enrollments of the JHU and CMU programs since those are probably the most relevant based on the proposal.

5) Has the industry been polled to see whether they might even recognize such a degree in both their hiring and salary structure? This is an important piece to include.

6) The following was included in the proposal: Penn State Great Valley also offers a MLD in Leadership Development. At University Park, program overlap exists with the Smeal Business College who offers various management and business degrees as well as the Psychology department who offers a MPS in Psychology of Leadership at work. In these cases, what distinguishes the M-ELIM program is the focus on Engineering Intrapreneurship combined with Engineering Leadership. Why are we not working with Smeal and Psychology on this effort? Finally, it is not quite clear on how rigorous the courses will be based on the descriptions.

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Wednesday, April 29, 2015 3:59 PM
To: Karen Thole
Cc: Dan Haworth; kthole@psu.edu; Andrew M. Erdman; Sven Bilen
Subject: RE: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Dear Dr. Thole,

SEDTAPP/Engineering Leadership Development appreciates the careful review by MNE and provides the following responses (in red below) to address each suggestion raised by MNE:

The MNE Department raises the following concerns about this proposed program:

1) We suggest considering changing the name as this is quite confusing. How does one “manage innovation”? From the very definition of innovation, it is unclear whether it can really be managed. The original name, “Master of Engineering Leadership and Intrapreneurship” was suggested to be changed to “Master of Engineering Leadership and Innovation Management” by our 2015 IPAC committee. To validate the change, we passed this potential name change through our Industrial Advisory Board (consisting of managers and executives from GE, GM, GKN, Bechtel, Lockheed Martin, ArcelorMittal, Merck, Rockwell Automation and Walter Robb) and the board agreed with the name change. One dissenting vote preferred the original because it was “shorter”. As to the question of whether innovation can be managed, we anticipate educating and coaching the students to provide an environment where innovation can successfully be undertaken in an existing corporate structure. This would include identifying the typical assessments associated with successful entrepreneurship, however to be promoted and executed within an existing corporate structure. Graduate programs in Innovation Management are offered at Carnegie Mellon University: ‘MS in Engineering & Technology Innovation Management’ and the University of Toronto: ‘Master of Management of Innovation’ as examples.

2) The overwhelming concern of this program is that it is not clear it belongs in a College of Engineering. There is probably a reason why a program with any similarities does not exist in top engineering programs. Rather than making use of the rich technical expertise in our college to form disciplinary or even technical interdisciplinary programs, the proposed M-ELIM program is “soft”. There
is concern that this may dilute PSU’s College of Engineering’s reputation for producing technically strong engineers at the graduate level. Two of the world class engineering attributes include being technically broad and solidly grounded. Where are these most important attributes? Very similar concerns were raised when the Engineering Leadership Development Minor was proposed in 1994. The highly successful 20 year history of the undergraduate minor gives testimony to the value of this adjunct to the technical aspects of our engineering curriculum. Graduates with a minor in Engineering Leadership Development are highly sought after by corporate recruiters, primarily because they bring to the table not only the technically broad and solidly grounded attributes, but many of the other aspects of world-class engineers, specifically globally engaged, innovative, collaborators, and visionary leaders. All of these attributes are key elements of the proposed master program, along with the remaining element, ethics. Further, there is a growing constituency of Engineering Leadership programs around the US and Canada. The Engineering Leadership Development Division of ASEE (formed in 2014) has already recorded over 500 members. Both undergraduate programs and graduate programs are growing in universities from the east coast to the west. Such programs exist within top Engineering Schools such as: Carnegie Mellon University - MS in Engineering & Technology Innovation Management, Purdue University - MS in Engineering w/ Concentration in Engineering Management and Leadership, University of Wisconsin - ME in Engineering in Professional Practice with a Technical Leadership Certificate, and Northeastern University - Graduate program in Engineering Leadership. In addition, we identified 67 Engineering Schools with graduate programs in Engineering Management with courses in leadership or entrepreneurship including: Massachusetts Institute of Technology, University of Michigan, Cornell, University of Maryland-Baltimore County, Northwestern University, University of North Carolina-Charlotte, and the University of Colorado-Boulder, all with leadership courses. What distinguishes our program is that it combines both Leadership and Innovation. Equally important are the recommendations found in “The Path Forward – The Future of Graduate Education in the United States (2010, Educational Testing Service)” related to encouraging the development of skills that enhance research impact for graduate students, including communications, teamwork, relating work to a broader context and application of research to larger corporate or social purposes, all hallmarks of this proposed Engineering Leadership program.

3) The proposed M-ELIM program is built on several faculty who are not tenured nor on the tenure-track. While each of these individuals are extremely talented and bring excellent expertise, it is of concern as to whether they will even be accepted by the Graduate School as graduate faculty. It mentions some other faculty who are being considered for the Graduate Faculty, but it seems that should be concluded prior to offering a graduate degree program. We agree that accepted graduate faculty is expected and required prior to offering this graduate degree program, and efforts are underway to both expand the faculty as well as to propose current faculty to the graduate faculty. These can progress in parallel and the actual offering of the program will be dependent on success on both fronts. The ‘Graduate Bulletin’ section of the proposal had been updated to include our full list of graduate faculty, however, due to an oversight on our part, the ‘Program Justification’ section had not been updated with the full list and this update will be included in the ‘Program Justification’ section (see attached revised program proposal).

4) Programs on Engineering Management are quite clear and it is of our opinion that those are what are needed for the industry, as offered by the schools mentioned in the proposal. It would be helpful to understand the enrollments of the JHU and CMU programs since those are probably the most relevant based on the proposal. Based on our benchmarking with industry partners, there is a desire and need for programs focused on Engineering Leadership and Innovation or Intrapreneurship. Some large companies offer engineering leadership programs for their high-potential, early-career employees (e.g. the Engineering Leadership Development Program at LMCO, the Edison Engineering Program at GE), but others may not have the resources to do so. The driving difference is that leadership programs train
early-career employees to lead (e.g. set a vision and strategy, garner support from the organization, work well in and lead teams – both locally and internationally), where management may be a later stage in their career. Our industrial partners see the hiring of a graduate of a leadership program as highly attractive.

5) Has the industry been polled to see whether they might even recognize such a degree in both their hiring and salary structure? This is an important piece to include. As noted above, we have an industrial advisory board consisting of management and executive representatives from 8 key corporate partners, all of whom financially support the Engineering Leadership Development program at Penn State. This board has reviewed the program and discussed it in two meetings over the past academic year. The support has been unanimous and enthusiastic. We further discussed this with the IPAC group, both in 2014 and 2015, and again, the support was unanimous.

6) The following was included in the proposal: **Penn State Great Valley also offers a MLD in Leadership Development. At University Park, program overlap exists with the Smeal Business College who offers various management and business degrees as well as the Psychology department who offers a MPS in Psychology of Leadership at work. In these cases, what distinguishes the M-ELIM program is the focus on Engineering Intrapreneurship combined with Engineering Leadership.**

Why are we not working with Smeal and Psychology on this effort? We have been meeting with Smeal (Assoc. Dean Brian Cameron), and have discussed this program and the programs at Smeal that may have related courses. It is our intention, and it appears that Smeal is in agreement, that we will be able to collaborate on some of the courses and electives. We have discussed the new master program with Psychology (Rick Jacobs and Asst. Dean Avis Kunz), and plan to collaborate on sharing some courses between our schools.

Finally, it is not quite clear on how rigorous the courses will be based on the descriptions. We are currently piloting the courses and will incorporate feedback from students, faculty, and observers in assuring that the courses are consistent with the high standards that Penn State expects and consistently delivers.

Please let us know if you would like to setup a time to meet and discuss this further. Thank you again for your feedback.

Sincerely,

Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu
Question #5 was not addressed. Note that we did not ask whether there was industry support, which you have stated, but rather whether there would companies would recognize the degree and thereby offer a bump in the salary. If graduate students are not given an increase as a result of the MEng degree, I believe the program will quickly go away. When MNE polled a similar group of companies as you named, those polled indicated there would be NO recognition of an MEng in their systems, but rather only an MS.

Question #6 continues to make me uncomfortable. This all sounds futuristic and it is difficult to offer a program without the pieces in place already.

Question #3 shows Sarah Zappe as a Graduate Faculty member, but the specific program is not listed. Finally, part of the answer to #2 is not relevant. We are not questioning the successful undergraduate minor in engineering leadership. We are questioning an actual degree program at the graduate level. This is a large leap.

Karen

Karen A. Thole, Professor and Department Head
Department of Mechanical and Nuclear Engineering
The Pennsylvania State University
136 Reber Building, University Park, PA 16802-1412
(814)865-2519 FAX (814)865-1280
kthole@psu.edu www.mne.psu.edu

From: Dena Lang [mailto:tcl133@psu.edu]
Sent: Friday, May 08, 2015 3:44 PM
To: Karen Thole
Cc: Dan Haworth; kthole@psu.edu; Andrew M. Erdman; Sven Bilen
Subject: Re: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals

Hi Karen,

Responses to your additional concerns are in green below:

Question #5 was not addressed. Note that we did not ask whether there was industry support, which you have stated, but rather whether there would companies would recognize the degree and thereby offer a bump in the salary. If graduate students are not given an increase as a result of the MEng degree, I believe the program will quickly go away. When MNE polled a similar group of companies as you named, those polled indicated there would be NO recognition of an MEng in their systems, but rather only an MS.

Has the industry been polled to see whether they might even recognize such a degree in both their hiring and salary structure? This is an important piece to include. As noted above, we have an industrial advisory board consisting of management and executive representatives from 8 key corporate partners, all of whom financially support the Engineering Leadership Development program at Penn State. This board has reviewed the program and discussed it in two meetings over the past academic year. The support has been unanimous and enthusiastic. We further discussed this with the IPAC group, both in 2014 and 2015, and again, the support was unanimous.

Based on companies (specifically GE, GKN, LMC, GM, Merck, Bechtel, Arcellor Mittal, and one start-up company) which are on our advisory board, it is reported that companies equally recognize both Master of Science and Master of Engineering degrees. Further, they do not grant an automatic pay increase to employees upon completion of an advanced degree (the exception being the start-up). Rather they operate under the reasonable assumption that the skills and knowledge attained by completing this course of study will enhance the individual’s capabilities to advance more quickly to higher levels of responsibility with the associated increase in pay. That performance forms the basis for
the individual’s manager to advocate an increase in their pay as part of the review process. Of course, starting pay is higher for a holder of a Master’s degree over a new hire Bachelor degree candidate. Question #6 continues to make me uncomfortable. This all sounds futuristic and it is difficult to offer a program without the pieces in place already.

6) The following was included in the proposal: *Penn State Great Valley also offers a MLD in Leadership Development. At University Park, program overlap exists with the Smeal Business College who offers various management and business degrees as well as the Psychology department who offers a MPS in Psychology of Leadership at work. In these cases, what distinguishes the M-ELIM program is the focus on Engineering Intrapreneurship combined with Engineering Leadership.*

Why are we not working with Smeal and Psychology on this effort? We have been meeting with Smeal (Assoc. Dean Brian Cameron), and have discussed this program and the programs at Smeal that may have related courses. It is our intention, and it appears that Smeal is in agreement, that we will be able to collaborate on some of the courses and electives. We have discussed the new master program with Psychology (Rick Jacobs and Asst. Dean Avis Kunz), and plan to collaborate on sharing some courses between our schools. We have had additional meetings with Dean Cameron from Smeal, Dr. Rothwell from Workforce Development, and Doug Lindsey from Psychology the week of 4/27-5/1 and have agreement on collaboration between our programs to offer each other’s courses as electives in fulfillment of our program requirements. We are continuing to work with these organizations, and will be requesting consultation from them in the review process associated with approval of this program. A meeting between Smeal (Dean Cameron) and Engineering (Dean Elnashai) is planned and it resulted from these preliminary meetings. Collaboration is developing.

Question #3 shows Sarah Zappe as a Graduate Faculty member, but the specific program is not listed.

3) Sara Zappe is on the Graduate Faculty in Educational Psychology and the program will be listed in the proposal.

Finally, part of the answer to #2 is not relevant. We are not questioning the successful undergraduate minor in engineering leadership. We are questioning an actual degree program at the graduate level. This is a large leap.

Our revised response follows:

Three of the five attributes of a world-class engineer include globally engaged, ethical, and innovative, attributes that are key elements of the proposed master program.

Taken from the PSU Engineering website (http://www.engr.psu.edu/WorldClass/):

**GLOBALLY ENGAGED:** World-Class Engineers understand the worldwide nature of their profession and are sensitive to the speed required to keep pace in geographically and culturally diverse environments.

**ETHICAL:** World-Class Engineers uphold the highest ethical standards. They readily identify, and carefully address, ethical issues that arise in their professional lives.

**INNOVATIVE:** World-Class Engineers develop precise definitions of complex problems and formulate sustainable solutions by thinking creatively across technical, business, social, and environmental dimensions.

Further, there is a growing constituency of Engineering Leadership programs around the US and Canada. The Engineering Leadership Development Division of ASEE (formed in 2014) has already recorded over 500 members. Graduate programs are growing in universities from the east coast to the west. Such programs exist within top Engineering Schools such as: Carnegie Mellon University - MS in Engineering & Technology Innovation Management, Purdue University - MS in Engineering w/ Concentration in Engineering Management and Leadership, University of Wisconsin - ME in Engineering in Professional Practice with a Technical Leadership Certificate, and Northeastern University - Graduate program in Engineering Leadership. In addition, we identified 67 Engineering Schools with graduate programs in Engineering Management with courses in leadership or entrepreneurship including: Massachusetts Institute of Technology, University of Michigan, Cornell, University of
Maryland-Baltimore County, Northwestern University, University of North Carolina-Charlotte, and the University of Colorado-Boulder, all with leadership courses. What distinguishes our program is that it combines both Leadership and Innovation. Equally important are the recommendations found in “The Path Forward – The Future of Graduate Education in the United States (2010, Educational Testing Service)” related to encouraging the development of skills that enhance research impact for graduate students, including communications, teamwork, relating work to a broader context and application of research to larger corporate or social purposes, all hallmarks of this proposed Engineering Leadership program.

Regards,
Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

From: Karen Thole [mailto:kthole@engr.psu.edu]
Sent: Friday, May 08, 2015 5:08 PM
To: Dena Lang
Cc: Dan Haworth; kthole@psu.edu; Andrew M. Erdman; Sven Bilen
Subject: RE: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals
Dena,
Thank you.
Karen A. Thole, Professor and Department Head
Department of Mechanical and Nuclear Engineering
The Pennsylvania State University
136 Reber Building, University Park, PA 16802-1412
(814)865-2519 FAX (814)865-1280
kthole@psu.edu www.mne.psu.edu

Electrical Engineering Department, College of Engineering:

From: Kultegin Aydin [mailto:aydin@engr.psu.edu]
Sent: Friday, May 08, 2015 4:16 PM
To: Dena Lang
Cc: Lynn Tressler
Subject: RE: Review and Consultation for M.Eng. Leadership and Innovation Management Program and Course Proposals
Dear Dena,
My only concern is that this is not a technical program that resembles any of our other degree programs in the college. A certificate or a minor in leadership might be more suitable for the COE.
Thanks,
Kultegin
Kultegin Aydin
Professor and Head
Dear Kultegin,

Thank you for your feedback regarding our graduate program and course proposals. We have added a section to our proposal that supports the inclusion of a graduate program in leadership and innovation within the College of Engineering based on benchmarking with our industry partners as well as a survey of over 100 graduate engineering programs. Please let us know if you have any further concerns/feedback:

Inclusion of Leadership and Innovation within the College of Engineering:

Three of the five attributes of a world-class engineer (globally engaged, ethical, and innovative) are key elements of the ELIM proposed program. Based on our benchmarking with industry partners, there is a desire and need for programs focused on Engineering Leadership and Innovation or Intrapreneurship. Some large companies offer engineering leadership programs for their high-potential, early-career employees (e.g. the Engineering Leadership Development Program at LMCO, the Edison Engineering Program at GE), but others may not have the resources to do so. The driving difference is that leadership programs train early-career employees to lead (e.g. set a vision and strategy, garner support from the organization, work well in and lead teams – both locally and internationally), where management may be a later stage in their career. Our industrial partners see the hiring of a graduate of a leadership program as highly attractive.

Further, there is a growing constituency of Engineering Leadership programs around the US and Canada. The Engineering Leadership Development Division of ASEE (formed in 2014) has already recorded over 500 members. Both undergraduate and graduate programs are growing in universities from the east coast to the west. Such programs exist within top Engineering Schools such as: Carnegie Mellon University - MS in Engineering & Technology Innovation Management, Purdue University - MS in Engineering w/ Concentration in Engineering Management and Leadership, University of Wisconsin - ME in Engineering in Professional Practice with a Technical Leadership Certificate, and Northeastern University - Graduate program in Engineering Leadership. In addition, we have identified 67 Engineering Schools with graduate programs in Engineering Management with courses in leadership or entrepreneurship including: Massachusetts Institute of Technology, University of Michigan, Cornell, University of Maryland-Baltimore County, Northwestern University, University of North Carolina-Charlotte, and the University of Colorado-Boulder, all with leadership courses. What distinguishes our program is that it combines both Leadership and Innovation. Equally important are the recommendations found in “The Path Forward – The Future of Graduate Education in the United States (2010, Educational Testing Service)” related to encouraging the development of skills that enhance research impact for graduate students, including communications, teamwork, relating work to a broader context and application of research to larger corporate or social purposes, all hallmarks of this proposed Engineering Leadership program.

Regards,
Consultation with Penn State Library

---------- Forwarded message ----------
From: Dena Lang <tcl133@psu.edu>
Date: Wed, May 20, 2015 at 11:56 AM
Subject: Consultation Support for Graduate Proposal and Courses
To: <ellysa@psu.edu>
Cc: Andrew M. Erdman <ame17@engr.psu.edu>

Hi Ellysa,

We are in the process of submitting a new graduate program (M. Eng. In Engineering Leadership and Innovation Management) and graduate course proposals for review; as part of the process we are seeking consultation from the Library. If you are supportive, please reply to this email indicating your support. If you have any concerns or feedback please let us know.

Thank you!
Dena Lang
Dena Lang, PhD
Associate Director of Engineering Leadership Research
213G Hammond Building
University Park, PA 16802
Office Phone: 814-863-9077
Email: tcl133@psu.edu

From: LINDA MUSSER [mailto:lrm4@psu.edu]
Sent: Monday, June 01, 2015 12:04 PM
To: Dena Lang
Subject: Re: M. Eng. In Engineering Leadership and Innovation Management

Hi Dena,

The Libraries will be able to support this very interesting sounding new program. Best of luck with it!

Linda Musser
Linda Musser
Acting Head of the Engineering Library
325 Hammond Building, University Park PA 16802
814-865-3451
lindamusser@psu.edu
I. Penn State SARI Requirements

All students in this program must complete the SARI requirements at Penn State prior to graduation. It is a two-part program that includes an online module and 5 hours of discussion based training.

[Part 1]

The online training module offered through the Collaborative Institutional Training Initiative (CITI) must be completed during the first year of study.

[Part 2]

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.

Consultation with ORP-SARI Documentation

June 25, 2015

Dr. Dena Lang
Associate Director of Engineering Leadership Research
213G Hammond Building

Dear Dena:

I am pleased to inform you that your SARI@PSU Program Plan for the proposed M. Eng. In Engineering Leadership and Innovation Management degree program has been received and approved. Thank you very much for taking the time to consult with us as you develop this new program.

We have set up an Angel web site to facilitate SARI@PSU program tracking and communication. At this site you will find a copy of your approved plan, and a unique spreadsheet that reflects the specific requirements of your SARI@PSU plan. You (or a program assistant) may download the spreadsheet, enter information regarding your students’ progress in meeting your SARI@PSU requirements, and return the spreadsheet to us via the dropbox on the Angel site by June 30 each year. We will keep your information updated, so that at any time you may download and view your current plan and tracking form. Our goal is to make this system as simple and transparent as possible, so please let us know if you have any comments or suggestions.

If, in the future, you find that changing needs require you to modify your program’s SARI@PSU educational requirements, please let us know and submit a revised SARI@PSU program plan form to ORP at least 30 days prior to the change. Information and documents to support the SARI@PSU program can be found on the SARI@PSU Resource Portal (www.research.psu.edu/orp/sari). As always, your questions, comments, and suggestions concerning any aspect of the SARI@PSU program are welcome.
Thank you again for your participation in this important initiative, and for supporting Penn State’s commitment to modeling and teaching the responsible conduct of research and scholarship in our community.

Sincerely,

Sharon
Sharon Shriver
Director, SARI@PSU Program
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hard copies 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: School of Graduate Professional Studies (Great Valley)
Department or Instructional Area: Engineering Division

New Graduate Program, Option, or Minor: [ ] Add
Designation of new graduate program:
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: [ ] Change [ ] Drop
Current designation of graduate program: Master of Professional Studies in Data Analytics
Current designation of graduate option:
Current designation of graduate minor:
New designation of existing graduate program (if changing):
New designation of existing graduate option (if changing):
New designation of existing graduate minor (if changing):

Brief description of the change (if not noted above): Change allows base program to be offered at GV - Presently offered only through World Campus

Indicate effective semester:
[ ] First semester following approval
[ ] Second semester following approval

Submitted by Graduate Program Head
Colin J. Neil
Printed name
Signature
Date: 2/1/16

Noted by College/School Representative to Graduate Council Subcommittee on New and Revised Programs and Courses:
David Russell
Printed name
Signature
Date: 2/1/16

Approved by College/School Dean/Chancellor (or Designee):
James A. Nemes
Printed name
Signature
Date: 1/29/16
For use by Graduate Council only

<table>
<thead>
<tr>
<th>Role</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:</td>
<td></td>
<td>4/5/2016</td>
</tr>
<tr>
<td>On Behalf of Luis Ayala</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printed name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: 4/5/2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended by Chair, Graduate Council Committee on Programs and Courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Behalf of Andris Freivalds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printed name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: 4/5/2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noted by Dean of the Graduate School:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Behalf of Regina Vasilatos-Younken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printed name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: 4/5/2016</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Program Change Proposal

Master of Professional Studies in Data Analytics

Contact: James A. Nemes, Director of Academic Affairs, School of Graduate Professional Studies, Penn State Great Valley, (jan16@PSU.edu)

March 24, 2016
Table of Contents

Description of Change 3
Justification 3
Elements of Residency 3
Program Operation and Maintenance 4
Evidence of Consultation 5
Revised Graduate Bulletin Listing 6
New Graduate Bulletin Listing 11
Responses 16
Description of Change

The proposed change to the program is to offer the M.P.S. in Data Analytics base program as a resident program at the Great Valley campus. Currently the program is only offered through World Campus. The two approved options in the program will continue to be offered only through World Campus.

Justification

The purpose of the M.P.S. in Data Analytics is to provide professionally oriented technical education that enables graduates to design, implement, and apply data analysis techniques to the broad array of application domains often referred to as “Big Data.” Penn State Great Valley has been offering a Graduate Certificate in Data Analytics since spring 2015. Since that time 9 have been admitted to the certificate program. A number of those students have inquired about a full degree program, and while the M.P.S. in Data Analytics offered through World Campus is an option for them, many students prefer learning in a traditional classroom setting. Being able to leverage the same faculty expertise delivering the program through World Campus, Great Valley will be able to meet the needs of students in the Greater Philadelphia area in the mode of program delivery that best suits their learning style. The M.P.S. in Data Analytics base program consists of nine credits of core courses, nine credits specific to the base program, nine credits of electives, and the three-credit capstone course. We anticipate the program to have approximately 25-30 students after a three year phase-in. Several of the courses in the program can serve as electives in the Master of Software Engineering and Master of Science in Information Science programs allowing the program to be delivered without additional faculty resources in the short term. A comparison of the academic plan for the program offered through World Campus and at Great Valley is shown in Table 1.

Elements of Residency

As is the case for the existing programs offered at the Great Valley campus, the proposed M.P.S. in Data Analytics is targeted at working professionals pursuing a graduate education on a part-time basis. Currently the program is only offered through World Campus. As is the case with our other on-campus programs, part-time students come to campus one or two evenings per week for course work where they interact with faculty and other students. In addition, students have the opportunity to participate in a range of on campus events, including cultural programs, research talks, and town-hall style meetings.
Table 1 Comparison of Academic Plans for Program Offered Through World Campus and at Great Valley

<table>
<thead>
<tr>
<th>Through World Campus</th>
<th>Great Valley</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core Courses (9 cr)</strong></td>
<td><strong>Core Courses (9 cr)</strong></td>
<td></td>
</tr>
<tr>
<td>STAT 500</td>
<td>STAT 500</td>
<td></td>
</tr>
<tr>
<td>IE 575</td>
<td>IE 575</td>
<td></td>
</tr>
<tr>
<td>SWENG 545 or STAT 557: Data Mining 1</td>
<td>SWENG 545</td>
<td>STAT 557 not offered at Great Valley</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base program (9 cr)</th>
<th>Analytics in Industry and Manufacturing Option (9 cr)</th>
<th>Business Analytics Option (9 cr)</th>
<th>Base Program (9 cr)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN SC 521:</td>
<td>IE 582:</td>
<td>BAN 530:</td>
<td>IN SC 521:</td>
<td></td>
</tr>
<tr>
<td>DAAN 825:</td>
<td>IE 577:</td>
<td>BAN 540:</td>
<td>DAAN 825:</td>
<td></td>
</tr>
<tr>
<td>DAAN 881:</td>
<td>IE 578:</td>
<td>BAN 550:</td>
<td>DAAN 881:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electives (9 credits)</th>
<th>Electives (9 credits)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IN SC 525</td>
<td>DAAN 822</td>
<td></td>
</tr>
<tr>
<td>DAAN 871</td>
<td>SWENG 584</td>
<td></td>
</tr>
<tr>
<td>SYSEN 505</td>
<td>SYSEN 536</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Program Capstone (3 cr)</th>
<th>Analytics in Industry and Manufacturing Option Capstone (3cr)</th>
<th>Business Analytics Option Capstone (3cr)</th>
<th>Capstone (3 cr)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAAN 888</td>
<td>IE 596</td>
<td>BAN 888</td>
<td>DAAN 888</td>
<td>Only the base program capstone.</td>
</tr>
</tbody>
</table>

**Program Operation and Maintenance**

The Program Chair will be Dr. Colin Neill, Director of Engineering Programs at Penn State Great Valley. Dr. Neill is also the current chair for the program offered through World Campus. As is the case for our other on-campus programs, incoming students will be assigned a faculty advisor at the time of acceptance into the program. Penn State Great Valley has the faculty expertise and capacity to offer the program. It is anticipated that core courses and base program-specific courses will be offered once per year. These courses can also serve as elective courses for other programs – predominately students in the Master of Science in Information
Science and Master of Software Engineering Programs. Depending on prior preparation, these courses may also serve as appropriate electives for students from our Master of Engineering Management and Master of Business Administration programs. Additional DAAN electives will be offered at least every two years. Courses from other programs at Great Valley may serve as electives for the students in the M.P.S. in Data Analytics depending on prior background and interest. It is anticipated that the capstone course will be offered annually. Since the intent of this program revision is to offer the M.P.S. in Data Analytics as an on-campus experience, it is not anticipated that these students will take courses through World Campus but that option exists for students who might experience some scheduling difficulty.
## Evidence of Consultation

### List of Units from which Consultation was sought

<table>
<thead>
<tr>
<th>Unit</th>
<th>Respondent</th>
<th>Remarks</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Engineering</td>
<td>Peter Butler, Associate Dean</td>
<td>No Objections</td>
<td></td>
</tr>
<tr>
<td>Smeal College of Business</td>
<td>Brian Cameron, Associate Dean for Professional Master's Programs</td>
<td>No Objections</td>
<td></td>
</tr>
<tr>
<td>College of Information Science and Technology</td>
<td>Pete Forster, Assistant Dean for Online Programs and Professional Education</td>
<td>No Objections</td>
<td></td>
</tr>
<tr>
<td>Penn State Harrisburg, The Capital College</td>
<td>Peter Idowu, Assistant Dean of Graduate Studies</td>
<td>Comment Incorporated</td>
<td></td>
</tr>
<tr>
<td>World Campus</td>
<td>David Sylvia, Director of Academic Affairs</td>
<td>No Objections</td>
<td></td>
</tr>
</tbody>
</table>
Revised Graduate Bulletin Listing

GRADUATE BULLETIN STATEMENT

Colin J. Neill  
Associate Professor, Software Engineering and Systems Engineering  
School of Graduate Professional Studies  
Penn State Great Valley  
30 E. Swedesford Road  
Malvern, PA 19355-1443  
610-725-5285  
cjneill@psu.edu

Degree Conferred:  
M.P.S.

Graduate Faculty

- Adrian Barb, Ph.D. (University of Missouri) Assistant Professor of Information Science  
- Russell R. Barton, Ph.D. (Cornell) Professor of Supply Chain and Information Systems  
- Chia-Jung Chang, Ph.D. (Georgia Tech) Assistant Professor of Industrial and Manufacturing Engineering  
- Mosuk Chow, Ph.D. (Cornell) Associate Professor of Statistics  
- Joanna DeFranco, Ph.D. (New Jersey Institute of Technology) Assistant Professor of Software Engineering  
- Enrique del Castillo, Ph.D. (Arizona State) Professor of Industrial and Manufacturing Engineering  
- Paul Griffin, Ph.D. (Texas A&M) Professor of Industrial and Manufacturing Engineering  
- Terry P. Harrison, Ph.D. (Tennessee) Strong Professor of Supply Chain and Information Systems  
- John M. Jordan, Ph.D. (Michigan) Clinical Professor of Supply Chain and Information Systems
Program Description

The M.P.S. in Data Analytics (M.P.S.-DAAN) degree is a 30-credit online, interdisciplinary master’s program that provides students the skills required to collect, classify, analyze, and model data at large and ultra-large scales and across domains using statistics, computer science, machine learning, and software engineering.

The curriculum consists of 30 credits, delivered both in residence at the School of Graduate Professional Studies (Great Valley) and online through the Penn State World Campus. The program provides broad coverage of topics related to predictive analytics while provide in-depth coverage of topics such as data collection and quality, large scale data storage and retrieval, and business and enterprise analytics.

Students select to follow either the base program, which prepares them to design and deploy predictive analytics systems, or a specialized option in Analytics in Industry and Manufacturing or Business Analytics. The base program is available both in residence and online; the options are only available online.

Admissions Requirements
Admission requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin. Applicants apply for admission to the program via the Graduate School application for admission.

Admission to the M.P.S. in Data Analytics program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant’s academic potential. Applicants with an undergraduate degree in a quantitative discipline such as science, engineering, or business may apply. Students from other disciplines will be considered based on prior coursework and/or standardized test scores. Applications must include a statement of professional goals, a curriculum vita or resume, and two letters of recommendation. Test scores from the GMAT or GRE exams are also required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

Degree Requirements

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

The M.P.S.-DAAN degree is conferred upon students who earn a minimum of 30 credits of coursework while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level). The program curriculum includes 9 credits of core courses, 9 credits of either a selected option or the base program, 9 credits of electives, and a 3-credit capstone course.

Required Courses

Prescribed courses for the degree include the following 9 credits of core courses

- STAT 500: Applied Statistics (3 cr.)
- IE 575: Foundations in Predictive Analytics (3 cr.)
- SWENG 545: Data Mining (3 cr.) OR STAT 557: Data Mining 1 (3 cr.)

Base Program

(Offered at Penn State Great Valley and through World Campus)

Director: Colin Neill, Ph.D. Associate Professor of Software Engineering and Systems Engineering

The base program will create graduates who can design, deploy, and manage the technology infrastructure and data analytical processes of predictive analytics including data aggregation, cleaning, storage, and retrieval. These graduates will work in positions that require them to design and maintain data analytics systems and tools such as Data Modeler, Data Architect, Extraction, Transformation, Loading (ETL) Developer, Business Intelligence (BI) Developer, Data Warehouse Developer and Data Analyst.

Base program required courses
• IN SC 521: Database Design Concepts (3 cr.)
• DAAN 825: Large-Scale Databases & Warehouses (3 cr.)
• DAAN 881: Data-Driven Decision Making (3 cr.)

Additional Courses

An additional 9 credits of elective courses must be selected from the approved list. The list of approved elective courses is maintained by the graduate program office.

Analytics in Industry and Manufacturing Option

(Offered through World Campus)

Director: Janis Terpenny, Peter & Angela Dal Pezzo Chair & Department Head, Harold & Inge Marcus Department of Industrial & Manufacturing Engineering

The Analytics in Industry and Manufacturing Option will create graduates who can identify the best methods, processes and tools for the analysis of a given dataset or problem and apply them to determine trends, patterns, and predictions as necessary. The Option will provide students with a technical background in the area and the skills to develop and use analytics tools. These graduates will work in positions that require them to conduct data analyses in context such as Systems Analyst, Data Analyst, Financial Analyst, BI Analyst, and Data Engineer.

• IE 582: Engineering Analytics (3 cr.)
• IE 577: Statistical Learning for System Analytics (3 cr.)
• IE 578: Production and Distribution Data Mining (3 cr.)

Business Analytics Option

(Offered through World Campus)

Director: Terry A. Harrison, Professor of Supply Chain and Information Systems

This option prepares graduates to explore and analyze large data sets to support data-driven business decisions. Target audiences include business analysts, analytic system designers and the data scientists who have a focus on problems arising in the context of business decision-making. The Option is organized around the industry-standard rubric of the spectrum of analytics activities: descriptive (what happened), diagnostic (why did it happen), predictive (what will happen) and prescriptive (what should happen).

• BAN 530: Business Strategies for Data Analytics (3 cr.)
• BAN 540: Marketing Analytics (3 cr.)
• BAN 550: Prescriptive Analytics for Business (3 cr.)
Culminating Experience

All students will complete their program of study with the capstone course corresponding to their chosen option. While each capstone course focuses on problems relevant to their specific domains, they all provide students with an opportunity to apply their knowledge of the theories, methods, processes, and tools of data analytics, learned throughout their program, in a culminating and summative experience. DAAN 888 is the culminating experience for the base program, IE 596 for the Analytics in Industry and Manufacturing Option, and BAN 888 for the Business Analytic Option. The choice of project topic and exact form will be mutually determined by the instructor and each student. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students are encouraged to upload their capstone projects to be available publically via ScholarSphere and to participate in the Graduate Exhibition.

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 599 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.
New Graduate Bulletin Listing

GRADUATE BULLETIN STATEMENT

Program Chair

Colin J. Neill
Associate Professor, Software Engineering and Systems Engineering
School of Graduate Professional Studies
Penn State Great Valley
30 E. Swedesford Road
Malvern, PA 19355-1443
610-725-5285
cjneill@psu.edu

Degree Conferred:

M.P.S.

Graduate Faculty

- Adrian Barb, Ph.D. (University of Missouri) Assistant Professor of Information Science
- Russell R. Barton, Ph.D. (Cornell) Professor of Supply Chain and Information Systems
- Chia-Jung Chang, Ph.D. (Georgia Tech) Assistant Professor of Industrial and Manufacturing Engineering
- Mosuk Chow, Ph.D. (Cornell) Associate Professor of Statistics
- Joanna DeFranco, Ph.D. (New Jersey Institute of Technology) Assistant Professor of Software Engineering
- Enrique del Castillo, Ph.D. (Arizona State) Professor of Industrial and Manufacturing Engineering
- Paul Griffin, Ph.D. (Texas A&M) Professor of Industrial and Manufacturing Engineering
- Terry P. Harrison, Ph.D. (Tennessee) Strong Professor of Supply Chain and Information Systems
- John M. Jordan, Ph.D. (Michigan) Clinical Professor of Supply Chain and Information Systems
- Mohammed Kassab, Ph.D. (Concordia) Assistant Professor of Software Engineering
- Soundar Kumara, Ph.D. (Purdue) Pearce Professor of Industrial and Manufacturing Engineering
- Phillip A. Laplante, Ph.D. (Stevens Institute of Tech) Professor of Software Engineering
- John I. McCool, Ph.D. (Temple) Distinguished Professor of Systems Engineering
Colin J. Neill, Ph.D. (Wales) Associate Professor of Software Engineering & Systems Engineering
David Nemhhard, Ph.D. (Michigan) Professor of Industrial and Manufacturing Engineering
Michael J. Piovoso, Ph.D. (Delaware) Professor of Electrical Engineering
Guanghua Qiu, Ph.D. (Penn State) Professor of Information Science
Arvind Rangaswamy, Ph.D. (Northwestern) Anchor Professor of Marketing
James L. Rosenberger, Ph.D. (Cornell) Professor of Statistics
Raghvinder Sangwan, Ph.D. (Temple) Associate Professor of Software Engineering
Durland L. Shumway, Ph.D. (Penn State) Assistant Professor of Statistics; Research Associate
Laura B. Simon, Ph.D. (Penn State) Senior Lecturer in Statistics
Aleksandra B. Slavkovic, Ph.D. (Carnegie Mellon) Assistant Professor of Statistics
Conrad Tucker, Ph.D. (Illinois) Assistant Professor of Industrial and Manufacturing Engineering
John E. Tyworth, Ph.D. (Oregon) Professor of Supply Chain and Information Systems

Program Description

The M.P.S. in Data Analytics (M.P.S.-DAAN) degree is a 30-credit interdisciplinary master’s program that provides students the skills required to collect, classify, analyze, and model data at large and ultra-large scales and across domains using statistics, computer science, machine learning, and software engineering.

The curriculum consists of 30 credits, delivered both in residence at the School of Graduate Professional Studies (Great Valley) and online through the Penn State World Campus. The program provides broad coverage of topics related to predictive analytics while provide in-depth coverage of topics such as data collection and quality, large scale data storage and retrieval, and business and enterprise analytics.

Students select to follow either the base program, which prepares them to design and deploy predictive analytics systems, or a specialized option in Analytics in Industry and Manufacturing or Business Analytics. The base program is available both in residence and online; the options are only available online.

Admissions Requirements

Admission requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin. Applicants apply for admission to the program via the Graduate School application for admission.

Admission to the M.P.S. in Data Analytics program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant’s academic potential. Applicants with an undergraduate degree in a quantitative discipline such as science, engineering, or business may apply. Students from other disciplines will be considered based on prior coursework and/or standardized test scores. Applications
must include a statement of professional goals, a curriculum vita or resume, and two letters of recommendation. Test scores from the GMAT or GRE exams are also required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

**Degree Requirements**

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

The M.P.S.-DAAN degree is conferred upon students who earn a minimum of 30 credits of coursework while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level). The program curriculum includes 9 credits of core courses, 9 credits of either a selected option or the base program, 9 credits of electives, and a 3-credit capstone course.

**Required Courses**

Prescribed courses for the degree include the following 9 credits of core courses

- STAT 500: Applied Statistics (3 cr.)
- IE 575: Foundations in Predictive Analytics (3 cr.)
- SWENG 545: Data Mining (3 cr.) OR STAT 557: Data Mining 1 (3 cr.)

**Base Program**

*(Offered at Penn State Great Valley and through World Campus)*

Director: Colin Neill, Ph.D. Associate Professor of Software Engineering and Systems Engineering

The base program will create graduates who can design, deploy, and manage the technology infrastructure and data analytical processes of predictive analytics including data aggregation, cleaning, storage, and retrieval. These graduates will work in positions that require them to design and maintain data analytics systems and tools such as Data Modeler, Data Architect, Extraction, Transformation, Loading (ETL) Developer, Business Intelligence (BI) Developer, Data Warehouse Developer and Data Analyst.

**Base program required courses**

- IN SC 521: Database Design Concepts (3 cr.)
- DAAN 825: Large-Scale Databases & Warehouses (3 cr.)
- DAAN 881: Data-Driven Decision Making (3 cr.)

**Additional Courses**

An additional 9 credits of elective courses must be selected from the approved list. The list of approved elective courses is maintained by the graduate program office.
Analytics in Industry and Manufacturing Option

(Offered through World Campus)

Director: Janis Terpenny, Peter & Angela Dal Pezzo Chair & Department Head, Harold & Inge Marcus Department of Industrial & Manufacturing Engineering

The Analytics in Industry and Manufacturing Option will create graduates who can identify the best methods, processes and tools for the analysis of a given dataset or problem and apply them to determine trends, patterns, and predictions as necessary. The Option will provide students with a technical background in the area and the skills to develop and use analytics tools. These graduates will work in positions that require them to conduct data analyses in context such as Systems Analyst, Data Analyst, Financial Analyst, BI Analyst, and Data Engineer.

- IE 582: Engineering Analytics (3 cr.)
- IE 577: Statistical Learning for System Analytics (3 cr.)
- IE 578: Production and Distribution Data Mining (3 cr.)

Business Analytics Option

(Offered through World Campus)

Director: Terry A. Harrison, Professor of Supply Chain and Information Systems

This option prepares graduates to explore and analyze large data sets to support data-driven business decisions. Target audiences include business analysts, analytic system designers and the data scientists who have a focus on problems arising in the context of business decision-making. The Option is organized around the industry-standard rubric of the spectrum of analytics activities: descriptive (what happened), diagnostic (why did it happen), predictive (what will happen) and prescriptive (what should happen).

- BAN 530: Business Strategies for Data Analytics (3 cr.)
- BAN 540: Marketing Analytics (3 cr.)
- BAN 550: Prescriptive Analytics for Business (3 cr.)

Culminating Experience

All students will complete their program of study with the capstone course corresponding to their chosen option. While each capstone course focuses on problems relevant to their specific domains, they all provide students with an opportunity to apply their knowledge of the theories, methods, processes, and tools of data analytics, learned throughout their program, in a culminating and summative experience. DAAN 888 is the culminating experience for the base program, IE 596 for the Analytics in Industry and Manufacturing Option, and BAN 888 for the Business Analytic Option. The choice of project topic and exact form will be mutually determined by the instructor and each student. A written
paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students are encouraged to upload their capstone projects to be available publically via ScholarSphere and to participate in the Graduate Exhibition.

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 599 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.
Responses
Jim,

I have no objections. This looks like a reasonable proposal.

-Peter

Peter J. Butler, PhD  
Associate Dean for Education, College of Engineering  
Professor of Biomedical Engineering  
Penn State University  
102A Hammond Building  
University Park, PA 16802  
office: (814) 863-3750  
email: pbutler@psu.edu

On Jan 20, 2016, at 4:33 PM, JAMES A NEMES <jan16@psu.edu> wrote:

Peter,

Just a reminder that we were hoping to have consultation on this by Friday and just as clarification this change has nothing to do with the issues we have been discussing related to IE 575 and the option. This change would simply allow Great Valley to offer the program on campus for those students who prefer a more traditional classroom learning experience to online.

Thanks,

Jim

James A. Nemes, D.Sc.  
Interim Chancellor  
Director of Academic Affairs  
Professor of Mechanical Engineering  
School of Graduate Professional Studies  
Penn State Great Valley  
30 East Swedesford Road  
Malvern, PA 19355-1443  
Phone: 610-648-3335  
Fax: 610-648-3377
From: JAMES A NEMES [mailto:jan16@psu.edu]
Sent: Friday, January 08, 2016 8:25 AM
To: 'Peter J. Butler' <pjhib@engr.psu.edu>; 'Brian Cameron'
<bcameron@smeal.psu.edu>; 'Pete Forster' <pforster@ist.psu.edu>; 'PETER IDOWU'
<pbl1@psu.edu>
Subject: Program Change Proposal

Brian, Peter, Peter, and Peter,

Please find attached a program change proposal for the MPS in Data Analytics. The change is to allow the Base Program, which currently is only offered through World Campus, to be offered as a resident program on the Great Valley campus. We have been offering a resident Graduate Certificate in Data Analytics and students have inquired about the degree program. Although the degree program is offered in a fully online environment through World Campus, we find that many learners still prefer a more traditional classroom experience, which this change would accommodate. No other changes to the program are proposed at this time. Given the relatively straightforward nature of the change we would appreciate a response by January 22nd.

If you have any questions please let me know.

Jim

James A. Nemes, D.Sc.
Interim Chancellor
Director of Academic Affairs
Professor of Mechanical Engineering
School of Graduate Professional Studies
Penn State Great Valley
30 East Swedesford Road
Malvern, PA 19355-1443
Phone: 610-648-3335
Fax: 610-648-3377
jan16@psu.edu

<Program Change Proposal DAAN.docx>
Hi Jim,

I see no reason that GV should not offer its MPS option in residence. No objections from IST. BTW, future reference, I'm the Associate not Assistant Dean. Thanks, Pete

---

From: JAMES A NEMES [mailto:jan16@psu.edu]
Sent: Friday, January 08, 2016 8:25 AM
To: 'Peter J. Butler' <pjbio@engr.psu.edu>; 'Brian Cameron' <bcameron@smeal.psu.edu>; Pete Forster <pforster@ist.psu.edu>; 'PETER IDOWU' <pbi1@psu.edu>
Subject: Program Change Proposal

Brian, Peter, Peter, and Peter,

Please find attached a program change proposal for the MPS in Data Analytics. The change is to allow the Base Program, which currently is only offered through World Campus, to be offered as a resident program on the Great Valley campus. We have been offering a resident Graduate Certificate in Data Analytics and students have inquired about the degree program. Although the degree program is offered in a fully online environment through World Campus, we find that many learners still prefer a more traditional classroom experience, which this change would accommodate. No other changes to the program are proposed at this time. Given the relatively straightforward nature of the change we would appreciate a response by January 22nd.

If you have any questions please let me know.

Jim

James A. Nemes, D.Sc.
Interim Chancellor
Director of Academic Affairs
Professor of Mechanical Engineering
School of Graduate Professional Studies
Penn State Great Valley
30 East Swedesford Road
Malvern, PA 19355-1443
Phone: 610-648-3335
Fax: 610-648-3377
jan16@psu.edu
Hi Jim

I discussed with Terry Harrison and we are fine with the proposed change.

Best regards,

Brian

From: JAMES A NEMES [mailto:jian16@psu.edu]
Sent: Friday, January 08, 2016 8:25 AM
To: 'Peter J. Butler' <pjibbio@engr.psu.edu>; 'Brian Cameron' <bcmameron@smeal.psu.edu>; 'Pete Forster' <pforster@ist.psu.edu>; 'PETER IDOWU' <pbi1@psu.edu>
Subject: Program Change Proposal

Brian, Peter, Peter, and Peter,

Please find attached a program change proposal for the MPS in Data Analytics. The change is to allow the Base Program, which currently is only offered through World Campus, to be offered as a resident program on the Great Valley campus. We have been offering a resident Graduate Certificate in Data Analytics and students have inquired about the degree program. Although the degree program is offered in a fully online environment through World Campus, we find that many learners still prefer a more traditional classroom experience, which this change would accommodate. No other changes to the program are proposed at this time. Given the relatively straightforward nature of the change we would appreciate a response by January 22nd.

If you have any questions please let me know.

Jim

James A. Nemes, D.Sc.
Interim Chancellor
Director of Academic Affairs
Professor of Mechanical Engineering
School of Graduate Professional Studies
Penn State Great Valley
30 East Swedesford Road
Thanks Peter. I had intended on taking out that World Campus exhibition and just leaving it as Graduate Exhibition.

Jim

James A. Nemes, D.Sc.
Interim Chancellor
Director of Academic Affairs
Professor of Mechanical Engineering
School of Graduate Professional Studies
Penn State Great Valley
30 East Swedesford Road
Malvern, PA 19355-1443
Phone: 610-648-3335
Fax: 610-648-3377
jan16@psu.edu

From: PETER IDOWU [mailto:pbi1@psu.edu]
Sent: Friday, January 08, 2016 9:25 AM
To: JAMES A NEMES <jan16@psu.edu>
Cc: Peter J. Butler <pjbbio@engr.psu.edu>; Brian Cameron <bcameron@smeal.psu.edu>; Pete Forster <pforster@ist.psu.edu>
Subject: Re: Program Change Proposal

Hi Jim,

We believe your plan to offer the MPS in Data Analytics base program in residence will serve the students well, so we fully support your program change proposal. I will recommend some minor revision to the text under Culminating Experience sections on page 10 and page 15. The statement underlined (below) could use some minor revision.

Culminating Experience
All students will complete their program of study with the capstone course corresponding to their chosen option. While each capstone course focuses on problems relevant to their specific domains, they all provide students with an opportunity to apply their knowledge of the theories, methods, processes, and tools of data analytics, learned throughout their program, in a culminating and summative experience. The choice of project topic and exact form will be
mutually determined by the instructor and each student. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students will be encouraged to upload their capstone work products to be available publically via ScholarSphere: https://scholarsphere.psu.edu/ and to participate in the World Campus Graduate Capstone Exhibition.

Regards,
Peter

Peter Idowu, Ph.D., P.E.
Assistant Dean of Graduate Studies, Penn State Harrisburg
Professor of Electrical Engineering

Penn State Harrisburg
C-114 Oblsted Building

777 W. Harrisburg Pike, Middletown PA 17057
(717) 948-6315 - Phone
(717) 948-6737 - Fax
idowu@psu.edu
http://sites.psu.edu/microgridtestbedpsb/
http://harrisburg.psu.edu/graduate-studies

From: "JAMES A NEMES" <jan16@psu.edu>
To: "Peter J. Butler" <pjbbiq@engr.psu.edu>, "Brian Cameron" <bcameron@smeal.psu.edu>, "Pete Forster" <pforster@ist.psu.edu>, "Peter Idowu" <pbi1@psu.edu>
Sent: Friday, January 8, 2016 8:24:38 AM
Subject: Program Change Proposal

Brian, Peter, Peter, and Peter,

Please find attached a program change proposal for the MPS in Data Analytics. The change is to allow the Base Program, which currently is only offered through World Campus, to be offered as a resident program on the Great Valley campus. We have been offering a resident Graduate Certificate in Data Analytics and students have inquired about the degree program. Although the degree program is offered in a fully online environment through World Campus, we find that many learners still prefer a more traditional classroom experience, which this change would accommodate. No other changes to the program are proposed at this time. Given the relatively
straightforward nature of the change we would appreciate a response by January 22nd.

If you have any questions please let me know.

Jim

James A. Nemes, D.Sc.
Interim Chancellor
Director of Academic Affairs
Professor of Mechanical Engineering
School of Graduate Professional Studies
Penn State Great Valley
30 East Swedesford Road
Malvern, PA 19355-1443
Phone: 610-648-3335
Fax: 610-648-3377
jan16@psu.edu
GRADUATE COUNCIL
PROGRAM, OPTION, OR MINOR PROPOSAL FORM

Submit 1 original, signed Graduate Council proposal form and 7 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. The proposals will be transmitted to 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.

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

College/School: Health and Human Development
Department or Instructional Area: Kinesiology

NEW GRADUATE PROGRAM, OPTION, OR MINOR: Add X

Designation of new graduate program: Dual Title Ph.D. Degree Program in Clinical and Translational Sciences
Classification of Instructional Programs (CIP) Code:
Designation of new graduate option:
Designation of new graduate minor:

Indicate effective semester (cannot be earlier than the first semester following approval): Immediately upon approval

EXISTING GRADUATE PROGRAM, OPTION, OR MINOR: Change X Drop

Current designation of graduate program: Dual Title Ph.D. Degree Program in Clinical and Translational Sciences
Current designation of graduate option:
Current designation of graduate minor:

New designation of existing graduate program (if changing):
New designation of existing graduate option (if changing):
New designation of existing graduate minor (if changing):

Indicate effective semester (cannot be earlier than the first semester following approval):

SUBMITTED BY GRADUATE PROGRAM HEAD:

David E. Conroy
Printed name
Signature
Date: 11/22/13

NOTED BY COLLEGE/SCHOOL REPRESENTATIVE TO GRADUATE COUNCIL SUBCOMMITTEE ON NEW AND REVISED PROGRAMS AND COURSES:

John H Chaliss
Printed name
Signature
Date: 11/21/13

APPROVED BY COLLEGE/SCHOOL DEAN/CHANCELLOR (OR DESIGNEE):

Kathryn Drager
Printed name
Signature
Date: 11-22-13
Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:

On Behalf of Luis Ayala  
Printed name  
Signature  
Date: 1/15/2016

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

On Behalf of Andris Freivalds  
Printed name  
Signature  
Date: 1/15/2016

Noted by Dean of the Graduate School:

On Behalf of Regina Vasilatos-Younken  
Printed name  
Signature  
Date: 1/15/2016
Graduate Program in Kinesiology change proposal

Adoption of the dual-title Ph.D. degree program in Clinical and Translational Sciences

Contents

1. Objectives of the Program Change ................................................................. 1
2. Justification for the Program Change .......................................................... 1
3. Proposed Bulletin Listing ................................................................. 8

1. Objectives of Program Change

The objective of this document is to propose a Dual-Title Ph.D. Degree in Kinesiology (Kines) and Clinical and Translational Sciences (CTS). A dual-title Ph.D. in Kines and CTS will expand the educational experience of students studying in the Graduate Program in Kinesiology (GPK) to include training, via a unique curriculum and research focus, aimed at preparing students for career paths that involve clinical trials or clinical research programs. The Kines component of the dual-title provides pre-doctoral students curricular training with a unique focus on human health and disease and the opportunity to concentrate in one or more disciplinary approaches including athletic training, biomechanics, exercise physiology, exercise psychology, motor control, and rehabilitation medicine. The CTS component of the dual-title provides an emphasis on epidemiological, behavioral, outcomes and health services research that transitions scientific findings from the laboratory to the clinical setting to best practices in the community. Pairing of the two training experiences in the Dual-Title Ph.D. in Kines and CTS, yields opportunities for interdisciplinary scholarship at the interface of basic science, clinical science and human health. This new offering does not duplicate other degree programs within the Department of Kinesiology, College of Health and Human Development or the University.

2. Justification for Program Change

The existing Graduate Certificate Program in Clinical Research offered through the Department of Public Health Sciences at the College of Medicine provides limited exposure to the field of CTS. It is an important adjunct for a limited pool of professionals, most of whom have completed their doctoral program. However, it cannot offer the same integrated training and research experiences offered by a dual-title Ph.D. degree. The Dual-Title Ph.D. in Kines and CTS is part of a national effort, led by the National Institutes of Health (NIH) Roadmap, to change the culture of health-related research by reducing program compartmentalization and encouraging interdisciplinary team-based science.

Interdisciplinary training in CTS prepares students for successful careers in industry (ranging from drug design to orthopedic clinical trials), community and public health, as well as more
traditional academic and clinical venues. Of particular interest is the explosive growth of clinical research sponsoring organizations, who now employ more than 66,000 people worldwide and account for $20 billion of industry revenue in 2010, or approximately one-third of total pharma and biotech research and development expenditures.¹

The expected benefits of the Dual-Title Ph.D. in Kines and CTS include:

- Value-added training and scholarship for current students rather than competition between graduate programs for an applicant pool;
- Addition of novel course work and training not prescribed in an existing (primary) graduate degree program;
- Integration of clinical/translational research training into thesis and dissertation work (e.g., Candidacy and Comprehensive Examinations, original research);
- Enhanced methodological/analytical skills and training;
- Expanded employment and career opportunities within the health sciences arena.

The Dual-Title Ph.D. Degree in Kines and CTS will encourage interdisciplinary scholarly work at the interface between many domains by focusing on human health. Using practicum, course work and research, the proposed program of study is designed to extend students’ knowledge beyond their primary area of study to foster a greater understanding and competence in clinical and health-related research. Ultimately, this approach should enable a new breed of scientists capable of targeting their research programs to address the unmet preventative, therapeutic and diagnostic needs of the future.

Below is the proposed organization and integration of the GPK (i.e., graduate program in Kines) with the CTS Graduate Program.

¹ http://www.acrohealth.org/fact-sheet.html
The Dual-Title Ph.D. Degree in Kines and CTS curriculum has four general features.

1. Basic and clinical science elective course work in each of the following areas:
   - Statistics (3 credits);
   - Epidemiology (3 credits);
   - Bioinformatics (3 credits);
   - Experimental design and interpretation (3 credits);
   - The regulatory environment (3 credits);
   - Scientific communication (3 credits).

Each requirement is met by selecting a course from the approved list provided below. Substitutions and additions will be considered by the CTS Predoctoral Program Co-Directors on a case-by-case basis, which allows for some flexibility as graduate course offerings evolve. The CTS program plans biennial updates to its list of elective courses.

2. Co-mentoring by basic and clinical scientists during students’ dissertation research.
3. Structured experiences in health care and clinical research.
4. Exposure to opportunities afforded by focusing basic sciences, clinical sciences and community engagement on both treatment and prevention to enhance human health.
The GPK requires 21 credits of electives (15 within the department and 6 outside of the department), some of which could be accrued toward requirements of both (i.e., Kines and CTS) programs. One Kines course satisfies requirements for both programs (Kines 588); assuming that the 6 GPK credits outside the department fulfill CTS requirements, the minimum number of additional credits that would be added to the curricular experience of students in the GPK accepted to the dual-title program would be 9. Additional course work would be reasonably achievable by the end of the third year of graduate studies. Students will select these additional courses from a list of pre-existing courses (see Table 1). No new courses in Kines are required to support the Dual-Title Ph.D. Degree in Kines and CTS.

Prospective dual-title trainees will express an interest in the program as early as during the recruitment process for GPK and will apply to the dual-title program no later than the end of the spring semester of the first year of study in the GPK. Students interested in the Dual-Title Ph.D. will be considered for admission to the CTS Program by the CTS Program co-directors and admissions committee with recommendations from the Kines graduate program. Typically, students in the GPK complete the Candidacy Examination at the end of the first year of graduate training. Graduate students in Kines accepted to the Dual-Title Ph.D. Degree in Kines and CTS will take the Candidacy Examination at the end of the third semester of graduate training to allow exposure to the CTS Curriculum and to assure commitment of an appropriate dissertation mentor.

Students must select three credits in each of the following areas from the currently approved list of courses. At least half must be at the 500 level or above.

**N.B.** This list includes only courses with permanent course numbers that have been approved by the Graduate School. However, the graduate curriculum evolves constantly. Provisional or experimental courses (typically 597 or 598), or other courses not listed here may be substituted for credit if prior approval is received from the Directors of the CTS Program. Consideration will be given to the extent that a request meets the spirit and intent of education in the curricular area.

Requirements for the Dual-Title Ph.D. Degree in Kines and CTS include 18 credits from the list of approved electives in the following areas.

**Statistics (3 credits)**
- HD FS 516 (3) Methods of Research in Human Development
- HD FS 518 (1) Applied Statistics Laboratory
- HD FS 519 (3) Methods of Statistical Analysis in Human Development
- H PA 564 (3) Research methods in health services research
- H PA 566 (3) Advanced methods in health services research I
- PHS 520 (3) Principles of biostatistics
- PHS 521 (3) Applied biostatistics
- PHS 522 (3) Multivariate biostatistics
- PHS 523 (3) Multivariate analysis
PHS 524 (3) Longitudinal data analysis
PHS 525 (3) Biostatistics for lab scientists
PHS 527 (3) Survival analysis
PHS 528 (3) Bayesian methods
STAT 500 (3) Applied statistics
STAT 501 (3) Regression methods
STAT 502 (3) Analysis of variance and design of experiments
STAT 504 (3) Analysis of discrete data
STAT 505 (3) Applied multivariate statistical analysis
STAT 506 (3) Sampling theory and methods
STAT 525 (3) Survival analysis I

Epidemiology (3 credits)
BB H/H P A 440 (3) Principles of epidemiology
HD FS 527 (3) Social epidemiology
H P A 540 (3) Epidemiological applications in health services research
NUTR 583 (3) Nutritional Epidemiology
PHS 550 (3) Principles of epidemiology
PHS 551 (3) Advanced epidemiological methods
PHS 552 (3) Molecular epidemiology of chronic disease
PHS 553 (3) Infectious disease epidemiology
STAT 507 (3) Epidemiologic research methods
VB SC 444 (3) Epidemiology of infectious diseases
VBSC 445 (3) Molecular epidemiology of infectious diseases

Bioinformatics (3 credits)
AN SC 543 (3) Animal genomics
B M B 484 (3) Functional genomics
B M B 485 (3) Human genomics and biomedical informatics
H P A 528 (3) Health data analysis for research
MCIBS 530 (VB SC 530) (3) Regulation of gene expression by xenobiotics
MCIBS 551 (BMMB 551) (3) Genomics
MCIBS 554 (BMMB 554) (3) Foundations in data driven life sciences
MCIBS 555 (BIOL 555, STAT 555) (3) Statistical analysis of genomics data
PHS 516 (3) Statistical genetics

Experimental design and interpretation (3 credits)
A B E 500 (BRS 500) (3) Research methods
BB H 502 (PSY 502) (3) Health: Biobehavioral perspectives
BB H 505 (3) Behavioral health research strategies
BMS 568 (3) Current topics in translational cancer research
BMS 581 (3) Molecular and translational approaches to human disease
HD FS 506 (3) Design and evaluation of prevention and health promotion programs across the lifespan
HD FS 508 (1-6) Best practices in preventive intervention
HD FS 534 (3) Person-specific data analysis
H P A 561 (3) Introduction to research design in health services research
PRINCIPLES OF DRUG ACTION

PHARM 520 (2) Principles of drug action
PHS 504 (3) Behavioral health intervention strategies
PHS 510 (3) Clinical research methods
PHS 511 (1) Methods used in translational research
PHS 519 (2) Patient-centered research
PHS 535 (3) Quality of care measurement
PHS 536 (3) Health survey research methods
PHS 540 (1) Decision analysis I
PHS 580 (3) Clinical trials: design and analysis
PSY 583 (3) Designing research in social psychology
SOC 518 (PL SC 518) (3) Survey methods I: Survey design
SOC 532 (3) Global health and mortality
STAT 503 (3) Design of experiments
STAT 509 (3) Design and analysis of clinical trials

THE REGULATORY ENVIRONMENT (3 CREDITS)

BB H 551 (3) World health promotion
BIOE 591 (1) Bioengineering ethics and professional development
BIOET 501 (3) Perspectives and methods in bioethics
BIOET 502 (3) Perspectives in macro-bioethics
BIOET 503 (PHIL 573) (3) Ethics and the responsible conduct of biomedical research
BIOET 504 (2) Research integrity in science and engineering
BMS 591 (1) Biomedical research ethics
CAS 453 (3) Health communication theory and research
CAS 567 (3) Health campaigns: design and evaluation
HLTHL 961 (3) Bioethics and public health law
HLTHL 971 (3) Law and medicine
HPA 420 (3) Principles of managed care
HPA 520 (3) Intro to health service organizations and delivery
HPA 551 (3) Quality improvement in healthcare
HPA 822 (3) Clinical issues for health services management
HPA 836 (3) Health law
MCIBS 591 (1) Ethics in the life sciences
MCIBS 571 (2) Current issues in biotechnology
NURS 458 (3) Ethical challenges in healthcare informatics
PHIL 432 (S T S 432) (3) Medical and health care ethics
PHS 500 (1) Research ethics for clinical investigators
PHS 505 (3) Public health program planning and evaluation
PHS 537 (3) Health policy and law

SCIENTIFIC COMMUNICATION (3 CREDITS)

AN SC 502 (2) Scientific scholarship
BMS 504 (1) Art of scientific communication I
BMS 505 (1) Art of scientific communication II
KINES 588 (3) Scientific writing
PHS 518 (2) Scientific communication
PSIO 501 (1) Scientific analysis and presentation

In addition to mandatory Scholarship and Research Integrity (SARI) and Institutional Review Board (IRB) or Institutional Animal Care and Use Committee (IACUC) training (as appropriate), CTS 590 (1) Seminar in Clinical and Translational Sciences (two semesters) and six credits of clinical rotation or practicum that is approved by the Directors of the CTS Graduate Program (CTS 596 or BMS 571) complete the curriculum, which brings the total CTS credit requirement to 26 (18 credits of electives, 2 credits of seminar, 6 credits of clinical rotation).

Graduate trainees accepted to the Dual-Title Ph.D. Degree in Kines and CTS and trainees in the CTS Program will be served by the CTS Institute’s (CTSI) Mentoring and Career Advisory and Development Panel (MCDAP). The MCDAP approves elective courses and provides mentoring and guidance beyond that offered by the primary research mentor. MCDAP members are selected by the CTSI Education and Training Co-Directors, due to their experience with mentoring and training junior faculty and graduate students in clinical, behavioral, and applied sciences. High priority is given to experience with cross-campus training. As CTS Program trainees are accepted, they identify a lead mentor from the MCDAP roster. The Kines mentor and MCDAP mentor will monitor student progress and identify areas for development that are aligned with the core competencies of the Dual-Title Ph.D. Degree in Kines and CTS. Areas for development may include “soft skills” such as leadership, diversity, and teamwork that are expected competencies for successful translational scientists but are not formally evaluated in the Candidacy Examination, Comprehensive Examination, or other required elements of the primary or dual-title degree.

*Fiscal Resources and Extramural Support.* The program is supported through the Penn State CTSI, sponsored by the University and the NIH. Currently, CTSI support is available for eight semesters per year, with an additional four semesters of support matched by the College of Health and Human Development. Students are provided up to 24 months of graduate stipend support. Up to seven trainees per year (four grant funded and two institutional matches) are supported.

It is anticipated that one to two students in the GPK will apply to the Dual-Title Ph.D. Degree in Kines and CTS each year. Historically the College of Health and Human Development has provided a second year of stipend and tuition for students in other units that are accepted into the Dual-Title Ph.D. Degree in CTS.

The proposed program will minimally impact current course offerings, faculty loads, and faculty advising duties. Trainees must complete a Final Oral Examination in which the dissertation research is accepted by their dissertation committee. Thus, a Ph.D. is requested as the degree title for this dual-title program.

There is no accrediting body for the proposed program area. A proposed sequence of study for students seeking the Dual-Title Ph.D. in Kines and CTS is presented below.
Year One
- Kines Course work
- CTS Course work (statistics and epidemiology; select from list)
- Complete Scholarship and Research Integrity (SARI) Training [1st semester]
- Apply to Dual-Title program
- Establish CTS mentors
- Language Proficiency
- Residency Requirement Fulfilled

Year Two
- Kines Course work
- CTS Course work (bioinformatics, experimental design, regulatory environment; select from list)
- CTS 590
- CTS 595
- Complete Candidacy Examination (scheduled by the GPK and CTS program office) [1st semester]
- Form Doctoral Committee
- Identify Dissertation Topic

Year Three and Beyond
- CTS 590
- CTS course work (scientific communication; select from list)
- Complete Comprehensive Examination (schedule with GPK and CTS program office) [no later than 2nd semester]
- Schedule KINES 600/601/610/611 credits post comprehensives
- Present Proposal
- Work on Dissertation Topic (e.g., review literature, collect data)
- Write Dissertation
3. Proposed Bulletin Listing

**Kinesiology (KINES)**

NANCY I. WILLIAMS, *Head of the Department*
275 Recreation Building
814-863-0847
kinesgrad@psu.edu

**Degrees Conferred**
Ph.D., M.S.

**The Graduate Faculty**
- Lacy Alexander, Ph.D. (Penn State) Research Associate Professor of Kinesiology
- April Armstrong, M.D. (Western Ontario) Associate Professor of Orthopaedics
- Melissa Bopp, Ph.D. (South Carolina-Columbia) Associate Professor of Kinesiology
- W. E. Buckley, Ph.D. (Penn State) Professor of Exercise and Sport Science, and Health Education
- John H. Challis, Ph.D. (Loughborough University of Technology) Professor of Kinesiology
- David E. Conroy, Ph.D. (Utah) Professor of Kinesiology
- Mary Jane De Souza, Ph.D. (Connecticut) Professor of Kinesiology
- Danielle Symons Downs, Ph.D. (Florida) Professor of Kinesiology
- Mark Dyreson, Ph.D. (Arizona) Professor of Kinesiology
- Robert B. Eckhardt, Ph.D. (Michigan) Professor of Developmental Genetics and Evolutionary Morphology
- Steriani Elavsky, Ph.D. (Illinois) Associate Professor of Kinesiology
- Sara B. Ferguson, M.D. (University of Pennsylvania) Assistant Professor of Dermatology
- Jinger S. Gottschall, Ph.D. (Colorado) Assistant Professor of Kinesiology
- Douglas R. Hochstetler, Ph.D. (Penn State) Associate Professor of Kinesiology
- Peter M. Hopsicker, Ph.D. (Penn State) Associate Professor of Kinesiology
- Xuemei Huang, Ph.D., M.D. (Beijing Medical University) Associate Professor of Neurology and Pharmacology
- W. Larry Kenney, Ph.D. (Penn State) Professor of Physiology and Kinesiology
- Donna H. Korzick, Ph.D. (Penn State) Associate Professor of Kinesiology and Physiology
- R. Scott Kretchmar, Ph.D. (Southern California) Professor of Exercise and Sport Science
- Mark L. Latash, Ph.D. (Rush) Distinguished Professor of Kinesiology
- Timothy R. McConnell (Kent State) Adjunct Professor of Kinesiology
- Sayers John Miller III, Ph.D. (Penn State) Assistant Professor of Kinesiology
- Gustavo Nader, Ph.D. (Illinois at Chicago) Associate Professor of Kinesiology
- Kristina A. Neely, Ph.D. (Western Ontario) Assistant Professor of Kinesiology
The graduate programs in Kinesiology are research oriented and are designed to meet the specific goals and interests of the student. The primary goal of the overall program is to provide students the opportunity to study in depth one area of specialization and to develop necessary research skills to enhance their professional competence. The master's program is designed to prepare students for future graduate study, while the doctoral program is directed toward careers in research and in teaching at the advanced undergraduate and graduate levels in colleges and universities. Six areas of study are available at both the master's and doctoral levels: (1) athletic training and sports medicine, (2) biomechanics, (3) exercise physiology, (4) history and philosophy of sport, (5) motor control, and (6) psychology of physical activity. Several well-equipped research facilities are available to support graduate study, including the Biomechanics Laboratory, Motor Behavior Laboratory, and Noll Physiological Research Center.

**Admission Requirements**

Requirements listed here are in addition to requirements stated in the [GENERAL INFORMATION](#) section of the Graduate Bulletin. Applicants must complete the [online Graduate School application](#) and pay a nonrefundable application fee.

Scores from the Graduate Record Examinations (GRE) are required for admission. The minimum requirements for admission to the master's program include a 3.00 junior/senior
grade-point average (on a 4.00 scale), satisfactory recommendations, a total of 1000 or higher on the verbal and quantitative sections of the GRE, and appropriate background courses in physical, biological, behavioral, and/or social science, depending on the intended area of specialization. Candidates from majors other than exercise and sport science/physical education are welcome to apply. In addition, doctoral applicants are expected to meet more stringent admission standards, including documented research capabilities (e.g., from an M.S. degree). Experience is highly desirable. Admission is highly competitive and the best-qualified students will be admitted subject to space availability and compatibility of the student with the department's research mission.

**Master's Degree Requirements**

Requirements listed here are in addition to requirements stated in the [DEGREE REQUIREMENTS](#) section of the *Graduate Bulletin*.

The M.S. program of study in the Department of Kinesiology requires a minimum of 30 credits, including:

- 6 credits selected from the six Department of Kinesiology areas of graduate study, for all of which the student must receive a quality letter grade;
- 6 credits selected from classes offered outside of the Department of Kinesiology, for all of which the student must receive a quality letter grade;
- KINES 590 - Graduate Colloquium, for two semesters (2 credits);
- KINES 600 - Thesis Research: (6 credits);
- 10 credits of electives.

Each specialization may require additional, specific courses. At least 18 credits in the 500 and 600 series combined must be included in the program. A minimum of 12 credits in course work (400, 500, and 800 series), as contrasted with research, must be completed in the major.

M.S. degree students must complete Scholarship and Research Integrity (SARI) Training (10 hours) and demonstrate proficiency in the English language.

The M.S. degree also requires the formation of a master’s committee, the writing of a satisfactory thesis accepted by the master’s committee, the head of the graduate program, and the Graduate School, and the passing of a thesis defense. The final public oral examination, conducted by the candidate's committee members, must be scheduled and passed after all other work, including the M.S. thesis, has been completed.

**Doctoral Degree Requirements**

Requirements listed here are in addition to requirements stated in the [DEGREE REQUIREMENTS](#) section of the *Graduate Bulletin*.
A program to meet the individual needs of each student is planned with the adviser in consultation with the doctoral committee members. Regardless of the area of study, the following are required of all Kinesiology doctoral degree candidates:

- 15 credits selected from the six Department of Kinesiology areas of graduate study, for all of which the student must receive a quality letter grade;
- 6 credits selected from classes offered outside of the Department of Kinesiology, for all of which the student must receive a quality letter grade;
- KINES 590 - Graduate Colloquium, all semesters until after the comprehensive exam has been passed; and
- Scholarship and Research Integrity (SARI) training (10 hours).

Beyond this minimum of 21 credits, the student’s adviser, and dissertation committee in consultation with the student set the structure and content of the doctoral program. A maximum of six (6) credits only from Independent Studies may count toward the 15 departmental credits required for the degree.

All doctoral students must pass a candidacy examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

**Dual-Title Ph.D. Degree in Kinesiology and Clinical and Translational Sciences (CTS)**

Doctoral students with research and educational interests in clinical and translational science may apply for the Dual-Title Ph.D. Degree in Kinesiology and Clinical and Translational Sciences following admission to the Graduate School and Kinesiology and prior to taking the candidacy examination in Kinesiology. An admissions committee comprised of faculty affiliated with the dual-title program will evaluate applicants. Applicants must have a graduate GPA of at least 3.5 in a research area related to human health. Prospective dual-title program students will write a statement of purpose that addresses the ways in which their research and professional goals will be enhanced by an interdisciplinary course of study in clinical and translational sciences.

This dual-title degree program emphasizes interdisciplinary scholarship at the interface of basic sciences, clinical sciences, and human health. Students in the dual-title program are required to have two advisers from separate disciplines: one individual serving as the primary mentor in the Graduate Program in Kinesiology and another individual serving as the secondary mentor in an area covered by the dual-title program who is a member of the Clinical and Translational Sciences faculty.

To qualify for the dual-title degree in Kinesiology and Clinical and Translational Sciences, students must satisfy the Kinesiology Ph.D. degree requirements listed in the “Doctoral Degree Requirements” section above. In addition, the Dual-Title Ph.D. Degree in Kinesiology
and Clinical and Translational Sciences requires the completion of 18 credits of course work from an approved list of courses. Students must select three credits in each of the following six areas: epidemiology, bioinformatics, experimental design and interpretation, statistics, regulatory environment, and scientific communication. At least half of the 18 credits must be at the 500 level or above. Up to 12 credits of course work may overlap with required elective courses of the Graduate Program in Kinesiology.

For students in the dual-title program, the candidacy examination will include content from both Kinesiology and Clinical and Translational Sciences, and must be completed within four semesters (summer sessions do not count) of entry into the Kinesiology graduate program. The candidacy committee must include at least one member of the Clinical and Translational Sciences graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

The doctoral committee of a Kinesiology and Clinical and Translational Sciences dual-title Ph.D. student must include at least one member of the CTS graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role. If the chair of the doctoral committee is not also a member of the graduate faculty in Clinical and Translational Sciences, the member of the committee representing Clinical and Translational Sciences must be appointed as co-chair. The fields of Kinesiology and CTS will be integrated in the student’s comprehensive exam, and the doctoral committee member representing CTS is responsible for constructing and grading the parts of the comprehensive exam that cover the CTS field of study.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research and education in both Kinesiology and Clinical and Translational Sciences. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

**Student Aid**
Graduate assistantships that are available to students in this program and other forms of student aid are described in the STUDENT AID section of the Graduate Bulletin. Students on graduate assistantships must adhere to the course load limits set forth in the Graduate Bulletin.

**Courses**
Graduate courses carry numbers from 500 to 599 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.

KINESIOLOGY (KINES) course list
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: Nursing
Department or Instructional Area: Nursing

New Graduate Program, Option, or Minor: □ Add
Designation of new graduate program: 
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: □ Change
□ Drop

Current designation of graduate program: Nursing
Current designation of graduate option: Nurse Educator and Nurse Administrator
Current designation of graduate minor: 

New designation of existing graduate program (if changing):
New designation of existing graduate option (if changing):
New designation of existing graduate minor (if changing):

Brief description of the change (if not noted above): Only deliver these options online through the World Campus

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

Submitted by Graduate Program Head

Judith Hupcey
Printed name
Signature
Date: 3/21/16

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

Susan Loeb
Printed name
Signature
Date: 3/21/16

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

Paula Milone-Nuzzo
Printed name
Signature
Date: 3/22/16
<table>
<thead>
<tr>
<th>Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Behalf of Luis Ayala</td>
</tr>
<tr>
<td>Printed name</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommended by Chair, Graduate Council Committee on Programs and Courses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Behalf of Andris Freivalds</td>
</tr>
<tr>
<td>Printed name</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Noted by Dean of the Graduate School:</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Behalf of Regina Vasilatos-Younken</td>
</tr>
<tr>
<td>Printed name</td>
</tr>
</tbody>
</table>
College of Nursing
Graduate Program in Nursing
Program Delivery Revision: MSN: Nurse Educator & Nurse Administrator Options

Table of Contents

a. Justification for Proposed Changes ....................................... 1
b. Revised Version of the Affected Areas .................................. 1
c. Departments Affected ......................................................... 1
a. **Justification for Proposed Changes**
This proposal addresses program delivery for the MSN Nurse Educator and Nurse Administrator options. The two options presently are offered through Resident Instruction and World Campus. We are requesting that these options only be offered through the World Campus.

The College of Nursing changed the degree granted for all advanced practice role options from the MS to the MSN in 2013 in order to better reflect the focus of the degree. Prior to the MSN degree being approved, the Nurse Educator and Nurse Administrator options were offered through Resident Instruction. Since that time, all courses are now available online and only offered through World Campus.

b. **Revised version of the affected area showing both the old program requirements and the new program requirements**
There are no program changes.

c. **Departments Affected**
None.

**Graduate Bulletin Changes**
None
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: Eberly College of Science
Department or Instructional Area: Department of Statistics

New Graduate Program, Option, or Minor: [ ] Add

Designation of new graduate program:
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: [ ] Change [ ] Drop

Current designation of graduate program: Statistics
Current designation of graduate option:
Current designation of graduate minor:

New designation of existing graduate program (if changing): Statistics
New designation of existing graduate option (if changing):
New designation of existing graduate minor (if changing):

Brief description of the change (if not noted above): Dual-Title Doctoral Degree Program in Social Data Analytics

Indicate effective semester:
[ ] First semester following approval
[ ] Second semester following approval

Submitted by Graduate Program Head

Dr. David Hunter
Printed name
Signature
Date: 1-5-2016

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

Steven Hoppelman
Printed name
Signature
Date: 1-6-2017

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

Dr. Charles Fisher
Printed name
Signature
Date: 1-6-2016
<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:</td>
<td>On Behalf of Luis Ayala</td>
<td>Valera Holt</td>
<td>4/15/2016</td>
</tr>
<tr>
<td>Recommendation by Chair, Graduate Council Committee on Programs and Courses:</td>
<td>On Behalf of Andris Freivalds</td>
<td>Valera Holt</td>
<td>4/15/2016</td>
</tr>
<tr>
<td>Noted by Dean of the Graduate School:</td>
<td>On Behalf of Regina Vasilatos-Younken</td>
<td>Valera Holt</td>
<td>4/15/2016</td>
</tr>
</tbody>
</table>
Jan 5, 2016

Aleksandra (Sesa) Slavkovic, Director of Graduate Studies
David Hunter, Department Head
Department of Statistics

Dear Sesa and David:

I am pleased to offer my enthusiastic endorsement of the proposal from the PhD Program in Statistics to adopt the dual-title PhD in Social Data Analytics (SoDA). I am also happy to confirm, of course, that this particular proposal was developed by the Department of Statistics over the last few months in direct consultation with me.

As you are well aware, SoDA was developed in full partnership with the Department of Statistics, with Sesa playing a leadership role. First discussions of the program occurred in 2010 among myself, members of the Statistics faculty (including both Sesa and David), previous graduate director Debashis Ghosh, and previous department head Bruce Lindsey. Sesa was a co-PI on the Big Data Social Science IGERT (BDSS) which has since 2012 funded the development of SoDA, continues as a member of the BDSS Executive Committee under which it has been developed and implemented, and now serves on the SoDA Program Committee. In total, eight members of the Statistics faculty are listed on the SoDA Graduate Faculty and have to varying degrees participated in the activities of BDSS and in the transitional implementation of SoDA as instructors of SoDA elective coursework, participants in SoDA core seminars, and/or as advisers.

Statistics currently has the largest contingent of Ph.D. students – four – in BDSS and participating in the SoDA curriculum, and others have applied to BDSS and expressed interest in applying for the SoDA dual title. We have already seen BDSS have a positive and expansive impact on graduate recruiting and placements in the Statistics PhD program, and it should only get stronger with the full implementation of the SoDA graduate program.

It is a pleasure to see this come to fruition.

Sincerely,

[Signature]

Burt L. Monroe
Director, Program in Social Data Analytics
burtmonroe@psu.edu
A Proposal to Graduate Council to Adopt the
Dual-Title Doctoral Degree Program in
Social Data Analytics

Submitted by
Department of Statistics

Contact:
David Hunter
Head, Department of Statistics
326 Thomas Building
814-865-1348
drh20@psu.edu
I. Overview ............................................................................................................................ 3

II. Justification for the Dual-Title Ph.D. in Statistics and Social Data Analytics .................. 3

III. Description of Required Social Data Analytics Course Work .......................................... 5
    A. General Course Work Requirements in the Dual-Title Ph.D. program in Social Data Analytics ....5
    B. Course Work Requirements, Dual-Title Ph.D. in Statistics and Social Data Analytics ...........7
    C. Example Course Work Path, Dual-Title Ph.D. in Statistics and Social Data Analytics .......9

IV. Additional Requirements, Dual-Title Ph.D. in Social Data Analytics ............................. 11

V. Proposed Amendment to Graduate Bulletin for Statistics (STAT) .................................. 14
    Degrees Conferred: ..............................................................................................................14
    Dual-Title Ph.D. in Statistics and Social Data Analytics ..............................................................14
    Admission Requirements .......................................................................................................14
    Requirements for the Dual-Title Ph.D. in Statistics and Social Data Analytics ......14

    Course Work .............................................................................................................14
    Candidacy Committee and Exam .....................................................................................20
    Doctoral Committee Composition ......................................................................................20
    Comprehensive Exam ........................................................................................................21
    Dissertation and Dissertation Defense ................................................................................21

VI. Proposed Amendment to Graduate Bulletin for Statistics (STAT) (clean copy) ............. 40

VII. Proposed Revision, Statistics Graduate Student Handbook ......................................... 35
I. Overview

The graduate program in Statistics proposes to adopt the proposed dual-title Ph.D. degree program in Social Data Analytics.

II. Justification for the Dual-Title Ph.D. in Statistics and Social Data Analytics

In response to ubiquitous and massive new sources of data, data science and analytics are emerging as new trans-disciplinary fields of inquiry, merging statistics, computer science, and visual analytics. Perhaps the greatest challenges and opportunities arise in particular from socially-generated big data, observed as a result of human interaction. As contemporary interactions become increasingly instrumented, recorded via web, mobile device, and distributed sensors, and as historic interactions become more easily quantifiable through digitization and sharing of document and image archives, society faces a transformative and disruptive data deluge, from which new scientific, economic, and social value can be extracted.

Big and complex social data challenge existing research models in the social sciences, in the computational and information sciences, and in the sciences of statistics and visualization. The scale and complexity of data has begun to overtake the capabilities of hardware, algorithms, and research designs of conventional social science, forcing us to reconfigure ourselves to face a new world of data-intensive social science. Conversely, the practices, concerns, and standards of statistics and social science methodology – reliability, validity, uncertainty, causality, ethics of human subjects research – challenge emerging practices in the new fields of data science and data analytics. As a result, big and complex social data overwhelm current disciplinary Ph.D. training models.

In 2009, the Penn State Quantitative Social Science Initiative, centered in the Department of Political Science, began discussions with faculty across Penn State about mechanisms for leveraging existing and emerging strengths in component disciplines to develop an interdisciplinary training model to meet these challenges. This culminated in 2012 with the awarding of a $3 million grant from the National Science Foundation’s Integrative Graduate Education and Research Traineeship (IGERT) program (which has received further support totaling over $2 million from the College of Liberal Arts, the College of Human Health & Development, the College of Information Sciences & Technology, the College of Sciences, the College of Earth & Mineral Sciences, the College of Engineering, the Social Science Research Institute, the Institute for CyberScience, and the Office of the Vice President for Research) to develop a new model for interdisciplinary Ph.D. training in “Big Data Social Science,” to be instantiated in a new dual-title Ph.D. program in “Social Data Analytics.”

Since 2012, the Big Data Social Science IGERT (BDSS-IGERT) has funded three cohorts totaling 19 Ph.D.

1 The IGERT (and now National Research Traineeship - NRT) programs are highly competitive and an explicit strategic target of the University’s Strategic Initiatives and Research Office (SIRO). SIRO’s official best practice guidelines, which govern the internal “downselect” process to determine the Penn State submission, include the proposal of a dual-title degree: https://www.research.psu.edu/limitedsubs/information/igert/IGERT_BP_Recomm.pdf. Penn State’s only other successful IGERT is instantiated in the Dual-Title Graduate Program in Biogeochemistry: http://www.biogeochemistry.psu.edu/.
students, and selected a fourth cohort of six Ph.D. students – in Political Science, Human Development & Family Studies, Sociology, Demography, Statistics, Geography, and Information Sciences & Technology – for two-year traineeships involving research rotations, collaborative research projects, externships, and a transitional curriculum in Social Data Analytics. The proposed degree is as developed, refined, and detailed in the multiyear IGERT proposal process, and as refined through the experience of the first three years of BDSS-IGERT. Currently there are five students within the Department of Statistics that are enrolled in the IGERT program.

A unique and defining feature of the proposed Social Data Analytics dual-title Ph.D. degree program, within the current explosion of programs in “data science,” “analytics,” “big data,” and similar areas, is the focus on integration of a social science orientation to the field of study. We distinguish this, sharply, from the usual characterization of social science as a “domain” of data science, and characterize social scientific thinking as a core pillar of Social Data Analytics.

Further, the multidisciplinary, comparative intellectual vision of the proposed Dual-Title Doctoral Degree Program in Social Data Analytics is fundamental to the current trends in Statistics as a field. Despite the push for training in the field of Big Data and Social Science, only a few cohesive doctoral level programs exist to date and most do not provide multidisciplinary degrees: Stanford’s Social Data Lab and Harvard’s Institute for Quantitative Social Science are great examples of sites for big data research in the social sciences intersecting with statistics, computer sciences, and other related fields, but do not offer doctoral programs. Most of the programs available are master’s degree programs and few, if any, focus on big data in the social sciences. Anecdotal evidence of extensive interest in this type of program is found in the queries, calls, and emails received from students, directors of graduate studies, and other faculty since the announcement of the Big Data Social Science IGERT award at Penn State in September 2012. This program was a big draw to our domestic applicants as we were able to attract over 18 U.S. Ph.D. applicants over the last two years due to the IGERT program, a significant increase to our previous years. The dual-title program will leverage the collaborative relationships, activities, and funding established within the ongoing IGERT program as a foundation on which to build a program for the study of big data integrating a social science orientation and statistical methodology. Owing to its uniqueness, the proposed program provides an academic niche, which will contribute to Penn State’s vision of becoming a leader in multidisciplinary, international, and multicultural scholarship. Moreover, we aim not only to place graduates in highly competitive academic positions to lead this new science, but also to demonstrate the relevance of Ph.D. training for some portion of those nonacademic positions in “deep analytics.”

For students in Statistics, the Social Data Analytics dual-title offers an intellectual home that integrates statistical methodology with interdisciplinary approaches to big data and analytics arising from computational, informational, and visual analytic sciences, and different social sciences.

In summary, the proposed dual-title Ph.D. in Statistics and Social Data Analytics will:

- Provide a cohesive curriculum for in-depth training in statistical science sufficient to succeed in that discipline, and a breadth of training across computational, informational, and visual analytic...
sciences, and various areas of social sciences, sufficient to lead in the emerging field of social data analytics.

- Train Statistic Ph.D.s who expand the capabilities of social data analytics, and use those capabilities creatively to answer important social scientific questions and to address grand social challenges.
- Supply, to both the academic and nonacademic markets, Statistic Ph.D.s whose training leads them to instinctively consider diverse and multinational perspectives on social data issues combined with innovative statistical methodologies, to instinctively and effectively prioritize ethics, scientific responsibility, and social consequences in the creation and use of social data, and to communicate effectively with both scientific and nonscientific audiences.

III. Description of Required Social Data Analytics Course Work

A. General Course Work Requirements in the Dual-Title Ph.D. program in Social Data Analytics

The minimum course work requirements for the dual-title Ph.D. degree in Social Data Analytics are as follows:

- Course work and other requirements for the primary program.
- SO DA 501 (3 credits)
- SO DA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
  - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
  - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives.
  - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
  - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives.
  - Cross-departmental distribution.
    - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department.
    - 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
    - 6 or more credits in approved courses outside the primary program.
- 3 or fewer credits in approved courses at the 400-level.

Students or faculty may request that the Social Data Analytics Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses. Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SO DA electives that also meet requirements of the primary program. Within this framework, final course selection is determined by the student in consultation with academic advisers from their home department and Social Data Analytics.

Through satisfaction of home degree requirements, and appropriate choice of electives to satisfy multiple criteria, students may satisfy these requirements with as few as 12 credits outside their home program (SO DA 501, SO DA 502, and 6 credits of appropriate interdisciplinary electives). In particular, students are encouraged to take courses carrying multiple AQCS designations.

There is no formal maximum number of credits from the primary degree that can be double-counted toward the SO DA degree. For those meeting the SO DA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree credits that count toward SO DA at 6. Adopting programs and advising committees may limit the number of credits taken for the SO DA degree that can count toward home degree requirements.
B. Course Work Requirements, Dual-Title Ph.D. in Statistics and Social Data Analytics

The following provides a side-by-side summary of how Social Data Analytics course work requirements interact with Statistics course work requirements in the dual-title Ph.D. in Statistics and Social Data Analytics.

| Table 1. Comparison of Course Work Requirements |
|-----------------------------------------------|-----------------------------------------------|
| **Ph.D. in Statistics**                      | **Ph.D. in Statistics & Social Data Analytics** |
| **Total credits**                            | **Total credits**                             |
| A minimum of 48 postbaccalaureate credits of course work. | A minimum of 54 postbaccalaureate credits of course work. |
| **Required course work**                     | **Required course work**                      |
| • STAT 511 (3 cr)                            | • STAT 511 (3 cr)                             |
| • STAT 512 (3 cr)                            | • STAT 512 (3 cr)                             |
| • STAT 513 (3 cr)                            | • STAT 513 (3 cr)                             |
| • STAT 514 (3 cr)                            | • STAT 514 (3 cr)                             |
| • STAT 515 (3 cr)                            | • STAT 515 (3 cr)                             |
| • STAT 517 (3 cr)                            | • STAT 517 (3 cr)                             |
| • STAT 553 (3 cr)                            | • STAT 553 (3 cr)                             |
| • STAT 561 (3 cr)                            | • STAT 561 (3 cr)                             |
| These also satisfy certain SO DA distribution requirements. | |
| **Professional development seminars (required)** | **Professional development seminars (required)** |
| • STAT 580 (2 cr)                            | • STAT 580 (2 cr)                             |
| • STAT 581 (1 cr)                            | • STAT 581 (1 cr)                             |
| • STAT 590 (2 cr)                            | • STAT 590 (2 cr)                             |
| • STAT 592 (1 cr)                            | • STAT 592 (1 cr)                             |
| **Required Social Data Analytics core seminars** | **Required Social Data Analytics core seminars** |
| • SO DA 501 (3 credits)                      | • SO DA 501 (3 credits)                       |
| • SO DA 502 (3 credits)                      | • SO DA 502 (3 credits)                       |
| **STAT electives**                           | **SO DA-approved distribution electives**     |
| 18 or more credits in approved courses, 12 of | 12 or more credits in approved courses,        |
which should be STAT. collectively meeting the following distribution requirements:

- **A**: Analytics (3+ cr)*
- **Q**: Quantification (6+ cr)*
- **C**: Computational/informational (6+ cr)*
- **S**: Social (6+ cr)
- 6 or more credits outside STAT
- 3 or more credits in disciplinary cluster 1: STAT or social science*
- 3 or more credits in disciplinary cluster 2: IST, GEOG, CSE, CMPSC or engineering
- 3 or fewer credits at the 400-level.

*The A, Q, and C requirements can be fulfilled by the required and elective sequence courses in the Statistics Ph.D.

The remaining requirements can be met by as few as 6 credits (two courses), as long as one course is in the GEOG/IST/Engineering cluster, the other is outside STAT, and both carry the S designation. Examples of such pairs:

- **PL SC 597 (Causal Inference)** & **GEOG 597 (Visual Analytics: Leveraging Geo-Social Data)**

**Communication & foreign language requirements**

<table>
<thead>
<tr>
<th>Communication &amp; foreign language requirements</th>
<th>Communication &amp; foreign language requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no foreign language requirement.</td>
<td>There is no foreign language requirement.</td>
</tr>
<tr>
<td>Communication may be satisfied by advanced</td>
<td>Communication may be satisfied by advanced</td>
</tr>
<tr>
<td>course work and competence developed in</td>
<td>course work and competence developed in</td>
</tr>
<tr>
<td>statistics, or other research methods.</td>
<td>statistics, or other research methods.</td>
</tr>
</tbody>
</table>

**Scholarship and Research Integrity**

<table>
<thead>
<tr>
<th>Scholarship and Research Integrity</th>
<th>Scholarship and Research Integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARI@PSU requirement is fulfilled</td>
<td>SARI@PSU requirement is fulfilled</td>
</tr>
<tr>
<td>through STAT 580, ORP workshops,</td>
<td>through STAT 580, ORP workshops,</td>
</tr>
<tr>
<td>and certification of CITI course</td>
<td>and certification of CITI course</td>
</tr>
<tr>
<td>completion.</td>
<td>completion.</td>
</tr>
</tbody>
</table>
C. Example Course Work Path, Dual-Title Ph.D. in Statistics and Social Data Analytics

Table 2 illustrates an example path through course work and other milestone requirements of the dual-title Ph.D. in Statistics and Social Data Analytics. It is modeled on course paths actually taken by Statistics Ph.D. students in BDSS-IGERT.

Table 2. Example Path Through Dual-Title Ph.D.

Year 1

<table>
<thead>
<tr>
<th>Department/#</th>
<th>Course Title</th>
<th>A</th>
<th>Q</th>
<th>C</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 511</td>
<td>Regression Analysis and Modeling</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STAT 513</td>
<td>Theory of Statistics I</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STAT 514</td>
<td>Theory of Statistics II</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STAT 590</td>
<td>Colloquium &amp; Perspectives on Statistics (1cr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 512</td>
<td>Design and Analysis of Experiments</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STAT 515</td>
<td>Stochastic Processes and MCMC</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 553</td>
<td>Asymptotic Tools</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STAT 592</td>
<td>Teaching Statistics (1cr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Candidacy Exam / Session - End of Semester 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Department/#</th>
<th>Course Title</th>
<th>A</th>
<th>Q</th>
<th>C</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 517</td>
<td>Probability Theory</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 551</td>
<td>Linear models</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 540</td>
<td>Statistical Computing</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 580</td>
<td>Statistical Consulting Practicum I (2cr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO DA 501</td>
<td>Big Social Data: Approaches and Issues</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STAT 557</td>
<td>Data Mining I</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>STAT 561</td>
<td>Statistical Inference I</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 581</td>
<td>Statistical Consulting Practicum II (1 cr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Year 3

<table>
<thead>
<tr>
<th>Department/#</th>
<th>Course Title</th>
<th>A</th>
<th>Q</th>
<th>C</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO DA 502</td>
<td>Social Data Analytics: Approaches and Issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 560</td>
<td>Seminar in Geographic Information Science</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 544</td>
<td>Categorical Data Analysis I</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STAT 590</td>
<td><strong>Colloquium &amp; Perspectives on Statistics (1cr)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 590</td>
<td><strong>Colloquium &amp; Perspectives on Statistics (1cr)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PL SC 518</td>
<td>Survey Methods I: Survey Design</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PL SC 505</td>
<td>Time Series Analysis in Political Science</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Written and Oral comprehensive exams: End of Semester 6*

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>27</td>
<td>12</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

This example satisfies statistics course requirements:

- Required courses (30 cr): STAT 511, 512, 513, 514, 515, 517, 553, 561, 580, 581, 590, 592
- STAT electives (12 cr): STAT 540, 544, 552, 557
- Non-STAT electives (18 cr): SO DA 501, SO DA 502, GEOG 560, PLSC 518, PLSC 505

This example satisfies Social Data Analytics course requirements:

- Required courses (6 cr): SO DA 501, 502
- SO DA-approved electives (48 cr > 12 cr): All courses marked A, Q, C, or S in Table 2.
- Analytics distribution (3 cr): STAT 557
- Quantification distribution (51 cr > 6 cr): all STAT courses, GEOG 560
- Computational / informational distribution (12 cr > 6 cr): STAT 515, 540, 557, GEOG 560
- Social distribution (6 cr): PL SC 505, 518 courses.
- Disciplinary cluster 1 (STAT / Social Science) (48 cr > 3 cr): all STAT courses, PL SC 505, 518
- Disciplinary cluster 2 (IST / GEOG / Engineering) (3cr): GEOG 560
- Out-program distribution (non-STAT) (9 cr > 6cr): PL SC 505, 518, GEOG 560
IV. Additional Requirements, Dual-Title Ph.D. in Social Data Analytics

The following provides a side-by-side summary of how additional Social Data Analytics requirements compare to and interact with Statistics requirements in the dual-title Ph.D. in Statistics and Social Data Analytics.

Table 3. Comparison of Other Requirements

<table>
<thead>
<tr>
<th>Ph.D. in Statistics</th>
<th>Ph.D. in Statistics &amp; Social Data Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Candidacy Exam / Session</strong></td>
<td><strong>Candidacy Exam / Session</strong></td>
</tr>
<tr>
<td>Held at the end of the spring semester of the first year.</td>
<td>Held at the end of the spring semester of the first year. Because of expanded requirements, Graduate Council policy allows for the possibility of delaying the candidacy exam by one semester for dual-title students. There will be a single candidacy exam, containing elements of both Statistics and Social Data Analytics. The candidacy committee must contain at least one member from Social Data Analytics. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Doctoral Committee</strong></td>
<td><strong>Doctoral Committee</strong></td>
</tr>
<tr>
<td>The doctoral committee consists of four or more</td>
<td>The doctoral committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council requirements, the doctoral committee shall contain at least four members. At least one of the committee members must be a faculty member on the Social Data Analytics graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role. If the committee chair does not serve in this combined role, Graduate Council policy dictates that the Social Data Analytics faculty member must be designated as co-chair of the committee.</td>
</tr>
<tr>
<td>active members of the Graduate Faculty, including</td>
<td>At least one regular member of the doctoral committee must represent a field outside the candidate’s major field of study in order to provide a broader range of disciplinary perspectives and expertise. This committee member is referred to as the “Outside Field Member.” Additionally, in order to avoid potential conflicts of interest, the primary appointment of at least one regular member of the doctoral committee must be in an administrative unit that is outside the unit in which the dissertation adviser’s primary appointment is held. This committee member is referred to as the “Outside Unit Member.”</td>
</tr>
<tr>
<td>at least two faculty members in the major field.</td>
<td></td>
</tr>
<tr>
<td>The dissertation adviser must be a member of the</td>
<td></td>
</tr>
<tr>
<td>doctoral committee. At least one regular member of the</td>
<td></td>
</tr>
<tr>
<td>doctoral committee must represent a field outside the</td>
<td></td>
</tr>
<tr>
<td>candidate’s major field of study in order to provide a</td>
<td></td>
</tr>
<tr>
<td>broader range of disciplinary perspectives and expertise.</td>
<td></td>
</tr>
<tr>
<td>This committee member is referred to as the “Outside</td>
<td></td>
</tr>
<tr>
<td>Field Member.” Additionally, in order to avoid potential</td>
<td></td>
</tr>
<tr>
<td>conflicts of interest, the primary appointment of at</td>
<td></td>
</tr>
<tr>
<td>least one regular member of the doctoral committee must</td>
<td></td>
</tr>
<tr>
<td>be in an administrative unit that is outside the unit in</td>
<td></td>
</tr>
<tr>
<td>which the dissertation adviser’s primary appointment is</td>
<td></td>
</tr>
<tr>
<td>held. This committee member is referred to as the “Outside Unit Member.”</td>
<td></td>
</tr>
</tbody>
</table>
Member.” The dual-title committee member may serve as the Outside Field Member. Additionally, the primary appointment of at least one regular member must be in an administrative unit outside the unit of primary appointment for the dissertation adviser. This committee member is referred to as the “Outside Unit Member.” The ideal arrangement then, is for a member of the Social Data Analytics graduate faculty with primary appointment in the primary program to act as dissertation chair, and for a member of the Social Data Analytics graduate faculty with primary appointment outside the administrative unit of the primary program to act as both Outside Field Member and Outside Unit Member.

Comprehensive Exam/Dissertation proposal

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive involve the defense of a dissertation proposal evaluated by the doctoral committee.

Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics. The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation.

Comprehensive Exam/Dissertation Proposal

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive involve the defense of a dissertation proposal, which must contain core Statistics content and substantial Social Data Analytics content, and is evaluated by the doctoral committee. The Social Data Analytics representative(s) on the student’s doctoral committee will participate in the evaluation of the comprehensive examination.

Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics with content from Social Data Analytics (acting as a first minor field). The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. The Social Data Analytics representative(s) on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation.
The dissertation proposal must contain substantial Social Data Analytics content.

<table>
<thead>
<tr>
<th><strong>Dissertation Defense</strong></th>
<th><strong>Dissertation Defense</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Upon completion of the doctoral dissertation, the candidate must pass an oral examination (the dissertation defense) to earn the Ph.D. degree. The oral examination is administered by the doctoral committee.</td>
<td>Upon completion of the doctoral dissertation, the candidate must pass an oral examination (the dissertation defense) to earn the Ph.D. degree. The oral examination is administered by the doctoral committee.</td>
</tr>
<tr>
<td>The student must write and orally defend a dissertation that reflects their original research and education in Statistics and Social Data Analytics.</td>
<td></td>
</tr>
</tbody>
</table>
V. Proposed Amendment to Graduate Bulletin for Statistics (STAT) (with changes tracked)

Statistics (STAT)

Program Home Page

DAVID HUNTER, Head of the Department
326 Thomas Building
814-865-1348

Degrees Conferred:
M.A.S.

M.S.

Ph.D.

Dual-title Ph.D. and M.S. in Statistics and Operations Research

Dual-title Ph.D. in Statistics and Social Data Analytics

Integrated B.A./B.S. in Mathematics and Master of Applied Statistics (M.A.S.)

Integrated B.S. in Statistics and Master of Applied Statistics (M.A.S.)

The Graduate Faculty

The Program

Graduate instruction and research opportunities are available in most areas of statistics and probability, including linear models, nonparametric statistics, robustness, statistical computing, analysis of count data, multivariate analysis, experimental design, reliability, stochastic processes and probability (applied and theoretical), distribution theory, statistical ecology, and biometrics.

Graduate students can gain practical experience in the application of statistical methodology through participation in the department’s statistical consulting center and collaborative research activities. In addition, collaborative projects with other departments provide longer term experience and support for selected students. Most students gain valuable teaching experience by assisting in the teaching and grading of courses. In addition, Ph.D. students with proper qualifications can receive support for teaching undergraduate courses.

The Master of Applied Statistics (M.A.S.) program is a professional degree designed to provide training in statistics focused on developing data analysis skills and exploration of all core areas
of applied statistics, without going deeply into the mathematical statistics foundations. It aims to provide its graduates with broad knowledge in a wide range of statistical application areas.

The Doctor of Philosophy (Ph.D.) and Master of Science (M.S.) degrees in Statistics are designed for advanced studies in applied and theoretical statistics. Special emphases include biostatistics, statistical ecology, environmental statistics, genomics, biometrics, and statistical computation. The M.S. degree is appropriate preparation for the department's Ph.D. degree.

**Admission Requirements**

Admission requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination accepted by a graduate program and authorized by the dean of the Graduate School, are required for admission.

While applications from all students (including those who already have done graduate work) are reviewed, completion of a standard calculus sequence is regarded as a prerequisite. Students with a 3.00 or better junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests. Students hoping to earn a Ph.D. in statistics may apply directly to the Ph.D. program without need for a master's degree.

**Degree Requirements**

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

**Professional Master of Applied Statistics Requirements**

For the M.A.S. degree, a minimum of 30 credits and a minimum grade-point average of 3.0 are required for graduation. Of the 30 credits, 24 must be courses from the Statistics department and 21 must be at the 500 level. The student must complete 6 credits in applied statistics (STAT 501, STAT 502), 6 credits in mathematical statistics (STAT 414, STAT 415) and 3 credits in statistical consulting (STAT 580 and 581). For all M.A.S. students, the STAT 581 course will have a comprehensive written project report required as part of the course, which serves as the culminating experience. To complete the remaining credit requirements, a student can select 9-15 credits from the following applied statistics courses: STAT 464, STAT 480, STAT 500, STAT 503, STAT 504, STAT 505, STAT 506, STAT 507, STAT 509, and STAT 510. In addition, students with suitable backgrounds may choose up to 6 credits from a departmental list of additional courses with approval from their adviser.
Master of Science Degree Requirements

For the M.S. degrees, a student must complete at least 30 credits, including at least 27 at the 500 or 600 level; 21 of the 27 500-level credits must be formal course work from the department of Statistics. A student must complete 6 credits in applied statistics (STAT 511, STAT 512), 6 credits in mathematical statistics (STAT 513, STAT 514), 3 credits in stochastic processes (STAT 515) and 3 credits in statistical consulting (STAT 580 and 581). The student must also pass a written master’s qualifying examination taken at the end of the first year. Finally, an M.S. student must register for at least 6 credits of thesis research (600 or 610) and submit a thesis. The thesis must be accepted by the advisers, a second reader, the head of the graduate program, and the Graduate School.

Doctoral Degree Requirements

The Department of Statistics requires a minimum total of 48 postbaccalaureate credits for the Ph.D. At least 42 credits, exclusive of the dissertation, must be in Statistics. Course work accepted for the M.S. in Statistics at Penn State will count toward the department’s 48-credit requirement. In the case of students who have earned credits in an advanced degree program at another university or in another department at Penn State, a maximum of 24 credits may count toward the 48-credit departmental requirement, subject to departmental approval.

For the Ph.D. degree, a student in Statistics must complete at least 48 credits, of which at least 42 must be STAT and at most three credits can be at the 400 level. In addition to the 18 credits of core course requirements from the first year (STAT 511, STAT 512, STAT 513, STAT 514, STAT 515, STAT 553), a Ph.D. student in Statistics must complete an additional 12 credits in advanced probability (STAT 517, 3 credits), statistical inference (STAT 561, 3 credits), statistical consulting (STAT 580, 2 credits, and STAT 581, 1 credit), colloquium (STAT 590, 2 credits) and teaching statistics (STAT 592, 1 credit), as well as 18 credits of electives taken from STAT 518, STAT 544, STAT 552, STAT 562, STAT 565, or other courses approved by the Graduate Studies Committee. The student also must pass a written Ph.D. candidacy exam, typically at the end of the first year, and a comprehensive exam given at the end of the third year. There are two ways for students to complete their comprehensive examination. Typically, both written and oral components of the comprehensive involve the defense of a dissertation proposal evaluated by the doctoral committee. Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics. The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation. Students must have their dissertation proposal approved as specified in the Department of Statistics Graduate Student Handbook. The candidate then must submit an acceptable Ph.D. dissertation and pass a final oral examination (the dissertation defense). The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.
The Ph.D. in Statistics offers concentration options in Biometrics, Biostatistics, Environmental Statistics, and Genometrics. The course and the examination requirements remain the same under these concentration options, however, the student must take 15 credits of electives from a list of courses identified by the concentration option.

**Doctoral Minor in Statistics Requirements**

The Department of Statistics has three possible path options for a Doctoral Minor in Statistics:

- **Option Path 1**: STAT/MATH 414 and 415, and at least three 500-level courses from the department.
- **Option Path 2**: Five or more courses totaling 15 credits at the 500-level from the department. Stat 464 may also count toward the 15 credits.
- **Option Path 3**: Four 500-level courses totaling 12 credits from the department and one additional course of 3 credits approved by the department head or graduate studies chair.

Please note: STAT 500 will not be counted toward the Doctoral Minor in Statistics under any option path.

For all path options, a 3.5 GPA is required in the courses to be counted toward the minor. Completion of one of the path options listed above, with the specified grade-point average, and the signature on the Graduate Minor Program form (http://stat.psu.edu/education/graduate-minor-application/view) constitutes approval of the Minor in Statistics. The candidate must indicate the wish to have a Graduate Minor in Statistics when the diploma card is filed and indicate the semester the Ph.D. degree is expected.

**Dual-Title Ph.D. and M.S. in Statistics and Operational Research**

The Operations Research dual-title degree program is administered by an Operations Research committee, which is responsible for management of the program. The program enables students from diverse graduate programs to attain and be identified with the tools, techniques, and methodology of operations research, while maintaining a close association with areas of application. Operations research is the analysis--usually involving mathematical treatment--of a process, problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency. To pursue a dual-title degree under this program option the student must apply to the Graduate School and register through one of the approved graduate programs.

**Admission Requirements**

Requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.

Students must apply and be admitted to the graduate program in Statistics and the Graduate School before they can apply for admission to the dual-title degree program. Students must apply for enrollment into the dual-title Ph.D. in Operations Research prior to taking their candidacy.
exam in Statistics. Students are encouraged to submit their application forms as early as possible, and not later than at least two semesters before their intended date of graduation. The “Request for Dual-Title Degree in Operations Research” form must be filled out in consultation with the Graduate Coordinator in the Statistics Department and submitted to the Chair of the Operations Research Program.

For the M.S. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent: MATH 140, MATH 141, MATH 220; CMPSC 101; and 3 credits of probability and statistics. The “Request for Masters Dual-Title Degree in Operations Research” form must be filled out.

For the Ph.D. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent: MATH 401, MATH 436; CMPSC 101; and 3 credits of probability and statistics. The “Request for PH.D. Dual-Title Degree in Operations Research” form must be filled out.

Degree Requirements

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

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in Statistics. In addition, they must satisfy the requirements described below, as established by the Operations Research committee.

For the M.S. dual-title degree in Operations Research, the minimum requirements are: 6 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes; 6 credits in optimization, including a minimum of 3 credits in linear programming; 3 credits in computational methods; and 3 credits in applications/specialization. A minimum of 9 credits must be in the 500 series. Particular courses may satisfy both the graduate major program requirements and those in the Operations Research program. The supervisor of the master’s thesis must be a member of the graduate faculty recommended by the chair of the program granting the degree and approved by the Operations Research committee as qualified to supervise thesis work in operations research.

The minimum requirements for the Ph.D. dual-title degree in Operations Research are: 9 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes; 9 credits in optimization, including a minimum of 3 credits in linear programming; 6 credits in computational methods, including a minimum of 3 credits in simulation; and 12 credits in applications/specialization. A minimum of 18 credits must
be in the 500 series, and particular courses may satisfy both the graduate major program requirements and those in the Operations Research program.

Candidacy Exam

The dual-title degree will be guided by the Candidacy Exam procedure of the Statistics graduate program. The candidacy exam for the dual-title degree may be given after at least 18 postbaccalaureate credits have been earned in graduate courses. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable. Operations Research must be integrated into the student’s candidacy examination, and it may require additional examination beyond the one required by Statistics in order to assess whether the student should be admitted into Ph.D. candidacy in both Statistics and Operations Research. In accordance with Graduate Council policy, the candidacy committee must include at least one member of the Operations Research graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

Doctoral Committee Composition

The doctoral committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council policy, the doctoral committee of a Statistics and Operations Research dual-title doctoral degree student must include at least one member of the Operations Research graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

If the chair of the committee representing Statistics is not also a member of the graduate faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral candidates for the dual-title doctoral degree in Statistics and Operations Research must pass a comprehensive examination that includes written and oral components.

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive examination involve the defense of a dissertation proposal, which must contain core Statistics content and substantial Operations Research content, and is evaluated by the doctoral committee. The Operations Research representative(s) on the student’s doctoral committee will participate in the evaluation of the comprehensive examination.
Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics with content from Operations Research (acting as a first minor field). The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. The Operations Research representative(s) on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Statistics and Operations Research. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Dual-Title Doctoral Degree in Statistics and Social Data Analytics

Statistics doctoral students seeking to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with statistics, may apply to pursue a dual-title Ph.D. in Statistics and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. aims to enable scientists who expand the capability of social data analytics, and use those capabilities creatively to answer important social scientific questions and to address grand social challenges, in both academic and nonacademic settings.

Admission Requirements

Requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.

Students must apply and be admitted to the graduate program in Statistics and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to Statistics and include remarks in their statement of purpose that address the ways in which their research and professional goals in statistics reflect an expanded interest in Social Data Analytics-related research.

To apply to the dual-title doctoral Ph.D. in Statistics and Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Program. An applicant must have a minimum grade-point average of 3.0 (on a 4.0 point scale) to be considered for enrollment in the dual-title degree program. Students must apply for
enrollment into the dual-title Ph.D. in Social Data Analytics prior to obtaining candidacy in Statistics.

**Degree Requirements**

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

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in Statistics. In addition, they must satisfy the requirements described below, as established by the Social Data Analytics Committee. Within this framework, final course selection is determined by the student in consultation with academic advisers from their home department and Social Data Analytics.

**Course Work**

The minimum course work requirements for the dual-title Ph.D. in Statistics and Social Data Analytics are as follows:

- **Course work** and other requirements for the Ph.D. in Statistics.
- SO DA 501 (3 credits)
- SO DA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
  - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
  - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives. *(A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.)*
  - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
  - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives. *(A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.)*
  - Cross-departmental distribution.
    - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department. *(A Statistics Ph.D. student would typically...*
satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.)

- 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
- 6 or more credits in approved courses outside Statistics.
- 3 or fewer credits in approved courses at the 400-level.

Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SO DA electives that also meet STAT requirements. In particular, the 12 elective SO DA credits can be met with as few as 6 credits of appropriately chosen course work. Conversely, 6 credits of SO DA course work, including SO DA 501 and SO DA 502, can be used to meet the STAT elective requirement. Within this framework, final course selection is determined by the student in consultation with academic advisers from Statistics and Social Data Analytics. **(There are no formal maxima for the number of double-counted credits. For those meeting the SO DA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree STAT credits that count toward SO DA at 6. For those meeting STAT elective requirements with the minimum of 18 credits, the 12 credit STAT minimum effectively limits the number of SO DA credits that count toward STAT at 6.)**

**Candidacy Exam**

The dual-title degree will be guided by the Candidacy Exam procedure of the Statistics graduate program. The candidacy exam for the dual-title degree may be given after at least 18 postbaccalaureate credits have been earned in graduate courses. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable. There will be a single candidacy examination to assess whether the student should be admitted into Ph.D. candidacy in both Statistics and Social Data Analytics. In accordance with Graduate Council policy, the candidacy committee must include at least one member of the Social Data Analytics graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.
The Social Data Analytics Program maintains a list of recommended background and skills that it recommends students have in place by the time they begin the interdisciplinary course work required to complete the Social Data Analytics degree. The candidacy exam is the appropriate setting for assessing the student’s preparation for the interdisciplinary work of the dual-title Ph.D. in Statistics and Social Data Analytics.

**Doctoral Committee Composition**

The doctoral committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council policy, the doctoral committee of a Statistics and Social Data Analytics dual-title doctoral degree student must include at least one member of the Social Data Analytics graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

If the chair of the committee representing Statistics is not also a member of the graduate faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair.

**Comprehensive Exam**

After completing all course work, doctoral candidates for the dual-title doctoral degree in Statistics and Social Data Analytics must pass a comprehensive examination that includes written and oral components.

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive examination involve the defense of a dissertation proposal, which must contain core Statistics content and substantial Social Data Analytics content, and is evaluated by the doctoral committee. The Social Data Analytics representative(s) on the student’s doctoral committee will participate in the evaluation of the comprehensive examination.

Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics with content from Social Data Analytics (acting as a first minor field). The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. The Social Data Analytics representative(s) on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation.

**Dissertation and Dissertation Defense**

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Statistics and Social Data Analytics. The dissertation must be accepted by the...
doctoral committee, the head of the graduate program, and the Graduate School.

Integrated B.S. in Statistics and Master of Applied Statistics (M.A.S.)

The Integrated Undergraduate-Graduate (IUG) degree with B.S. in Statistics and Master of Applied Statistics (M.A.S.) is designed to be completed in five years. This integrated degree will enable a select number of highly qualified and career-oriented students to obtain training in statistics focused on developing data analysis skills and exploration of core areas of applied statistics at the undergraduate and graduate levels. The M.A.S. degree is a professional master's degree that emphasizes applications and does not provide as much training in the mathematical and statistical theory. The degree prepares students with interests in mathematics, computation, and the quantitative aspects of science for careers in industry and government as statistical analysts. Research divisions in the pharmaceutical industry, quality control, and quality engineering divisions in manufacturing companies, clinical research units, corporate planning and research units, and other data-intensive positions require persons with training in mathematics, computation, database management, and statistical analysis, which this program will provide.

Application Process

The number of openings in the integrated B.S./M.A.S. program is limited. Students must apply to and meet the admission requirements of the Graduate School, as well as the graduate program in which they intend to receive their master’s degree. Admission will be based on specific criteria and the recommendation of faculty. Students shall be admitted to an IUG program no earlier than the beginning of the third semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree, as specified in the proposed IUG plan of study. Applicants to the integrated program:

- Must be enrolled in the Statistics B.S. program.
- Must have completed at least 60 credits of the undergraduate degree program, including the two courses: STAT 414 and STAT 415.
- Must submit a transcript and a statement of purpose.
- Must present a departmental approved plan of study in the application process in consultation with the M.A.S. program director. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
- Must be recommended by the chair of the department’s undergraduate program committee.
- Must be accepted into the M.A.S. program in Statistics.

Degree Requirements

Students in the IUG program must satisfy the requirements for both the B.S. and M.A.S. degrees; 120 credits are required for the B.S. and 30 credits for the M.A.S. The following twelve graduate-level credits (number of credits in parentheses) can apply to both B.S. and M.A.S. degrees; six of these are at the 500 level:
If students accepted into the IUG program are unable to complete the M.A.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.A./B.S. in Mathematics and Master of Applied Statistics (M.A.S.)

The Integrated Undergraduate-Graduate (IUG) degree with B.A./B.S. in Mathematics and Master of Applied Statistics (M.A.S.) is designed to be completed in five years. This integrated degree will enable a select number of highly qualified and career-oriented students to obtain training in statistics focused on developing data analysis skills, and exploration of core areas of applied statistics at the graduate levels in addition to an undergraduate degree in Mathematics. The M.A.S. degree is a professional master’s degree that emphasizes applications. The degree prepares students with interests in mathematics, computation, and the quantitative aspects of science for careers in industry and government as statistical analysts. Research divisions in the pharmaceutical industry, quality control, and quality engineering divisions in manufacturing companies, clinical research units, corporate planning and research units, and other data intensive positions require persons with training in mathematics, computation, database management, and statistical analysis, which this program will provide.

Application Process

The number of openings in the integrated B.A./B.S. and M.A.S. program is limited. Students must apply to and meet the admission requirements of the Graduate School, as well as the graduate program in which they intend to receive their master’s degree. Admission will be based on specific criteria and the recommendation of faculty. Students shall be admitted to an IUG program no earlier than the beginning of the third semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree, as specified in the proposed IUG plan of study. Applicants to the integrated program:

- Must be enrolled in the Mathematics B.A./B.S. program.
- Must have completed at least 60 credits of the undergraduate degree program including the two courses: STAT 414 and STAT 415.
- Must submit a transcript and a statement of purpose.
- Must present a departmental approved plan of study in the application process in consultation with the M.A.S. program director. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
- Must be recommended by the chair of Mathematics Department's undergraduate program committee. Two additional recommendation letters must be sent to the M.A.S. admissions committee.
- Must be accepted into the M.A.S. program in Statistics.

**Degree Requirements**

Students in the IUG program must satisfy the requirements for both the B.A./B.S. and M.A.S. degrees; 120 credits are required for the B.A./B.S. and 30 credits for the M.A.S. The following twelve graduate level credits (number of credits in parentheses) can apply to both B.A./B.S. and M.A.S. degrees, six of these are at the 500 level:

**STATISTICS (STAT)**

- 414. Introduction to Probability Theory (3)
- 415. Introduction to Mathematical Statistics (3)
- 501. Regression Methods (3)
- 502. Analysis of Variance and Design of Experiments (3)

If students accepted into the IUG program are unable to complete the M.A.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

**Student Aid**

Graduate assistantships available to students in this program and other forms of student aid are described in the STUDENT AID section of the Graduate Bulletin. GRE scores are required for consideration for assistantships. Students on graduate assistantships must adhere to the course load limits set forth in the Graduate Bulletin.

**Courses**

Graduate courses carry numbers from 500 to 599 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.

**STATISTICS (STAT) course list**
VI. Proposed Amendment to Graduate Bulletin for Statistics (STAT) (clean copy)

Statistics (STAT)

Program Home Page

DAVID HUNTER, Head of the Department
326 Thomas Building
814-865-1348

Degrees Conferred:
M.A.S.
M.S.
Ph.D.

Dual-title Ph.D. and M.S. in Statistics and Operations Research

Dual-title Ph.D. in Statistics and Social Data Analytics

Integrated B.A./B.S. in Mathematics and Master of Applied Statistics (M.A.S.)

Integrated B.S. in Statistics and Master of Applied Statistics (M.A.S.)

The Graduate Faculty

The Program

Graduate instruction and research opportunities are available in most areas of statistics and probability, including linear models, nonparametric statistics, robustness, statistical computing, analysis of count data, multivariate analysis, experimental design, reliability, stochastic processes and probability (applied and theoretical), distribution theory, statistical ecology, and biometrics.

Graduate students can gain practical experience in the application of statistical methodology through participation in the department’s statistical consulting center and collaborative research activities. In addition, collaborative projects with other departments provide longer term experience and support for selected students. Most students gain valuable teaching experience by assisting in the teaching and grading of courses. In addition, Ph.D. students with proper qualifications can receive support for teaching undergraduate courses.

The Master of Applied Statistics (M.A.S.) program is a professional degree designed to provide training in statistics focused on developing data analysis skills and exploration of all core areas of applied statistics, without going deeply into the mathematical statistics foundations. It aims to provide its graduates with broad knowledge in a wide range of statistical application areas.
The Doctor of Philosophy (Ph.D.) and Master of Science (M.S.) degrees in Statistics are designed for advanced studies in applied and theoretical statistics. Special emphases include biostatistics, statistical ecology, environmental statistics, genomics, biometrics, and statistical computation. The M.S. degree is appropriate preparation for the department's Ph.D. degree.

**Admission Requirements**

Admission requirements listed here are in addition to requirements stated in the [GENERAL INFORMATION](#) section of the Graduate Bulletin.

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination accepted by the Statistics graduate program, are required for admission.

While applications from all students (including those who already have done graduate work) are reviewed, completion of a standard calculus sequence is regarded as a prerequisite. Students with a 3.00 or better junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests. Students hoping to earn a Ph.D. in statistics may apply directly to the Ph.D. program without need for a master's degree.

**Degree Requirements**

Requirements listed here are in addition to requirements stated in the [DEGREE REQUIREMENTS](#) section of the Graduate Bulletin.

**Professional Master of Applied Statistics Requirements**

For the M.A.S. degree, a minimum of 30 credits and a minimum grade-point average of 3.0 are required for graduation. Of the 30 credits, 24 must be courses from the Statistics department and 21 must be at the 500 level. The student must complete 6 credits in applied statistics (STAT 501, STAT 502), 6 credits in mathematical statistics (STAT 414, STAT 415) and 3 credits in statistical consulting (STAT 580 and 581). For all M.A.S. students, the STAT 581 course will have a comprehensive written project report required as part of the course, which serves as the culminating experience. To complete the remaining credit requirements, a student can select 9-15 credits from the following applied statistics courses: STAT 464, STAT 480, STAT 500, STAT 503, STAT 504, STAT 505, STAT 506, STAT 507, STAT 509, and STAT 510. In addition, students with suitable backgrounds may choose up to 6 credits from a departmental list of additional courses with approval from their adviser.

**Master of Science Degree Requirements**

For the M.S. degrees, a student must complete at least 30 credits, including at least 27 at the 500 or 600 level; 21 of the 27 500-level credits must be formal course work from the department of Statistics. A student must complete 6 credits in applied statistics (STAT 511, STAT 512), 6 credits in mathematical statistics (STAT 513, STAT 514), 3 credits in stochastic processes
(STAT 515) and 3 credits in statistical consulting (STAT 580 and 581). The student must also pass a written master’s qualifying examination taken at the end of the first year. Finally, an M.S. student must register for at least 6 credits of thesis research (600 or 610) and submit a thesis. The thesis must be accepted by the advisers, a second reader, the head of the graduate program, and the Graduate School.

**Doctoral Degree Requirements**

The Department of Statistics requires a minimum total of 48 postbaccalaureate credits for the Ph.D. At least 42 credits, exclusive of the dissertation, must be in Statistics. Course work accepted for the M.S. in Statistics at Penn State will count toward the department’s 48-credit requirement. In the case of students who have earned credits in an advanced degree program at another university or in another department at Penn State, a maximum of 24 credits may count toward the 48-credit departmental requirement, subject to departmental approval.

For the Ph.D. degree, a student in Statistics must complete at least 48 credits, of which at least 42 must be STAT and at most three credits can be at the 400 level. In addition to the 18 credits of core course requirements from the first year (STAT 511, STAT 512, STAT 513, STAT 514, STAT 515, STAT 553), a Ph.D. student in Statistics must complete an additional 12 credits in advanced probability (STAT 517, 3 credits), statistical inference (STAT 561, 3 credits), statistical consulting (STAT 580, 2 credits, and STAT 581, 1 credit), colloquium (STAT 590, 2 credits) and teaching statistics (STAT 592, 1 credit), as well as 18 credits of electives taken from STAT 518, STAT 544, STAT 552, STAT 562, STAT 565, or other courses approved by the Graduate Studies Committee. The student also must pass a written Ph.D. candidacy exam, typically at the end of the first year, and a comprehensive exam given at the end of the third year. There are two ways for students to complete their comprehensive examination. Typically, both written and oral components of the comprehensive involve the defense of a dissertation proposal evaluated by the doctoral committee. Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics. The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation. Students must have their dissertation proposal approved as specified in the Department of Statistics Graduate Student Handbook. The candidate then must submit an acceptable Ph.D. dissertation and pass a final oral examination (the dissertation defense). The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

The Ph.D. in Statistics offers concentrations in Biometrics, Biostatistics, Environmental Statistics, and Genometrics. The course and the examination requirements remain the same under these concentrations, however, the student must take 15 credits of electives from a list of courses identified by the concentration.
Doctoral Minor in Statistics Requirements

The Department of Statistics has three possible paths for a Doctoral Minor in Statistics:

- **Path 1**: STAT/MATH 414 and 415, and at least three 500-level courses from the department.
- **Path 2**: Five or more courses totaling 15 credits at the 500-level from the department. Stat 464 may also count toward the 15 credits.
- **Path 3**: Four 500-level courses totaling 12 credits from the department and one additional course of 3 credits approved by the department head or graduate studies chair.

Please note: STAT 500 will not be counted toward the Doctoral Minor in Statistics under any path.

For all paths, a 3.5 GPA is required in the courses to be counted toward the minor. Completion of one of the paths listed above, with the specified grade-point average, and the signature on the Graduate Minor Program form constitutes approval of the Minor in Statistics. 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. At least one graduate faculty member from the minor field must be on the candidate’s doctoral committee.

Dual-Title Ph.D. and M.S. in Statistics and Operational Research

The Operations Research dual-title degree program is administered by an Operations Research committee, which is responsible for management of the program. The program enables students from diverse graduate programs to attain and be identified with the tools, techniques, and methodology of operations research, while maintaining a close association with areas of application. Operations research is the analysis--usually involving mathematical treatment--of a process, problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency. To pursue a dual-title degree under this program option the student must apply to the Graduate School and register through one of the approved graduate programs.

Admission Requirements

Requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.

Students must apply and be admitted to the graduate program in Statistics and the Graduate School before they can apply for admission to the dual-title degree program. Students must apply for enrollment into the dual-title Ph.D. in Operations Research prior to taking their candidacy exam in Statistics. Students are encouraged to submit their application forms as early as possible, and not later than at least two semesters before their intended date of graduation. The “Request for Dual-Title Degree in Operations Research” form must be filled out in consultation with the Graduate Coordinator in the Statistics Department and submitted to the Chair of the Operations Research Program.
For the M.S. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent: MATH 140, MATH 141, MATH 220; CMPSC 101; and 3 credits of probability and statistics. The “Request for Masters Dual-Title Degree in Operations Research” form must be filled out.

For the Ph.D. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent: MATH 401, MATH 436; CMPSC 101; and 3 credits of probability and statistics. The “Request for PH.D. Dual-Title Degree in Operations Research” form must be filled out.

Degree Requirements

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

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D in Statistics. In addition, they must satisfy the requirements described below, as established by the Operations Research committee.

For the M.S. dual-title degree in Operations Research, the minimum requirements are: 6 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes; 6 credits in optimization, including a minimum of 3 credits in linear programming; 3 credits in computational methods; and 3 credits in applications/specialization. A minimum of 9 credits must be in the 500 series. Particular courses may satisfy both the graduate major program requirements and those in the Operations Research program. The supervisor of the master’s thesis must be a member of the graduate faculty recommended by the chair of the program granting the degree and approved by the Operations Research committee as qualified to supervise thesis work in operations research.

The minimum requirements for the Ph.D. dual-title degree in Operations Research are: 9 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes; 9 credits in optimization, including a minimum of 3 credits in linear programming; 6 credits in computational methods, including a minimum of 3 credits in simulation; and 12 credits in applications/specialization. A minimum of 18 credits must be in the 500 series, and particular courses may satisfy both the graduate major program requirements and those in the Operations Research program.

Candidacy Exam

The dual-title degree will be guided by the Candidacy Exam procedure of the Statistics graduate
program. The candidacy exam for the dual-title degree may be given after at least 18 postbaccalaureate credits have been earned in graduate courses. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable. Operations Research must be integrated into the student’s candidacy examination, and it may require additional examination beyond the one required by Statistics in order to assess whether the student should be admitted into Ph.D. candidacy in both Statistics and Operations Research. In accordance with Graduate Council policy, the candidacy committee must include at least one member of the Operations Research graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

**Doctoral Committee Composition**
The doctoral committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council policy, the doctoral committee of a Statistics and Operations Research dual-title doctoral degree student must include at least one member of the Operations Research graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

If the chair of the committee representing Statistics is not also a member of the graduate faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair.

**Comprehensive Exam**
After completing all course work, doctoral candidates for the dual-title doctoral degree in Statistics and Operations Research must pass a comprehensive examination that includes written and oral components.

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive examination involve the defense of a dissertation proposal, which must contain core Statistics content and substantial Operations Research content, and is evaluated by the doctoral committee. The Operations Research representative(s) on the student’s doctoral committee will participate in the evaluation of the comprehensive examination.

Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics with content from Operations Research (acting as a first minor field). The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. The Operations Research representative(s) on the student’s doctoral committee will develop questions for and participate
in the evaluation of the comprehensive examination. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Statistics and Operations Research. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Dual-Title Doctoral Degree in Statistics and Social Data Analytics

Statistics doctoral students seeking to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with statistics, may apply to pursue a dual-title Ph.D. in Statistics and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. aims to enable scientists who expand the capability of social data analytics, and use those capabilities creatively to answer important social scientific questions and to address grand social challenges, in both academic and nonacademic settings.

Admission Requirements

Requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.

Students must apply and be admitted to the graduate program in Statistics and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to Statistics and include remarks in their statement of purpose that address the ways in which their research and professional goals in statistics reflect an expanded interest in Social Data Analytics-related research.

To apply to the dual-title doctoral Ph.D. in Statistics and Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Program. An applicant must have a minimum grade-point average of 3.0 (on a 4.0 point scale) to be considered for enrollment in the dual-title degree program. Students must apply for enrollment into the dual-title Ph.D. in Social Data Analytics prior to obtaining candidacy in Statistics.
Degree Requirements

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

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D in Statistics. In addition, they must satisfy the requirements described below, as established by the Social Data Analytics Committee. Within this framework, final course selection is determined by the student in consultation with academic advisers from their home department and Social Data Analytics.

Course Work

The minimum course work requirements for the dual-title Ph.D. in Statistics and Social Data Analytics are as follows:

- Course work and other requirements for the Ph.D. in Statistics.
- SO DA 501 (3 credits)
- SO DA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
  - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
  - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives. (*A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.*)
  - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
  - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives. (*A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.*)
  - Cross-departmental distribution.
    - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department. (*A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.*)
    - 3 or more credits in approved courses with the prefix IST, GEOG, or that of a
Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SO DA electives that also meet STAT requirements. In particular, the 12 elective SO DA credits can be met with as few as 6 credits of appropriately chosen course work. Conversely, 6 credits of SO DA course work, including SO DA 501 and SO DA 502, can be used to meet the STAT elective requirement. Within this framework, final course selection is determined by the student in consultation with academic advisers from Statistics and Social Data Analytics. (There are no formal maxima for the number of double-counted credits. For those meeting the SO DA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree STAT credits that count toward SO DA at 6. For those meeting STAT elective requirements with the minimum of 18 credits, the 12 credit STAT minimum effectively limits the number of SO DA credits that count toward STAT at 6.)

Candidacy Exam

The dual-title degree will be guided by the Candidacy Exam procedure of the Statistics graduate program. The candidacy exam for the dual-title degree may be given after at least 18 postbaccalaureate credits have been earned in graduate courses. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable. There will be a single candidacy examination to assess whether the student should be admitted into Ph.D. candidacy in both Statistics and Social Data Analytics. In accordance with Graduate Council policy, the candidacy committee must include at least one member of the Social Data Analytics graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

The Social Data Analytics Program maintains a list of recommended background and skills that it recommends students have in place by the time they begin the interdisciplinary course work required to complete the Social Data Analytics degree. The candidacy exam is the appropriate setting for assessing the student’s preparation for the interdisciplinary work of the dual-title Ph.D. in Statistics and Social Data Analytics.

Doctoral Committee Composition

The doctoral committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council policy, the doctoral committee of a Statistics and Social Data Analytics dual-title doctoral degree student must include at least one
member of the Social Data Analytics graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

If the chair of the committee representing Statistics is not also a member of the graduate faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair.

Comprehensive Exam
After completing all course work, doctoral candidates for the dual-title doctoral degree in Statistics and Social Data Analytics must pass a comprehensive examination that includes written and oral components.

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive examination involve the defense of a dissertation proposal, which must contain core Statistics content and substantial Social Data Analytics content, and is evaluated by the doctoral committee. The Social Data Analytics representative(s) on the student’s doctoral committee will participate in the evaluation of the comprehensive examination.

Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics with content from Social Data Analytics (acting as a first minor field). The examination focuses on the dissertation prospects and the student’s preparation to undertake dissertation research, and is evaluated by the doctoral committee. The Social Data Analytics representative(s) on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee’s recommendation.

Dissertation and Dissertation Defense
Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Statistics and Social Data Analytics. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Integrated B.S. in Statistics and Master of Applied Statistics (M.A.S.)

The Integrated Undergraduate-Graduate (IUG) degree with B.S. in Statistics and Master of Applied Statistics (M.A.S.) is designed to be completed in five years. This integrated degree will enable a select number of highly qualified and career-oriented students to obtain training in statistics focused on developing data analysis skills and exploration of core areas of applied statistics at the undergraduate and graduate levels. The M.A.S. degree is a professional master's degree that emphasizes applications and does not provide as much training in the mathematical and statistical theory. The degree prepares students with interests in mathematics, computation,
and the quantitative aspects of science for careers in industry and government as statistical analysts. Research divisions in the pharmaceutical industry, quality control, and quality engineering divisions in manufacturing companies, clinical research units, corporate planning and research units, and other data-intensive positions require persons with training in mathematics, computation, database management, and statistical analysis, which this program will provide.

Application Process

The number of openings in the integrated B.S./M.A.S. program is limited. Students must apply to and meet the admission requirements of the Graduate School, as well as the graduate program in which they intend to receive their master’s degree. Admission will be based on specific criteria and the recommendation of faculty. Students shall be admitted to an IUG program no earlier than the beginning of the third semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree, as specified in the proposed IUG plan of study. Applicants to the integrated program:

- Must be enrolled in the Statistics B.S. program.
- Must have completed at least 60 credits of the undergraduate degree program, including the two courses: STAT 414 and STAT 415.
- Must submit a transcript and a statement of purpose.
- Must present a departmental approved plan of study in the application process in consultation with the M.A.S. program director. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
- Must be recommended by the chair of the department’s undergraduate program committee.
- Must be accepted into the M.A.S. program in Statistics.

Degree Requirements

Students in the IUG program must satisfy the requirements for both the B.S. and M.A.S. degrees; 120 credits are required for the B.S. and 30 credits for the M.A.S. The following twelve credits (number of credits in parentheses) can apply to both B.S. and M.A.S. degrees; six of these are at the 500 level:

**STATISTICS (STAT)**

414. Introduction to Probability Theory (3)
415. Introduction to Mathematical Statistics (3)
501. Regression Methods (3)
502. Analysis of Variance and Design of Experiments (3)

If students accepted into the IUG program are unable to complete the M.A.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.
Integrated B.A./B.S. in Mathematics and Master of Applied Statistics (M.A.S.)

The Integrated Undergraduate-Graduate (IUG) degree with B.A./B.S. in Mathematics and Master of Applied Statistics (M.A.S.) is designed to be completed in five years. This integrated degree will enable a select number of highly qualified and career-oriented students to obtain training in statistics focused on developing data analysis skills, and exploration of core areas of applied statistics at the graduate levels in addition to an undergraduate degree in Mathematics. The M.A.S. degree is a professional master’s degree that emphasizes applications. The degree prepares students with interests in mathematics, computation, and the quantitative aspects of science for careers in industry and government as statistical analysts. Research divisions in the pharmaceutical industry, quality control, and quality engineering divisions in manufacturing companies, clinical research units, corporate planning and research units, and other data intensive positions require persons with training in mathematics, computation, database management, and statistical analysis, which this program will provide.

Application Process

The number of openings in the integrated B.S./M.A.S. program is limited. Students must apply to and meet the admission requirements of the Graduate School, as well as the graduate program in which they intend to receive their master’s degree. Admission will be based on specific criteria and the recommendation of faculty. Students shall be admitted to an IUG program no earlier than the beginning of the third semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree, as specified in the proposed IUG plan of study. Applicants to the integrated program:

- Must be enrolled in the Mathematics B.A./B.S. program.
- Must have completed at least 60 credits of the undergraduate degree program including the two courses: STAT 414 and STAT 415.
- Must submit a transcript and a statement of purpose.
- Must present a departmental approved plan of study in the application process in consultation with the M.A.S. program director. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
- Must be recommended by the chair of Mathematics Department's undergraduate program committee. Two additional recommendation letters must be sent to the M.A.S. admissions committee.
- Must be accepted into the M.A.S. program in Statistics.

Degree Requirements

Students in the IUG program must satisfy the requirements for both the B.A./B.S. and M.A.S. degrees; 120 credits are required for the B.A./B.S. and 30 credits for the M.A.S. The following twelve credits (number of credits in parentheses) can apply to both B.A./B.S. and M.A.S. degrees, six of these are at the 500 level:
STATISTICS (STAT)
414. Introduction to Probability Theory (3)
415. Introduction to Mathematical Statistics (3)
501. Regression Methods (3)
502. Analysis of Variance and Design of Experiments (3)

If students accepted into the IUG program are unable to complete the M.A.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the STUDENT AID section of the Graduate Bulletin. GRE scores are required for consideration for assistantships. Students on graduate assistantships must adhere to the course load limits set forth in the Graduate Bulletin.

Courses

Graduate courses carry numbers from 500 to 599 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.

STATISTICS (STAT) course list
VII. Proposed Revision, Statistics Graduate Student Handbook

The only revision required in the Handbook is the insertion of a new section entitled “Dual-title Doctoral Degree in Statistics and Social Data Analytics”. The proposed new text, to be inserted is highlighted below:

L. Dual-Title Doctoral Degree in Statistics and Social Data Analytics

Statistics doctoral students seeking to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with statistics, may apply to pursue a dual-title Ph.D. in Statistics and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. aims to enable scientists who expand the capability of social data analytics, and use those capabilities creatively to answer important social scientific questions and to address grand social challenges, in both academic and nonacademic settings.

The Department of Statistics and the Social Data Analytics Program offer a dual-title Ph.D. in Statistics and Social Data Analytics. Official application to and enrollment in the program is handled through the Social Data Analytics program.

Students enrolled in this dual-title Ph.D. choose Social Data Analytics as their first minor field. Upon acceptance by the Social Data Analytics admissions committee, the student is also assigned an academic adviser from the Social Data Analytics graduate faculty. Students must satisfy course work requirements with 18 credits in Social Data Analytics related course work, 6 credits of which is generally over and above standard requirements for the Statistics Ph.D.

The specific course requirements are as follows:

- 6 credits in core interdisciplinary seminars: SO DA 501 and SO DA 502.
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy distribution requirements, as listed in the Graduate Degree Bulletin. A total of 6 approved elective credits meeting the (S) [Social] and (Q) [Quantification] minimum distributions are generally met by fulfillment of the Statistics Ph.D. requirements. As a result, the elective requirement is met through 6 or more credits in approved courses meeting the following requirements:
  - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
  - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
  - 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
  - 6 or more credits in approved courses outside Statistics.
  - 3 or fewer credits in approved courses at the 400-level.
There is no formal maximum number of credits from the primary STAT degree that can be double-counted toward the SO DA degree. For those meeting the SO DA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree STAT credits that count toward SO DA at 6. Adopting programs and advising committees may limit the number of credits taken for the SO DA degree that can count toward home degree requirements.

In accordance with procedures described in the *Graduate Bulletin* and elsewhere in this handbook, a representative of the Social Data Analytics graduate faculty Social Data Analytics faculty will serve on the student’s candidacy committee and doctoral committee. The dissertation must be on a topic that reflects original research and expertise in both statistics and Social Data Analytics.

For more detailed information about the dual-title program, please contact the Social Data Analytics program.
II. Proposed Bulletin Listing

Social Data Analytics

Burt Monroe, In Charge
230 Pond Lab
814-865-9215
burtmonroe@psu.edu

Degrees Conferred

Students electing this degree program through participating programs earn a degree with a dual title at the Ph.D. level, i.e., in (graduate program name) and Social Data Analytics.

The following graduate programs offer a dual degree in Social Data Analytics: Ph.D. in Political Science and Social Data Analytics; Ph.D. in Sociology and Social Data Analytics; Ph.D. in Statistics and Social Data Analytics.

Graduate Faculty¹

The Program

The Social Data Analytics dual-title degree program is administered by the Social Data Analytics Committee, which is responsible for the management of the program. The committee maintains program definition, identifies faculty and courses appropriate to the program, and recommends policy and procedures for its operation to the Dean of the Graduate School. The program enables students from diverse graduate programs to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with a home discipline. Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. To pursue a dual-title degree under this program the student must apply to the Graduate School and register through one of the approved graduate programs.

Admission Requirements

Students must apply and be admitted to the graduate program in their home department and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known on their applications to the major programs and include remarks in their statement of purpose that address the ways in which their research and professional goals in their chosen home field reflect an expanded interest in Social Data Analytics.

¹ As officially listed.
To be enrolled in the Dual Title Doctoral Degree Program in Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4 point scale) to be considered for enrollment in the dual-title degree program. Students must apply for enrollment into the dual-title degree program in Social Data Analytics prior to obtaining candidacy in their home department.

General Graduate Council admissions requirements are stated in the **GENERAL INFORMATION** section of the Graduate Bulletin.

**Degree Requirements**

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

To qualify for the dual-title degree, students must satisfy the requirements of their major doctoral program in which they are primarily enrolled. In addition, they must satisfy the requirements described below, as established by the Social Data Analytics Committee.

The minimum course work requirements for the dual-title Ph.D. degree in Social Data Analytics are as follows:

- Course work and other requirements of the primary program.
- SO DA 501 (3 credits)
- SO DA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
  - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
  - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives.
  - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
  - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives.
  - Cross-departmental distribution.
    - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department.
    - 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
- 6 or more credits in approved courses outside the primary program.
- 3 or fewer credits in approved courses at the 400-level.

Students or faculty may request that the Social Data Analytics Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses. Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SoDA electives that also meet requirements of the primary program. Within this framework, final course selection is determined by the student in consultation with academic advisers from their home department and Social Data Analytics.

The Social Data Analytics Program maintains a list of background and skills that it recommends students have in place by the time they begin the interdisciplinary coursework required to complete the Social Data Analytics degree.

**Candidacy Committee Composition**

The candidacy committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council, the candidacy committee must include at least one member of the Social Data Analytics graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role.

**Candidacy Exam**

The dual-title degree will be guided by the Candidacy Exam procedure of the primary program and the Graduate Council. In accordance with the Graduate Council, there will be a single candidacy examination, assessing candidacy for both primary program and the dual-title program. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable.

**Doctoral Committee Composition**

The doctoral committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council requirements, the doctoral committee shall contain at least four members. At least one of the committee members must be a faculty member on the Social Data Analytics graduate faculty. Faculty members who hold appointments in both programs’ graduate faculty may serve in a combined role. If the committee chair does not serve in this combined role, Graduate Council rules dictate that the Social Data Analytics faculty member must be designated as co-chair of the committee. If the candidate has a minor, that field must be represented on the committee by a Minor Field Member.

At least one regular member of the doctoral committee must represent a field outside the candidate’s major field of study, the “Outside Field Member.” The dual-title committee member may serve as the Outside Field Member. Additionally, the primary appointment of at least one regular member must be in an administrative unit outside the unit of primary appointment for the dissertation adviser. This
committee member is referred to as the “Outside Unit Member.” The ideal arrangement then, is for a member of the Social Data Analytics graduate faculty with primary appointment in the primary program to act as dissertation chair, and for a member of the Social Data Analytics graduate faculty with primary appointment outside the administrative unit of the primary program to act as both Outside Field Member and Outside Unit Member.

**Comprehensive Exam**

The dual-title degree will be guided by the Comprehensive Exam procedure of the primary program. After completion of required course work, doctoral candidates for the dual-title doctoral degree must pass a comprehensive examination. In programs where this includes evaluation of a written exam, the Social Data Analytics representative on the student's doctoral committee will participate in the writing and evaluation of the exam, in accordance with procedures maintained by the primary program. In programs where the comprehensive exam involves defense of a dissertation prospectus, the Social Data Analytics representative on the student's doctoral committee will participate in the evaluation of the prospectus, including ensuring the proposed dissertation has substantial Social Data Analytics content.

**Dissertation and Dissertation Defense**

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in their home discipline and Social Data Analytics. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

**Social Data Analytics Doctoral Minor**

Doctoral students may take a doctoral minor in Social Data Analytics. This is the appropriate option for doctoral students in programs that have not adopted the dual-title Ph.D. degree in Social Data Analytics, and for students otherwise pursuing an incompatible degree program, such as another dual-title.

As with all graduate minors, a student seeking a minor must have the approval of the student's major program of study, the Social Data Analytics program, and the Graduate School, and official requests to add a minor to a doctoral candidate's academic record must be submitted to Graduate Enrollment Services prior to establishing the doctoral committee and prior to scheduling the comprehensive examination.

The doctoral minor in Social Data Analytics requires at least 15 credits in approved courses, with at least 6 at the 500-level and, and with the requirement for 12 (or more) elective credits reduced to 9 (or more) elective credits. Additional deviations from distribution minimums and maximums may be allowed, but must be approved by the Social Data Analytics program.