1. Approval of minutes for the meeting of April 5, 2016

2. Dean’s Report (Amr Elnashai)

3. Updates from Undergraduate Studies Committee (Chris Giebink) – no items to report

4. Updates from Graduate Studies Committees (Esther Gomez)

5. Updates from Engineering Technology Committee (Engr Tech Chair)

6. Updates from Faculty Senate (Engineering Senator)

7. Other Business
Engineering Faculty Council

April 05, 2016, 11:00AM

202 Hammond

Present: Conrad Tucker, Chris Giebink, Christine Masters, Doug Wolfe, Esther Gomez, Kelly Maranda, Nanyin Zhang, Peter Butler, Ronald Land, Terry Speicher, Zoubeida Ounaies

Meeting Agenda

1. Approval of minutes for the meeting of March 15, 2016
   - Unanimously approved.

2. Dean’s Report (Peter Butler)
   - The graduate program.
     - Assessment:
       - Working on the assessment plan to include five or so high-level qualities that the program should have, such as research generating new knowledge, in-depth knowledge of one disciple and knowledge of major issues.
       - One learning objective per program.
       - Tom and Peter are closely working together on the plan. The tentative time line is late fall.
     - The recruitment event was well received. There was a large increase in the number of students who say they will consider PSU after the recruitment event.
     - Graduate Fellowship. 10 GEF and 21 UGF were awarded. 9 out of 21 UGF slots have been filled.
   - The undergraduate Program. The numbers of entrance to major are higher than the numbers allowed for almost all majors. The college works with each department and help hire instructors/TAs/graders needed.
   - Online education.
     - A proposal has been submitted. Some courses are offered as lectures that are captured and streamed; other ones are instructions and designs.
     - Revenue sharing proposals are under consideration.
     - There is a feedback that the world campus is now going to allow portfolios of courses as oppose to programs only.
   - BME/ChemE building is still going forward. Biological Engineering building renovation has been postponed.

3. Updates from Undergraduate Studies Committee (Zoubeida Ounaies)
   - No items reported.

4. Updates from Graduate Studies Committees (Esther Gomez)
   A total of 1 item was reviewed:
   - Graduate Credit Certificate in Engineering Leadership and Innovation Management: Via On-Campus, Off-Campus, and Online Delivery – GSR has approved the proposal.
     - Unanimously approved.

5. Updates from Engineering Technology Committee (Ron Land)
   - Ron will retire from EFC after serving for over 20 years.
6. Updates from Faculty Senate (Doug Wolfe)
   - Special Joint Senate Committee on General Education Assessment
     - Recommendation 1: A standing Joint Committee on General Education Assessment should be formed to guide the assessment process.
     - Recommendation 2: The new standing joint committee should recommend the development of datasets to inform general education assessment. Such datasets should include, but are not limited to:
       1. A General Education Curricular Inventory that shows patterns of course offerings, student enrollment, and student grades by major and location.
       2. General Education curriculum mapping that shows the relationship between General Education and undergraduate majors.
       3. General Education course objective mapping that shows the relationship to General Education learning objectives.
   - Joint Diversity Awareness Task Force: Reinstatement of the Joint Diversity Awareness Task Force with New Charge and New Membership. US/IL Courses Survey Recommendations
   - SC on Committees and Rules.
   - Revisions to Senate Policy 59-10 Requirements for Minors.

7. Other Business
   None.
Graduate Studies and Research Committee Summary
for EFC Meeting- August 23, 2016
Summer 2016 G&S&R Activity
Prepared by Lori Long
Proposal report and proposals attached to email

Graduate Faculty Nominations (8) reviewed and (7) approved:

**Category R**
- Rhett Jeffries, PhD – ME – APPROVED
- Abdaalla Ramadan Nassar, PhD – ESMCH – APPROVED
- Scott Lewis, PhD – Mechanical Engineering - APPROVED
- Sean Knecht, PhD – EDSGN – APPROVED
- Teresa (Dena) Lang, PhD – EDSGN – APPROVED
- Sarah Ritter, PhD – EDSGN – APPROVED
- Charles Cox, PhD – EDSGN – in review
- Xinli Qu, PhD – EDSGN – APPROVED

Program Proposals Reviewed: NONE

Graduate Certificate Proposals (1) reviewed and (1) approved:
- Engineering Leadership and Innovation Management - APPROVED

Course Proposals (4) reviewed and (4) Approved:
- ESC 520_Change - APPROVED
- ESC 521_Change - APPROVED
- ESC 522_Change - APPROVED
- ESC 523_Change - APPROVED

Other:
Accrediting bodies, like ABET, continue to stress the importance of both the technical and non-technical components of successful engineers in engineering curriculum. The attention of professional societies is also calling for development of leadership competencies within the already packed engineering curriculum. ● The ELIM certificate program fills an unmet need of engineering leadership education for students in engineering specific disciplines such as ME, EE, etc. at the graduate level to supplement PSU’s excellent technical education, with courses designed to educate and develop important leadership competencies.

The course objective is to develop engineers who will positively impact societal change by applying nanoscale science and engineering to move nanotechnology from materials and designs to applications and products.

After successfully completing this course, students will be able to apply scientific principles of quantum mechanics, self-assembly and nanoscale material structures, with engineering design and manufacturing principles that can be applied to develop novel materials with a broad spectrum of engineering applications. The course objective is to develop engineers who will positively impact societal change by applying nanoscale science and engineering to move nanotechnology from materials and designs to applications and products.

After successfully completing this course, students will be able to apply scientific principles of quantum mechanics, self-assembly and nanoscale material structures, with engineering design and manufacturing principles that can be applied to develop novel materials with a broad spectrum of engineering applications. The educational objectives will relate the impact of engineering at the nano-scale to products, services, and society. Students will be required to employ engineering and scientific journal articles in the readings, homework, and exams of this course as well as in its case history project. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the educational objectives.
# Proposals Submitted to EFC

<table>
<thead>
<tr>
<th>Proposal Type</th>
<th>Title</th>
<th>Type</th>
<th>Number or Degree</th>
<th>Action Requested</th>
<th>Vote</th>
<th>GS&amp;R*</th>
<th>Justification (Why/What for)</th>
<th>Summary of Discussion Points</th>
</tr>
</thead>
</table>
| Course | Pattern Transfer at the Nano-scale | ESC | S21 | Change | Approve U | | The instructional objectives include effectively employing the usual vehicles of lectures and textbook assignments but also effectively utilizing (1) hands-on experiences and cleanroom demonstrations as well as journal literature as viable teaching instruments. The Teaching/Videoing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and student hands on experiences. Students will be required to employ engineering and scientific journal articles in the readings, homework, and exams of this course. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the instructional objectives. The educational objectives of this course focus on conveying the unique issues encountered and the unique tools and materials employed in pattern transfer at the nano-scale. After successfully completing this course, a student will be able to design, simulate and transfer nanoscale patterns using photon, particle, physical contact, chemical, and other emerging and advanced pattern transfer techniques. | - I approve as well.  
- I approve.  
- I approve this course proposal.  
- I approve. |
| Course | Fabrication and Characterization for Top-down Nano-manufacturing | ESC | S22 | Change | Approve U | | The instructional objectives include effectively employing the usual vehicles of lectures and textbook assignments but also effectively utilizing cleanroom demonstrations and student hands-on work as well as journal literature as viable teaching instruments. The Teaching/Videoing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and hands-on experiences. Students will be required to employ engineering and scientific journal articles in the readings, homework, and exams of this course. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the instructional objectives. The educational objectives include conveying (1) the breadth of processing diversity provided by using top-down nanofabrication, (2) the advantages of top-down nano-scale processing in certain situations and (3) the importance of characterization in top-down processing control and verification. The course objective is to develop engineers working at the nano-scale who are fully cognizant of the potential and of issues related to top-down nanofabrication techniques. After successfully completing this course, a student will be able to deposit, etch and characterize nano-scale materials, devices, and systems made using top-down fabrication techniques. | - Yes agreed  
- I approve.  
Kind of sloppy. The short and long description are the same and have numerous grammar mistakes that should be corrected. Otherwise course looks great. I approve.  
- I approve. |
Proposals Submitted to EFC

<table>
<thead>
<tr>
<th>Proposal Type</th>
<th>Title</th>
<th>Mnemonic</th>
<th>One Year Masters (OYM)</th>
<th>Number or Degree</th>
<th>Action Requested (Add/Change)</th>
<th>Vote GS&amp;R*</th>
<th>Notification (Why/What for)</th>
<th>Summary of Discussion Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course</td>
<td>Fabrication and Characterization for Bottom-up Nano-manufacturing</td>
<td>ESC</td>
<td>522</td>
<td>Change</td>
<td>Approve U</td>
<td></td>
<td></td>
<td>The instructional objectives include effectively employing the usual vehicles of lectures and textbook assignments, but also effectively utilizing classroom demonstrations as well as student hands-on activities and journal literature as viable teaching instruments. The Teaching/Videoing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and hands-on experiences. Students will be required to employ engineering and scientific journal articles in the readings, homework, and exams of this course. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the instructional objectives. The educational objectives include conveying (1) the unique attributes of the nano-scale and their causes, (2) the breadth of processing diversity provided by using bottom-up nanotechnology, (3) the advantages of bottom-up nano-scale processing in certain situations, and (4) the ties between biology and bottom-up synthesis and fabrication. The course objective is to develop engineers working at the nano-scale who are cognizant of bottom-up nanofabrication, of its ties to biology, and of its emerging characterization approaches. After successfully completing this course, a student will be able to synthesize, functionalize, and characterize nano-scale materials, devices, and systems using bottom-up fabrication techniques.</td>
</tr>
</tbody>
</table>
Proposal for
Penn State College of Engineering Graduate Credit Certificate in

**Engineering Leadership and Innovation Management**

Via On-Campus, Off-Campus, and Online Delivery

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Dr. Sven G. Bilén

Head of the School of Engineering Design, Technology, and Professional Programs; Professor of Engineering Design, Electrical Engineering, and Aerospace Engineering

College of Engineering

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March 3, 1016
Proposed Title: Engineering Leadership and Innovation Management

Principal Faculty Members Proposing Program:
Dr. Sven G. Bilén, Head of the School of Engineering Design, Technology, and Professional Programs; Professor of Engineering Design, Electrical Engineering, and Aerospace Engineering College of Engineering

A. Admission/Program Requirements: Requirements listed here are in addition to the Graduate Council requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.

Applicants must hold either (1) a baccalaureate degree in engineering, science, or related discipline from a regionally accredited U.S. institution or (2) a tertiary (postsecondary) degree that is deemed comparable to a four-year bachelor's degree from a regionally accredited U.S. institution. This degree must be from an officially recognized degree-granting institution in the country in which it operates. Applicants must have a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests.

● Application Procedures: Applicants to the Engineering Leadership and Innovation Management (ELIM) Certificate Program must submit the following materials:
  o Penn State graduate degree application form and application fee;
  o World Campus program application (if applicable);
  o A Leadership and Innovation Portfolio that includes a statement of career and educational goals including documentation of a minimum of one year of related full-time work. Students wishing to enter the program directly from an undergraduate degree can fulfill the 1-year requirement for work 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. The statement should be an essay (2-3 pages in length) that demonstrates the applicant’s written communication skills;
  o Submission of a resume
  o Submission of official transcripts from all post-secondary institutions attended.

● Admissions decisions for the program are based on the quality of the applicant's credentials. The decisions are based on a review of the complete application portfolio. During the admission process, students who appear to be better suited for another graduate level program will be encouraged to apply to the appropriate program. Graduate Record Examination (GRE) scores are not required.

● Course/Research Credit Requirement: The Engineering Leadership and Innovation Management (ELIM) certificate (12-credits) is comprised of four required classes:
  o ENGR 501 Engineering Leadership for Corporate Innovation (3 credits)
  o ENGR 802 Engineering Across Cultures and Nations (3 credits)
  o ENGR 804 Engineering Product Innovation (3 credits);
  o ENGR 405 Project Management for Professionals (3 credits)*

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

- **Duration of Program:** World campus students should be able to complete the program in a calendar year. University Park students will be able to complete the program in two semesters.

- **Tuition and Applicable Charges:** University Park and World Campus students will be assessed the regular tuition (PA/Non-PA; Information Technology and Activities Fees) for graduate course work.

- **Financial Aid:** Not applicable for non-degree students; they do not qualify for assistantship or fellowship support.

- **Insurance Coverage:** F-1 and J-1 visa holders are required to have insurance coverage.

- **Grades/GPA & Certification Criteria:** Students who complete the defined course sequence with a grade of “C” or better will be awarded the certificate. Successful completion of the certificate program will be recorded on the student’s transcript.

B. Market Report/Feasibility Study

**Overview**

The primary goal of the Engineering Leadership and Innovation Management certificate program is to provide professionals with the knowledge and skills 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. The certificate program highlights the changing nature of the field of Engineering, impacted by globalization and the importance of intercultural competencies and innovation management in the workforce. Upon completion of the certificate, students will have developed attributes required by today’s successful engineering executives. Specifically, these include improved ability to lead technical teams and expanded professional skills in leadership, intercultural competence, and innovation management within the engineering profession. The nine-credit certificate program is built from the College of Engineering approved Engineering Leadership and Innovation Management (ELIM) graduate degree program. The program proposal and new courses associate with this certificate are going through the final stages of approval at the Graduate School.

**Justification for the Certificate**

- Accrediting bodies, like ABET, continue to stress the importance of both the technical and non-technical components of successful engineers in engineering curriculum. The attention of professional societies is also calling for development of leadership competencies within the already packed engineering curriculum.

- The ELIM certificate program fills an unmet need of engineering leadership education for students in engineering specific disciplines such as ME, EE, etc. at the graduate level to supplement PSU’s
excellent technical education, with courses designed to educate and develop important leadership competencies.

- The ELIM certificate aligns with the College of Engineering’s strategic initiatives:
  
  o Supports six of the seven attributes of a world-class engineer (technically broad, globally engaged, ethical, innovative, excellent collaborators, and visionary leaders).
  
  o Supports the mission of the College of Engineering to “nurture and train world-class socially aware, globally connected, diverse engineers, educators, and researchers with rigorous core knowledge and problem-solving skills, who understand complex, interacting engineering and societal systems”.
  
  o Directly aligns with the strategic goals of the College of Engineering to enhance the educational experience with leadership training, global awareness, and cultural sensitivity and provides relevant elective credits that align with the college’s strategy to offer and continuously expand one-year non-thesis Master of Engineering degrees.
  
  o Aligns with the institutional thrust area of Innovative Engineering Education related to ‘Global engineering education and experiences’.

- As noted on ASME’s website, “Engineering leadership programs are becoming a part of modern universities, and courses on enhancing leadership abilities have become a critical part of the business world in general and the engineering field specifically. (Emphasis added)”. For these reasons, the Engineering Leadership and Innovation Management certificate has a home in the Penn State College of Engineering.

- The development of this certificate has been in collaboration with the Smeal College of Business, Work Force Education in the College of Education, and Engineering Management at Great Valley with ongoing conversions with other relevant established programs.

Market demand for the certificate

Market Study by World Campus:
Research from the Penn State Outreach Marketing Research & Communication office (February 2016) indicated that there is an online student market for a graduate-level certificate in Engineering Leadership and Innovation Management to be delivered through the Penn State University World Campus. World Campus is in support of the development of this graduate certificate.

Key findings of the World Campus market study include:

- The target audience is 1.9 million workers. Jobs are expected to grow 11 percent over the course of the next decade with 74,000 annual openings.
- Approximately 24% of employed engineers have earned a master’s degree.
- The number of applicants to World Campus graduate programs who hold a bachelor’s degree in engineering has increased 37 percent over the last five years.
- Engineering jobs that relate to the proposed ELIM certificate typically required:
  
  o Bachelor’s degree in engineering
  
  o Candidates to use innovation leadership skills to improve a company’s process efficiencies or to bring new products to market.
  
  o Jobs with an external focus required candidates to have skill sets in areas of marketing and customer support/relations management.
All job candidates were expected to have skills in the areas of leadership, communication, and project management.

Because of the size of the job sector, the anticipated growth in jobs, and the educational level of professionals in the engineering field, a residential and online Engineering Leadership and Innovation Management (ELIM) certificate is being proposed. The ELIM certificate complements other online certificates offered by Penn State delivered through the World Campus and these certificates would likely benefit from synergistic marketing approaches targeted at enrolling new adult students.

**Similar Programs in Other Engineering Schools**

To bridge the gap between industry needs and engineering education there has been rapid growth in engineering leadership/innovation programs across the U.S. and Canada. Several of the top engineering schools in the US and Canada now have graduate certificate programs focused on engineering leadership development and/or innovation, within the context of engineering (Table 1). These programs are all positioned within their respective engineering colleges. The inclusion of the ELIM certificate within the College of Engineering is appropriate and justified based on similar offerings at top engineering schools such as those listed in Table 1. With Engineering Leadership developing into a recognized and needed discipline, the Penn State College of Engineering would be remiss to not be a leader in this emerging engineering discipline at the graduate level, especially given the ELDM program’s strength at the undergraduate level.

**Table 1: Related graduate programs in top Engineering Schools:**

<table>
<thead>
<tr>
<th>School</th>
<th>Program</th>
<th>Program Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Western Reserve University</td>
<td>Engineering Innovation, Management and Leadership</td>
<td>Graduate Concentration-</td>
</tr>
<tr>
<td>Stanford</td>
<td>Engineering leadership</td>
<td>Professional or Graduate Certificate</td>
</tr>
<tr>
<td>University of Washington</td>
<td>Engineering leadership</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>Cornell</td>
<td>Engineering leadership</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>Boston University</td>
<td>Engineering Innovation</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>SUNY Empire</td>
<td>Innovation Management and Technology Transfer</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>University of Colorado at Boulder</td>
<td>Engineering Entrepreneurship, Engineering Management, &amp; Leadership &amp; Management</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>University of Illinois-Urbana Champaign</td>
<td>Business Management for Engineers</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>Purdue University</td>
<td>Engineering w/ Concentration in Engineering Management and Leadership</td>
<td>Graduate Concentration</td>
</tr>
<tr>
<td>University of Wisconsin-Milwaukee</td>
<td>Engineering in Professional Practice with a Technical Leadership Certificate</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>Northeastern University</td>
<td>Engineering Management with Engineering Leadership Certificate</td>
<td>Graduate Certificate</td>
</tr>
<tr>
<td>University of Toronto</td>
<td>Certificate in Entrepreneurship, Leadership, Innovation and Technology in Engineering</td>
<td>Graduate Certificate</td>
</tr>
</tbody>
</table>
C. Facilities/Program Supervision: The Engineering Leadership Development (ELD) program has been offering courses in Engineering Leadership on a resident instruction basis at Penn State University Park’s College of Engineering since 1995.

The ELD program is a nationally and internationally recognized unit with a record of offering quality degree programs. The ELD program currently offers an undergraduate minor on campus. The ELD program is offering a one-year Masters of Engineering in Engineering Leadership and Innovation Management (ELIM), pending final approval from the Board of Trustees, July 2016.

Faculty and associates within the School of Engineering, Design, Technology, and Professional Programs (SEDTAPP) will oversee the ELIM certificate program. Faculty within the unit provide a variety of technical, theoretical, and practical expertise for course development and curricular review for ensuring quality and relevance. Dr. Sven G. Bilén, Department Head for SEDTAPP, will provide overall supervision of the program and Dena Lang will serve as the Director of Graduate Studies and Ms. Meg Handley will serve as the Program Coordinator. In alignment with the full graduate program, graduate faculty associated with the certificate will include: Sven G. Bilén, Dena Lang, Wesley E. Donahue, Kathryn Jablokow, Gül E. Okudan Kremer, Esther Obonyo, Conrad Tucker, and Sarah E. Zappe. The ELD program also has a dedicated staff assistant to serve as support to faculty and program coordinators.

D. Research Component: There is no research component in this program.

E. Quality Assurance:
   - Academic Unit Responsible for the Program: The School of Engineering Design, Technology, and Professional Programs
   - 500- and 800-Level Courses: All 500- and 800-level courses will be delivered by graduate faculty or faculty approved to teach graduate courses by the Graduate School.
   - 400-Level Courses: ENGR 405, Project Management for Professionals will be delivered by faculty associated with the ELD program.
   - Program Content/Location, Delivery Mechanisms: Upon completion of the certificate, students will have developed attributes required by today’s successful engineering leaders. Specifically, these include improved ability to lead technical teams and expanded professional skills in leadership, intercultural competence, and innovation management within the engineering profession. Graduates will be able to:
     - Distinguish leadership theory relevant to an engineering context and apply concepts to establish team/project alignment with an organization’s mission, vision, strategy, and tactics.
     - Apply critical skills in reflection and identification of leadership strengths to lead cross-cultural and international projects, teaming with engineers and business professionals from around the U.S. and the world.
     - Identify new product opportunities, define product improvement strategies and plans, and develop a product service, or process from concept to prototype.
     - Identify needs and effectively allocate resources to complete a project.
The twelve-credit certificate program is built from the College of Engineering approved Engineering Leadership and Innovation Management (ELIM) graduate degree program. The ELIM program proposal and new courses are going through the final stages of approval at the Graduate School.

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

*Related courses may be substituted for ENGR 405 per an approved list of courses by the ELD office. See approved course list attached.

Other elective courses outside this list may be petitioned for substitution to meet the ENGR 405 requirement

The Engineering Leadership and Innovation Management (ELIM) certificate program will be offered at the University Park campus (On-Campus), and through the World Campus. Consultation was conducted with staff and administrators of the World Campus who are supportive of the program.

- **Student Support Services:** Faculty members with graduate faculty status will serve as advisers to students enrolled in the program. Students will be welcome to contact the Certificate Program Lead and/or Coordinator with questions about administrative, academic or professional matters. A shared departmental staff assistant provided by the School of Engineering Design, Technology, and Professional Programs will provide administrative support. Additionally, students enrolling in the online version of the certificate will be provided with support through various administrative functions of World Campus.

- **Relationship Between Post-Baccalaureate Credit/Graduate Certificate Program Course Work and Graduate Degree Program Course Work:** Grade requirements for the certificate courses adhere to the minimum requirements for the graduate program of study. No more than 15 credits of accumulated course work earned as a non-degree student may be applied toward a graduate degree program, with transferability and applicability being determined by the graduate degree program and the Graduate School. Note that completion of the certificate program neither guarantees nor implies subsequent admission and transfer of credit to a graduate degree program and that completion of the certificate program does not imply the completion of the graduate degree. If the student is accepted into the ELIM degree program, the courses, which constitute this Graduate Certificate in ELIM, will also count towards meeting the requirements of the ELIM graduate program.

- **Organizational Unit(s)/Fiscal Responsibility:** The College of Engineering at University Park and the World Campus will share responsibility, where appropriate, for ensuring the development and delivery of a fiscally viable program. The Director of Graduate Studies, Dr. Dena Lang, in collaboration with the program coordinator Ms. Meg Handley, the Director of Engineering
Leadership Development, Mr. Andrew Erdman, the Department Head of SEDTAPP, Dr. Sven Bilén, the Associate Dean of the College of Engineering, Dr. Peter Butler, the Director of Academic Affairs for Graduate Programs, World Campus, Dr. David Sylvia, and the World Campus Program Manager, Richard Brungard, will be the administrative liaisons in reporting and analyzing the cost-effectiveness of the program. The World Campus will conduct an annual financial review, where appropriate, and program viability and sustainability will be determined in conjunction with World Campus for the online offering. The College of Engineering at University Park and the World Campus are in the process of finalizing agreements for this online offering in which the department receives compensation, on a per student basis, for those enrolling through World Campus which will support course offerings, program development, and administration. Through this collaboration, World Campus agrees to cover the author compensation and instructional design costs for initial course development. After that, all costs associated with authors for course revisions and additional new courses would be the responsibility of the School for Engineering Design, Technology, and Professional Programs. World Campus would be responsible for all costs associated with the World Campus Learning Design unit.

- **5-Year Sunset Clause:** Initial approval of the program is requested for the period of January 2017 through January 2023. The department will conduct an internal evaluation of the academic and fiscal viability of this program during the 2022-2023 academic year to determine if it should be renewed or discontinued. Admitted students will be accommodated through completion of the program for a period of up to a year.

- **Consultation With Appropriate Units/Programs:**

  **Consultation Summaries (full consultation documentation follows these summaries)**

<table>
<thead>
<tr>
<th>COE Department</th>
<th>Name</th>
<th>Consultation Result</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>Chimay Anumba</td>
<td>Approved without concerns</td>
<td></td>
</tr>
<tr>
<td>ABE</td>
<td>Paul Heinemann</td>
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<tr>
<td>ACS</td>
<td>Victor Sparrow</td>
<td></td>
<td>No Response</td>
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<td>AERSP</td>
<td>George Lesieutre</td>
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<td></td>
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<tr>
<td>BIOE/BME/IGDP</td>
<td>Chen Dong</td>
<td>Approved without concerns</td>
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<td>CE/ENV/CEE</td>
<td>Patrick Fox</td>
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<td>Planned to respond but response not received by submission</td>
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<tr>
<td>CH E</td>
<td>Philip Savage</td>
<td>Approved without concerns</td>
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<tr>
<td>CSE/EECS</td>
<td>Raj Acharya</td>
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<tr>
<td>Program</td>
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<tr>
<td>EE/EECS</td>
<td>Kultegin Aydin</td>
<td>Approved without concerns</td>
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<tr>
<td>ESMCH/E/SC/ESM</td>
<td>Judith Todd</td>
<td>Approved without concerns</td>
<td></td>
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<tr>
<td>IE</td>
<td>Karen Thole</td>
<td>Approved without concerns</td>
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<tr>
<td>IME</td>
<td>Janis Tenpenny</td>
<td>Planned to respond but response not received by submission</td>
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<tr>
<td>Consultation summaries outside the College of Engineering Department Heads</td>
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<td></td>
<td></td>
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<tr>
<td>Supply-Chain, Corporate Innovation &amp; Entrepreneurship, &amp; Business Analytics Certificates</td>
<td>Smeal College of Business</td>
<td>Brian Cameron, Associate Dean for Professional Masters Program</td>
<td>Approved without concerns</td>
</tr>
<tr>
<td>Enterprise Architecture Supply-Chain, Corporate Innovation &amp; Entrepreneurship, &amp; Business Analytics Certificates</td>
<td>College of IST</td>
<td>Carleen Maitland, Interim Associate Dean for Undergraduate &amp; Graduate Education</td>
<td>Approved; Suggested change the program lead name to align with graduate faculty appointments; STATUS: Implemented suggested changes to document in section C.; Graduate Faculty Nomination for Dena Lang Approved</td>
</tr>
<tr>
<td>Human Factors Engineering</td>
<td>College of Engineering</td>
<td>Andris Freivalds: Harold and Inge Marcus Department of Industrial and Manufacturing Engineering</td>
<td>Approved with comments regarding inclusion of 400-level courses in a graduate credit certificate; clarified requirements and issue was resolved</td>
</tr>
<tr>
<td>Operations &amp; Supply-Chain Certificate</td>
<td>Business Administration, Harrisburg</td>
<td>Richard Young, Faculty, Operations and Supply-Chain Certificate</td>
<td>Response indicated he did not feel the consultation applied to the program out of Harrisburg</td>
</tr>
<tr>
<td>Organization Development &amp; Change certificates</td>
<td>College of Education, Workforce Education</td>
<td>William Rothwell, Professor of Education</td>
<td>No response</td>
</tr>
<tr>
<td>Philanthropic Leadership</td>
<td>College of the Liberal Arts</td>
<td>Ray Lombra, Special Assistant to the Dean,</td>
<td>Approved without concerns</td>
</tr>
<tr>
<td>University College</td>
<td>David Christiansen</td>
<td>Approved without concerns</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Beherend, School of Business</td>
<td>Jeffery Pinto, Morrow and Black University Chair</td>
<td>On sabbatical and not sure he would have time to respond;</td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>Great Valley</td>
<td>Colin Neil, Associate Professor of Software and Systems Engineering; Director of</td>
<td>Approved without concerns</td>
</tr>
</tbody>
</table>
College of Engineering Consultations

Original Email to Department Heads:

From: Meg Handley <mhh11@engr.psu.edu>
Date: Tuesday, February 23, 2016 at 10:18 AM
To: Arthur Motta <ATMNUC@engr.psu.edu>, Cheng Dong <cxdbio@engr.psu.edu>, "Chimay J. Anumba" <anumba@engr.psu.edu>, "George A. Lesieutre" <gal4@engr.psu.edu>, Harriet Nembhard <hbn2@psu.edu>, Janna Maranas <jmaranas@engr.psu.edu>, Jeff Catchmark <JCatchmark@engr.psu.edu>, Judith Todd <JTodd@engr.psu.edu>, Karen Thole <kthole@engr.psu.edu>, Kultegin Aydin <aydin@engr.psu.edu>, "Patrick J. Fox" <pjfox@engr.psu.edu>, Paul Heinemann <hzh@engr.psu.edu>, Phillip Savage <psavage@engr.psu.edu>, Raj Acharya <acharya@engr.psu.edu>, Sven Bilen <SBilen@engr.psu.edu>, "Victor W. Sparrow" <VWSACS@engr.psu.edu>, "Peter J. Butler" <pjbbio@engr.psu.edu>, THERESA MAYER <TSM2@PSU.EDU>, MELISSA SHOWALTER <MUS41@PSU.EDU>, AMY HASAN <ALH31@PSU.EDU>, AMY MANEY <AQM5@PSU.EDU>, BETH KENNEDY <BAU1@PSU.EDU>, CARRIE FRIDAY <CLC2@PSU.EDU>, DAWN NELSON <DMN3@PSU.EDU>, DEBORAH MAYES <DVM3@PSU.EDU>, DEVON JOHNSON <DCJ2@PSU.EDU>, Doretta Garvey <dgbio@engr.psu.edu>, Juls Kralik <irkme@engr.psu.edu>, "Catherine B. MacKenzie" <cbm19@engr.psu.edu>, LAURINDA BENNER <LJT6@PSU.EDU>, LISA DAUB <LQR1@PSU.EDU>, LISA PETRINE <LAP31@PSU.EDU>, NANCY SMITH <NJS1@PSU.EDU>, Olga Covasa <oxc10@engr.psu.edu>, Pamela Stauffer <pstauffer@engr.psu.edu>, PAUL HUMPHREYS <PLH153@PSU.EDU>, "Sheila L. Corl" <sx11@engr.psu.edu>, Sherry Walk <swalk@engr.psu.edu>, "Andrew M. Erdman" <ame17@engr.psu.edu>, Dena Lang <tcl133@engr.psu.edu>

Subject: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Dear COE Department Heads,

The Engineering Leadership Program is seeking input from you regarding consultation for our proposed College of Engineering graduate credit certificate in Engineering Leadership and Innovation Management. This graduate certificate is designed for both online and residential offerings to provide engineering leadership education in engineering specific disciplines at the graduate level to supplement the COE’s excellent technical education. The attached document outlines the proposal in detail.

Please provide feedback by March 1st to: Meg Handley (mhh11@psu.edu).

Thank you,
Meg Handley

—
Meg Handley, MS, BCC
Associate Director of Engineering Leadership Outreach

Proposal for ELIM certificate (Updated 3-3-2016)
Hi Meg,

The Department of Architectural Engineering is supportive of this proposal.

Dr. Chimay Anumba

---

Department of Agricultural and Biological Engineering

This proposal looks okay to us.

Paul

Paul Heinemann
Professor and Head
Department of Agricultural and Biological Engineering
814-865-2633
hz@psu.edu

---

From: Meg Handley <mhh11@engr.psu.edu>
Date: Tuesday, March 1, 2016 at 1:25 PM
To: VICTOR SPARROW <VWS1@PSU.EDU>
Cc: KAREN THAL <KJT3@PSU.EDU>
Subject: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Dr. Sparrow

We are seeking consultation on the attached graduate certificate as noted from the email below. We are planning on submitting the document with all the consultations we have received by this Friday, March 4th to meet EFC deadlines. Input from your department regarding consultation by Thursday, March 3rd, would be most appreciated to include in our final submission.

Thank you for your time and consideration.

Meg Handley

---

Meg Handley, MS, BCC
Associate Director of Engineering Leadership Outreach
College of Engineering
School of Engineering Design, Technology, and Professional Programs
Penn State University
University Park, PA 16802
213G Hammond Building

---

Department of Aerospace Engineering

From: "George A. Lesieutre" <gal4@engr.psu.edu>
Date: Thursday, February 25, 2016 at 3:31 PM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

The Department of Aerospace Engineering supports the establishment of this graduate certificate.

-GL

**************************************************************************

Proposal for ELIM certificate (Updated 3-3-2016)
George A. Lesieutre
Professor and Head, Aerospace Engineering
Director, Center for Acoustics & Vibration
Penn State University
**********************************************************
+1-814-863-0103
---

Department of Biomedical Engineering

From: Cheng Dong <cxdbio@engr.psu.edu>
Date: Tuesday, February 23, 2016 at 3:15 PM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Hi Meg,
BME sees no problem with it.
Thanks,
Cheng

-Cheng Dong, Ph.D.
Distinguished Professor & Department Head
Department of Biomedical Engineering
205 Hallowell Building
The Pennsylvania State University
University Park, PA 16802
Tel: (814) 865-8091
Fax: (814) 863-0490
Email: cxd23@psu.edu
URL: http://bme.psu.edu/faculty/Dong.html
---

From: "Patrick J. Fox" <pjfox@engr.psu.edu>
Date: Tuesday, March 1, 2016 at 1:55 PM

Proposal for ELIM certificate (Updated 3-3-2016)
To: Meg Handley <mhh11@engr.psu.edu>
Cc: PATRICK FOX <PJF14@PSU.EDU>, DEVON JOHNSON <DCJ2@PSU.EDU>, "William D. Burgos" <WDB3@engr.psu.edu>

Subject: Re: Review and Consultation for Graduate Certificate- Engineering Leadership & Innovation Management

Bill - please see below - can we proved a response by Thursday?

Sent from my iPhone

On Mar 1, 2016, at 1:29 PM, Meg H. Handley <mhh11@engr.psu.edu> wrote:

Dr. Fox

We are seeking consultation on the attached graduate certificate as noted from the email below. We are planning on submitting the document with all the consultations we have received by this Friday, March 4th to meet EFC deadlines. Input from your department regarding consultation by Thursday, March 3rd, would be most appreciated to include in our final submission.

Thank you for your time and consideration.

Meg Handley

---

Meg Handley, MS, BCC
Associate Director of Engineering Leadership Outreach
College of Engineering
School of Engineering Design, Technology, and Professional Programs
Penn State University
University Park, PA 16802
213G Hammond Building
---

Chemical Engineering

From: Phillip Savage <psavage@engr.psu.edu>
Date: Monday, February 29, 2016 at 8:48 PM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Meg

I quickly read through the proposal. I saw no obvious problems and I have no objections.

Phil

________________
Phillip E. Savage
Department Head, Chemical Engineering
Walter L. Robb Family Chair
Editor, Industrial & Engineering Chemistry Research
160 Fenske Lab
The Pennsylvania State University
University Park, PA 16802
---

Computer Science Engineering

From: Meg Handley <mhh11@engr.psu.edu>
Date: Tuesday, March 1, 2016 at 2:07 PM
To: RAJ ACHARYA <RUA1@PSU.EDU>
Cc: BETH KENNEDY <BAU1@PSU.EDU>

Subject: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Dr. Acharya

We are seeking consultation on the attached graduate certificate as noted from the email below. We are planning on submitting the document with all the consultations we have received by this Friday, March 4th to meet EFC deadlines. Input from your department regarding consultation by Thursday, March 3rd, would be most appreciated to include in our final submission.

Thank you for your time and consideration.

Meg Handley

—

Meg Handley, MS, BCC
Associate Director of Engineering Leadership Outreach
Proposal for ELIM certificate (Updated 3-3-2016)

College of Engineering
School of Engineering Design, Technology, and Professional Programs
Penn State University
University Park, PA 16802
213G Hammond Building
---

Electrical Engineering

From: Kultegin Aydin <aydin@engr.psu.edu>
Date: Monday, February 29, 2016 at 10:02 AM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: RE: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

The Electrical Engineering Department supports the proposed College of Engineering graduate credit certificate in Engineering Leadership and Innovation Management.

Kultegin Aydin

Kultegin Aydin  Professor and Head  Department of Electrical Engineering
School of Electrical Engineering and Computer Science  The Pennsylvania State University  129 EE East,
University Park, PA 16802  Phone: (814) 863-2788
Fax: (814) 865-6392
---

Engineering Science and Mechanics

From: MICHAEL LANAGAN <MXL46@PSU.EDU>
Date: Wednesday, March 2, 2016 at 8:00 AM
To: MEREDITH HANDLEY <MHH11@PSU.EDU>
Cc: Judith Todd <JTodd@engr.psu.edu>
Subject: Re: Review and Consultation for Graduate Certificate- Engineering Leadership & Innovation Management

Hi Meg,
This is an excellent proposal with a comprehensive market analysis.
Mike Lanagan
From: "Judith Todd" <JTodd@engr.psu.edu>
To: "Mike Lanagan" <MLanagan@PSU.EDU>
Sent: Tuesday, March 1, 2016 3:08:07 PM
Subject: FW: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Mike

Please review and let Meg know if you approve.

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

---

Department of Mechanical and Nuclear Engineering
From: Karen Thole <kthole@engr.psu.edu>
Date: Wednesday, February 24, 2016 at 11:02 AM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: RE: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Meg,

MNE is fine with the program.
Outside Consultation

Smeal College of Business, Certificate consultation in Business Analytics, Supply Chain, and Corporate Innovation and Entrepreneurship

From: Brian Cameron <bcameron@smeal.psu.edu>
Date: Thursday, February 25, 2016 at 8:09 AM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: RE: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Hi Meg

Yes, the concentration areas you list below are correct and everything looks good with the proposal. We look forward to working with you as you move this forward.

Best of luck

Brian

---

Enterprise Architecture, Carleen Maitland, Interim Associate Dean for Undergraduate and Graduate Education

From: Carleen Maitland <cmaitland@ist.psu.edu>
Date: Tuesday, February 23, 2016 at 10:29 AM
To: Meg Handley <mhh11@engr.psu.edu>
Cc: "cfm12@psu.edu" <cfm12@psu.edu>
Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Dr. Maitland
Thank you for the suggestion. We will change the name to our department head until the graduate faculty nomination are complete.
Best.
Meg

Hi Meg,
This looks fine.

It might be prudent to wait for the graduate faculty status review for Deana prior to putting forward a graduate program which names her as lead.

Carleen
Sent from my iPhone
---

Human Factors Engineering and Ergonomics

From: Andris Freivalds <axf@engr.psu.edu>
Date: Friday, February 26, 2016 at 2:56 PM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: RE: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Meg,

Oh, they must have changed the requirements, because my certificate with 2 500-level and 1 400-level was not given the ‘graduate’ certificate label.

But if those are the current rules, then your certificate is perfectly fine with me.

Andy

From: Meg H. Handley <axf@engr.psu.edu>  Sent: Friday, February 26, 2016 12:54 PM  To: Andris Freivalds
Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Andy

Thanks for your time and your comments. I double-checked the website for graduate certificates and found this line:

-A postbaccalaureate certificate may be designated as a graduate certificate if at least half of the course credits required are at the graduate level (500 or 800 level).

I’m assuming that means that our’s would be considered a graduate certificate considering only one of the four courses is at the 400 level? I will also double check with Vicki to ensure I am not missing anything.

Thank you

Meg

---

Meg Handley, MS, BCC
Associate Director of Engineering Leadership Outreach  
College of Engineering  
School of Engineering Design, Technology, and Professional Programs  
Penn State University  
University Park, PA 16802  
213G Hammond Building  

From: Andris Freivalds <axf@engr.psu.edu>  
Date: Friday, February 26, 2016 at 9:53 AM  
To: Meg Handley <mhh11@engr.psu.edu>  
Subject: RE: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management  

Meg,  

I have no problem giving my personal feedback, so long as it is not represented as coming from the Co-Chair of the Graduate Council Joint Curricular Committee.  

The proposal for the certificate looks fine (especially since the graduate program was already approved, usually the process happens in reverse order).  

However, I have one comment. It is my understanding (and you probably should check with Vicki Hewitt in the Grad School on this) that the term ‘graduate certificate’ can only be applied if all courses are graduate courses. Since you have ENGR 405 in the mix, then I think you may need to use the term ‘post baccalaureate’.  

Otherwise, good luck.  

Andy  

Andris Freivalds, Ph.D., CPE  
The Harold and Inge Marcus  
Dept. of Industrial & Manufacturing Engineering  
310 Leonhard Bldg  
Penn State University  
University Park, PA 16802 USA  
Tel: 814-863-2361  
FAX: 814-863-4745  
e-mail: axf@psu.edu  
Personal Website: http://www2.ie.psu.edu/Freivalds/Personal/Freivalds.htm  

---
Supply-Chain and Operations Management, Harrisburg

From: Meg Handley <mhh11@engr.psu.edu>

Date: Wednesday, February 24, 2016 at 2:51 PM

To: RICHARD ROBERT YOUNG <rry100@psu.edu>

Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Dr. Young

Thanks for your note. We researched the programs that may be interested in giving feedback on our proposed certificate and we noted your name in association with the Project Management certificate program. Our program is designed for technical leadership development and has a project management component. We wanted to be thorough in our consult and included your program due to the connection with project management.

If you have no concerns and do not feel you need to be consulted, please just respond with that information.

Thank you for your time and I hope you are well.

Meg Handley

—

Meg Handley, MS, BCC
Associate Director of Engineering Leadership Outreach
College of Engineering
School of Engineering Design, Technology, and Professional Programs
Penn State University
University Park, PA 16802
213G Hammond Building

From: RICHARD ROBERT YOUNG <rry100@psu.edu>

Date: Wednesday, February 24, 2016 at 10:58 AM

To: Meg Handley <mhh11@engr.psu.edu>

Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management
Meg:

I’m not quite sure why this was sent to me since I’m in Supply Chain Management and quite removed from the discipline at hand. Please advise.

Rich Young

---

Post-baccalaureate Certificate in Philanthropic Leadership, College of the Liberal Arts

From: Raymond Lombra <rl3@psu.edu>
Date: Saturday, February 27, 2016 at 10:29 PM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Meg, I have looked over the proposed certificate program and find it to be well conceived and timely; I support its approval, ray

Raymond Lombra
Professor of Economics
Senior Adviser to the Dean
Director, Post-baccalaureate Program in Philanthropic Leadership
138 Sparks Building
College of the Liberal Arts
Pennsylvania State University
University Park, PA 16802
814-865-9555
814-863-2085 (fax)

---

University College

From: DAVID CHRISTIANSEN <djc21@psu.edu>
Date: Tuesday, February 23, 2016 at 3:36 PM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: RE: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Meg,
This looks like an excellent addition to the curriculum. The University College supports this certificate. Best of luck with its implementation.

David

Brian H. Cameron | Associate Dean for Professional Master's Programs | Smeal College of Business | The Pennsylvania State University | University Park, PA 16802 | Phone: 814-863-1460 |
Email: bcameron@smeal.psu.edu

---

The Black School of Business, Behrend College

From: Meg Handley <mhh11@engr.psu.edu>
Date: Tuesday, March 1, 2016 at 1:47 PM
To: JEFFREY PINTO <jkp4@psu.edu>
Subject: Re: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Dr. Pinto

We certainly appreciate any time you may have. We are planning to submit to meet EFC deadlines this Friday with any consultations we may have.

Thank you and all the best on your Sabbatical.

Best.

Meg Handley

—

Meg Handley, MS, BCC
Associate Director of Engineering Leadership Outreach
College of Engineering
School of Engineering Design, Technology, and Professional Programs
Penn State University
University Park, PA 16802
213G Hammond Building

From: JEFFREY PINTO <jkp4@psu.edu>
Date: Tuesday, February 23, 2016 at 11:28 AM
To: Meg Handley <mhh11@engr.psu.edu>
Subject: RE: Review and Consultation for Graduate Certificate-Engineering Leadership & Innovation Management

Hi Meg,

I am on sabbatical this semester and traveling extensively. I doubt that I will have time to review this document.

Jeff

Jeffrey K. Pinto, Ph.D.
Andrew Morrow and Elizabeth Lee Black Chair
In the Management of Technology
Black School of Business
Penn State – Erie
Erie PA 16563
(814) 898-6430

---

Great Valley, Engineering Programs
Dear Meg:

I have reviewed your proposal and on behalf of the Engineering Division of the School of Graduate Professional Studies, I support the development and delivery of the graduate certificate in Engineering Leadership & Innovation Management.

Good luck with the program and we look forward to collaborating in the future.

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

Proposal for ELIM certificate (Updated 3-3-2016)
Name of the Certificate Program: Engineering Leadership and Innovation Management
(Do NOT include the words, “Postbaccalaureate Certificate in” or “Graduate Certificate in” within the title.)

Person in Charge: Sven Bilen

Address: 213C Hammond Building University Park, PA 16802

Telephone: 814-863-1526 Fax: E-Mail: Sbilen@psu.edu

Description of the Certificate Program Including Purpose, Objectives, and Total Number of Credits Required:
[Example: The primary goal of the program is to prepare engineers to develop the next generation of engineering products, systems, and services for industry and government. The 15-credit curriculum integrates the traditional engineering disciplines in a synergistic manner. All candidates are required to take the professional, skill-based, 9-credit core module and two other 3-credit courses. Selected courses must be at the 500 level or above.]
(Do NOT exceed 1000 characters, including spaces)
The primary goal of the Engineering Leadership and Innovation Management certificate program is to provide professionals with the knowledge and skills 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. The certificate program highlights the changing nature of the field of Engineering, impacted by globalization and the importance of intercultural competencies and innovation management in the workforce. Upon completion of the certificate, students will have developed attributes required by today’s successful engineering executives. Specifically, these include improved ability to lead technical teams and expanded professional skills in leadership, intercultural competence, and innovation management within the engineering profession. The twelve-credit certificate program is built from the College of Engineering approved Engineering Leadership and Innovation Management (ELIM) graduate degree program.

Admission Requirements:
(Including completion of a baccalaureate degree as applicable)
[Example: An applicant for a postbaccalaureate or graduate certificate must have received, from a regionally accredited institution, a baccalaureate degree earned under residence and credit conditions substantially equivalent to those required by Penn State. Ordinarily, an entering student must have completed in a satisfactory manner a minimum of course work in designated areas, etc.]
Applicants must apply for admission to the certificate program via the Graduate School application for admission. Admission requirements are stated in the GENERAL INFORMATION section of the Graduate Bulletin. International applicants must satisfy the English proficiency requirement.
Applicants must hold either (1) a baccalaureate degree in engineering, science, or relevant discipline from a regionally accredited U.S. institution or (2) a tertiary (postsecondary) degree that is deemed comparable to a four-year bachelor's degree from a regionally accredited U.S. institution. This degree must be from an officially recognized degree-granting institution in the country in which it operates. Applicants must have a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests.
Applicants to the Engineering Leadership and Innovation Management (ELIM) certificate must submit the following materials:

- Penn State graduate degree application form and application fee;
- World Campus program application (if applicable);
- A Leadership and Innovation Portfolio that includes a statement of career and educational goals including documentation of a minimum of one year of related full-time work. Students wishing to enter the program directly from an undergraduate degree can fulfill the 1-year requirement for work 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. The statement should be an essay (2-3 pages in length) that demonstrates the applicant’s written communication skills.
- Submission of a resume
- Submission of official transcripts from all post-secondary institutions attended
Admissions decisions for the program are based on the quality of the applicant's credentials. The decisions are based on a review of the complete application portfolio. During the admission process, students who appear to be better suited for another graduate level program will be encouraged to apply to the appropriate program. Graduate Record Examination (GRE) scores are not required.

**List of Courses** Included in the Certificate:
(Including course designation [prefix and number])

*Example:* SYSEN 510
SYSEN 511

The Engineering Leadership and Innovation Management (ELIM) certificate (12-credits) is comprised of four courses:
- ENGR 501 Engineering Leadership for Corporate Innovation (3 credits-required course)
- ENGR 802 Engineering Across Cultures and Nations (3 credits-required course)
- ENGR 804 Engineering Product Innovation (3 credits)
- ENGR 405 Project Management for Professionals (3 credits-required course)*

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

**Effective Semester:** Spring 2017

**Expiration Semester:** (maximum of 5 years from effective date) Spring 2022

*Note: All courses required in a postbaccalaureate or graduate certificate must be permanent courses (i.e., do not include 497/498, 597/598, or 897/898 courses as part of a postbaccalaureate or graduate certificate) that have been approved by the appropriate curricular committee (University Faculty Senate, for 400-level courses; Graduate Council Subcommittee on New and Revised Programs and Courses for graduate-level courses).
Graduate Council Subcommittee On New And Revised Programs and Courses

COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSAMA O AWADELKARIM</td>
<td>ooa1</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

College with curricular responsibility: Engineering (EN)

Type of Proposal: □ Add  [x] Change  □ Drop

Course Designation

(ESC 520) Engineering at the Nano-scale

Course Information

Cross-Listed Courses:

NANO 520

Prerequisites:

Corequisites:

Concurrents:

ESC 412

Recommended Preparations:

Abbreviated Title: Engr at Nano-scale

This course will be delivered:

[x] in residence

[x] off-site

[x] online

Bulletin Listing

Minimum Credits: 3

Maximum Credits: 3

Repeatable: NO

Department with Curricular Responsibility:

Engineering Science And Mechanics (UPEN_ESCM)

Short Description: Nanoscale scientific phenomena and their engineering impact, uniqueness of the nano-scale, exemplary applications.

Effective Semester: FA 2016

Travel Component: NO

Course Outline
A brief outline or overview of the course content:
1. Review of the broad basic science background necessary to effectively engineer at the nano-scale.
   1.1 Physical phenomena
   1.1.1 Mechanics at the nano-scale
   1.1.2 Thermodynamics at the nano-scale
   1.1.3 Optics at the nano-scale
   1.1.4 Fluids at the nano-scale
   1.2 Chemical phenomena
   1.2.1 Bonding
   1.2.2 Building blocks
   1.3 Materials phenomena
   1.3.1 Surfaces vs. Bulk
   1.4 Life Sciences phenomena
   1.4.1 Life at the nano-scale
   1.4.2 Nano-scale: nexus of living and non-living
2. Uniqueness of the nano-scale:
   2.1 The surface to volume ratio of nanoparticles can be very large allowing surface phenomena to dominate over bulk phenomena.
   2.2 The physical and chemical properties of a nanoparticle can change with size
   2.3 Nano-scale sizes are in the realm of very basic biological and physical objects.
   2.4 Unusual forms of chemical bonding can exist.
   2.5 Self-assembly can be initiated and controlled
   2.6 Quantum phenomena can be obvious
   2.7 Wave-particle duality becomes a meaningful consideration
   2.8 Material-electromagnetic radiation interactions can involve quantum phenomena as well as physical (wave) optics effects
3. Impact of this uniqueness on engineering
   3.1 Properties
   3.2 Function
   3.3 Products
4. Exploiting this uniqueness for manufacturing processes, services, and products
5. Exemplary applications highlighting the unique science interplay and engineering opportunities at the nanoscale taken from among:
   5.1 Nanotechnology in Medicine and Biotechnology
   5.2 Nanotechnology in Agriculture and Food
   5.3 Nanotechnology and the Environment
   5.4 Nanotechnology in Electronics and Spintronics
   5.5 Nanotechnology in Opto-electronics and Photonics
   5.6 Nanotechnology in Sensing
   5.7 Nanotechnology in Transportation Technology
   5.8 Nanotechnology in Building Technology
   5.9 Nanotechnology in Energy Production and Storage
   5.10 Nanotechnology in Informatics
6. The future of nanotechnology
   6.1 Why is it growing in importance?
   6.2 Why not pico-technology?
7. Introduction to the impact of nanotechnology on society

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
1. Review of the broad basic science background necessary to effectively engineer at the nano-scale. (4 weeks)
2. Uniqueness of the nano-scale. (2 weeks)
3. Impact of the uniqueness of the nano-scale on engineering. (3 weeks)
4. Exploiting this uniqueness for manufacturing processes, services, and products. (3 weeks)
5. Examples of nano-scale engineered materials and structures. (2 weeks)
6. The impact of nanotechnology applications on society and the future of nanotechnology. (1 week)

Long Course Description:
Engineering at the nano-scale, its current applications, its future directions, and its impact on society are the subjects of E SC 520. The uniqueness of the nano-scale is addressed by first reviewing the basic aspects of our picture of the physical world (e.g. Newtonian and quantum mechanics, geometrical and physical optics) and then exploring the relative impact of these aspects on physical, chemical, and biological phenomena at the nano-scale. Which phenomena dominate as a function of scale and how this competition affects properties and structures is explored in detail allowing the opportunities of the nano-scale to emerge. Impact of the uniqueness of the nano-scale on engineering and the possibilities offered for engineering applications, ranging from
manufacturing processing to better building materials to better drug delivery systems, are discussed throughout the course. These creative possibilities afforded by engineering at the nano-scale are highlighted by a varying array of applications taken from fields including medicine and biotechnology, agriculture and food, environmental mitigation, electronics and spintronics, opto-electronics, photonics, sensing, materials, transportation technology, energy production, energy storage, and informatics.

The name(s) of the faculty member(s) responsible for the development of the course:

- Name: STEPHEN JOSEPH FONASH (sjf2)
  Title: KUNKLECHAIR PROF EMERITUS
  Phone: +1 814 865 4931
  Address: 0118 RES BL WEST UNIVERSITY PARK UNIVERSITY PARK, PA 16802
  Campus: 
  City: 
  Fax: 

- Name: OSAMA O AWADELKARIM (ooa1)
  Title: DIR. CTR NANO ED & UTILIZ
  Phone: +1 814 863 1773
  Address: 0212 EARTH & ENGR SCIENCES UNIVERSITY PARK UNIVERSITY PARK, PA 16802
  Campus: 
  City: 
  Fax: 

Course Justification

Instructional, Educational, and Course Objectives:
This section should define what the student is expected to learn and what skills the student will develop.
The instructional objectives of this course are to combine a scientific foundation in quantum mechanics principles, atomic and molecular self-assembly, and nanoscale material structures, with engineering design and manufacturing principles that can be applied to develop novel materials with a broad spectrum of engineering applications.

The educational objectives will relate the impact of engineering at the nano-scale to products, services, and society. Students will be required to employ engineering and scientific journal articles in the readings, homework, and exams of this course as well as in its case history project. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the educational objectives.

The course objective is to develop engineers who will positively impact societal change by applying nanoscale science and engineering to move nanotechnology from materials and designs to applications and products.

After successfully completing this course, students will be able to apply scientific principles of quantum mechanics, self-assembly and nanoscale material structures to show how nanoscale materials can be developed with properties that are significantly different from those of bulk materials. They will be able to apply physical and chemical principles related to thermodynamics, mechanics, optics and fluids, among others, to propose potential designs of novel nanoscale materials. In their case history projects, the students will apply these designs to an engineering application of their choice.

Evaluation Methods:
Include a statement that explains how the achievement of the educational objective identified above will be assessed. The procedures for determining students’ grades should be specifically identified.
The course evaluation methods will be one exam/semester, one case history study/semester, and 6 homework assignments/semester. The exam will have a weight of 20%, the case history will have a weight of 50%, and the block of 6 homework assignments will have a weight of 30%.

Relationship/Linkage of Course to Other Courses:
This statement should relate the course to existing or proposed new courses. It should provide a rationale for the level of instruction, for any prerequisites that may be specified, or for the course’s role as a prerequisite for other courses.
E SC 520 requires E SC 412 as a co-requisite. E SC 412 covers the safety, health, and environmental issues arising from the materials, structures, systems, equipment, and infrastructures encountered in engineering practice at the nano-scale.
Relationship of Course to Major, Option, Minor, or General Education:
This statement should explain how the course will contribute to the major, option, or minor and indicate how it may function as a service course for other departments.
E SC 520 is a required core for the proposed one-year, resident non-thesis Master of Science degree in Engineering at the Nano-scale.

A description of any special facilities:
The Teaching/Videoing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be used in this course for demonstrations.

Frequency of Offering and Enrollment:
It is anticipated that this course will be offered every Fall. The enrollment is anticipated to be 20 students/offerings.

Justification for Changing The Proposal:
Include a justification for each change to the course. Particular attention should be paid to the effects of the course change within the discipline and in other disciplines where the course may be required within a major or used as a service course. When a unit submits several course changes, with or without new course proposals, a general statement covering the programmatic effects of the changes should be submitted.
The Graduate Council Joint Curricular Committee requested the change to cross list this course with the new program code (NANO 520) created for the new Engineering at the Nano-scale program.

Review History
This section represents all consultation history that has occurred on this proposal

Legend

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Consultation

Recipient Name: OSAMA AWADELKARIM
Department: Engineering Science And Mechanics
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: DIR. CTR NANO ED & UTILIZ

Request sent: 8/4/2016 at 8:49 AM
Concur: Yes
Comments:
Reviewed On: 8/4/2016 at 9:10 AM

Head of Department

Recipient Name: JUDITH TODD
Department: (Not Available)
Position: Head of Department  
Campus: UNIVERSITY PARK CAMPUS

Title:

Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

SCCA Representative

Recipient Name: ERIC DONNELL  
Department: (Not Available)

Position: SCCA Representative  
Campus: UNIVERSITY PARK CAMPUS

Title:

Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

Dean of the College

Recipient Name: PETER BUTLER  
Department: (Not Available)

Position: Dean of the College  
Campus: UNIVERSITY PARK CAMPUS

Title:

Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

Review on Behalf of the Dean of the Graduate School

Recipient Name: VICKI HEWITT  
Department: (Not Available)

Position: Review on Behalf of the Dean of the Graduate School  
Campus: UNIVERSITY PARK CAMPUS

Title:

Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]
Feedback from the Graduate Council Joint Curricular Committee

Recipient Name: ROBERT BANNON  
Department: (Not Available)  
Position: Feedback from the Graduate Council Joint Curricular Committee  
Campus: (Not Available)  
Title:  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]  

Publication in the Senate Curricular Report

Recipient Name: CORTNEY SMITH  
Department: (Not Available)  
Position: Publication in the Senate Curricular Report  
Campus: (Not Available)  
Title:  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]  

Recipient Name: KADI CORTER  
Department: (Not Available)  
Position: Publication in the Senate Curricular Report  
Campus: (Not Available)  
Title:  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]  

Curricular Information

Blue Sheet Item #:  
Review Date:  

SCRID Numbers

(ESC 520):  
( ):
Graduate Council Subcommittee On New And Revised Programs and Courses

COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
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<td>WOOK JUN NAM</td>
<td>wxn105</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
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College with curricular responsibility: Engineering (EN)

Type of Proposal: □ Add [X] Change □ Drop

Current Bulletin Listing

Abbreviation: ESC

Number: 521

Course Designation

(ESC 521) Pattern Transfer at the Nano-scale

Course Information

Cross-Listed Courses:

NANO 521(EN)

Prerequisites:

Corequisites:

Concurrents:

ESC 412, ESC 520

Recommended Preparations:

Abbreviated Title: NANO PATTERN TRANS

This course will be delivered:

[X] in residence

[X] off-site

[X] online

Bulletin Listing

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<td>Department with Curricular Responsibility:</td>
<td>()</td>
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<tr>
<td>Short Description:</td>
<td>Pattern transfer approaches for bottom-up, top-down, and hybrid fabrication at the nano-scale.</td>
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</table>
Course Outline

A brief outline or overview of the course content:
1. Pattern Design
   1.1 Pattern definition
   1.2 Design simulation
2. Photon-based pattern transfer
   2.1 Nano-scale UV lithography
      2.1.1 Geometrical/physical optics
      2.1.2 Light sources and their wavelengths
      2.1.3 Resists and resist development
      2.1.4 Immersion lithography
      2.1.5 Contact lithography
      2.1.6 Proximity lithography
      2.1.7 Projection lithography
      2.1.8 Extreme ultra violet (EUV) lithography
   2.2 Nano-scale x-ray lithography
      2.2.1 Resists and resist development for x-ray lithography
   2.3 Laser lithography
3 Particle-based pattern transfer
   3.1 Electron beam lithography
      3.1.1 Systems
      3.1.1.1 Beam source
      3.1.1.2 Beam control
      3.1.1.3 Electron projection lithography
      3.1.1.4 Multiple e-beam lithography
   3.2 Ion beam lithography
   3.3 Neutral Particle Lithography
   4 Physical-contact pattern transfer
   4.1 Nano-imprinting lithography
      4.1.1 Thermal nano-imprinting lithography
      4.1.1.1 Systems
      4.1.1.1.1 Piston type
      4.1.1.1.2 Air cushion press
      4.1.1.1.3 Pattern alignment
      4.1.1.2 Resist—physics and chemistry
      4.1.1.2.1 Thermo plastics
      4.1.1.2.2 Glass transition temperature
      4.1.1.3 Master molds
   4.1.2 UV nano-imprinting lithography (NIL)
      4.1.2.1 Systems
      4.1.2.1.1 UV nano-imprinting
      4.1.2.1.2 Step-and-Flesh UV nano-imprinting
   4.1.2.2 Resist—physics and chemistry
      4.1.2.2.1 Pattern alignment
   4.1.2.3 Master molds
   4.2 Nano-molding pattern transfer
   4.3 Scanning probe lithography
5. Chemical pattern transfer
   5.1 Molecular self-assembly lithography
      5.1.1 Materials
   5.1.2 Process steps
   5.2 Block co-polymer lithography
6. Some other techniques
   6.1 Nano-sphere lithography
   6.2 Magnetolithography

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
1. Pattern design. (1 week)
2. Photon pattern transfer. (5 weeks)
3. Review and Midterm Exam (1 week)
4. Particle pattern transfer. (4 weeks)
5. Physical-contact pattern transfer. (2 weeks)
6. Chemical pattern transfer. (1 week)
7. Other pattern transfer techniques. (1 week)

Long Course Description:
Engineering at the nano-scale often requires creating and then transferring a pattern when fabricating a desired nano-scale structure. This course explores the basic processes of pattern design and then addresses the techniques used to transfer a nano-scale pattern to a surface or structure. The course looks into pattern transfer techniques that employ particles, photons, and additional chemical and physical means as the transfer mechanisms. Included in the photon approaches are studies of deep UV and X-ray pattern transfer. Particle transfer mechanisms discussed include ion and neutral particle approaches. Physical-contact pattern transfer is also explored including discussions of nano-imprinting lithography, nano-molding lithography, and scanning probe lithography. Chemical pattern transfer is another approach to pattern transfer and one that uniquely uses chemical processes to create patterns. Examples to be discussed in this course include molecular self-assembly lithography and block co-polymer lithography. Emerging pattern transfer techniques, such as magneto-lithography, will be included in E SC 521 for completeness. In many of these pattern transfer methodologies, a “writing” of the transferring pattern into some intermediary medium termed a resist is required. In pattern technologies requiring resists, the resist materials and their positioning as well as required physical and chemical properties will be discussed.

The name(s) of the faculty member(s) responsible for the development of the course:

- Name: WOOK NAM (wxn105)
  Title: Assistant Professor
  Phone: +1 814 865 9081
  Address: 0212Q EARTH & ENGR SCIENCES
  Campus: University Park
  City: University Park
  Fax:

- Name: STEPHEN JOSEPH FONASH (sjf2)
  Title: KUNKLECHAIR PROF EMERITUS
  Phone: +1 814 865 4931
  Address: 0118 RES BL WEST UNIVERSITY PARK UNIVERSITY PARK, PA 16802
  Campus: University Park
  City: University Park
  Fax:

Course Justification

Instructional, Educational, and Course Objectives:
This section should define what the student is expected to learn and what skills the student will develop.
The instructional objectives include effectively employing the usual vehicles of lectures and textbook assignments but also effectively utilizing (1) hands-on experiences and cleanroom demonstrations as well as journal literature as a viable teaching instruments.

The Teaching/Videoing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and student utilization. Students will be required to employ engineering and scientific journal articles in the readings, home work, and exams of this course. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the instructional objectives.

The educational objectives of this course focus on conveying the unique issues encountered and the unique tools and materials employed in pattern transfer at the nano-scale.

After successfully completing this course, a student will be able to design, simulate and transfer nanoscale patterns using photon, particle, physical contact, chemical, and other emerging and advanced pattern transfer techniques.

Evaluation Methods:
Include a statement that explains how the achievement of the educational objective identified above will be assessed.
The procedures for determining students’ grades should be specifically identified. The course evaluation methods will be of two types: (1) two in-class examinations/semester and (2) six written homework assignments/semester. Each exam and the block of 6 homework assignments will have a weight of 33%.

Relationship/Linkage of Course to Other Courses:
This statement should relate the course to existing or proposed new courses. It should provide a rationale for the level of instruction, for any prerequisites that may be specified, or for the course’s role as a prerequisite for other courses. E SC 412 and E SC 520 are co-requisites for E SC 521. Students take the equipment and materials safety, health, and environmental issues course (E SC 412) concurrently with E SC 521.

Relationship of Course to Major, Option, Minor, or General Education:
This statement should explain how the course will contribute to the major, option, or minor and indicate how it may function as a service course for other departments. E SC 521 is a required core course for the proposed one-year, resident, non-thesis Master of Science degree in Engineering at the Nano-scale.

A description of any special facilities:
The Teaching/Videoing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and hands-on experiments.

Frequency of Offering and Enrollment:
It is anticipated that this course will be offered every Fall semester. The first offering is proposed for Fall, 2016. The enrollment is anticipated to be 20 students/offering.

Justification for Changing The Proposal:
Include a justification for each change to the course. Particular attention should be paid to the effects of the course change within the discipline and in other disciplines where the course may be required within a major or used as a service course. When a unit submits several course changes, with or without new course proposals, a general statement covering the programmatic effects of the changes should be submitted. The Graduate Council Joint Curricular Committee requested the change to cross list this course with the new program code (NANO 521) created for the new Engineering at the Nano-scale program.

Review History
This section represents all consultation history that has occurred on this proposal

Legend

Approve  Rejected  Waiting Review  User Action Required
Pending Action(s)  Moved to Rejected Status  Approved  (#) - Review Order Sequence Number

Consultation

Recipient Name: WOOK JUN NAM  Department: ENGINEERING SCIENCE AND MECHANICS
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: Assistant Professor

Request sent: 4/26/2016 at 2:34 PM
Concur: Yes
Comments:
Reviewed On: 4/26/2016 at 2:41 PM

Head of Department

Recipient Name: JUDITH TODD
Position: Head of Department
Title:
Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

SCCA Representative

Recipient Name: ERIC DONNELL
Position: SCCA Representative
Title:
Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Dean of the College

Recipient Name: PETER BUTLER
Position: Dean of the College
Title:
Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS
Review on Behalf of the Dean of the Graduate School

Recipient Name: VICKI HEWITT
Department: (Not Available)
Position: Review on Behalf of the Dean of the Graduate School
Campus: UNIVERSITY PARK CAMPUS

Title:

Feedback from the Graduate Council Joint Curricular Committee

Recipient Name: ROBERT BANNON
Department: (Not Available)
Position: Feedback from the Graduate Council Joint Curricular Committee
Campus: (Not Available)

Title:

Publication in the Senate Curricular Report

Recipient Name: CORTNEY SMITH
Department: (Not Available)
Position: Publication in the Senate Curricular Report
Campus: (Not Available)

Title:
Curricular Information

Blue Sheet Item #: 
Review Date:

SCRID Numbers

(ESC 521):
(NANO 521):
Graduate Council Subcommittee On New And Revised Programs and Courses

COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

<table>
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<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
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<tr>
<td>Wook Jun Nam</td>
<td>wxn105</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
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</table>

College with curricular responsibility: Engineering (EN)

Type of Proposal: [ ] Add  [x] Change  [ ] Drop

Course Designation

(ESC 522) Fabrication and Characterization for Top-down Nano-manufacturing

Course Information

Cross-Listed Courses:
NANO 522(EN)

Prerequisites:
ESC 412, ESC 520, ESC 521

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Top-down Nano-MFG

This course will be delivered:

- [x] in residence
- [x] off-site
- online

Bulletin Listing

Minimum Credits: 3
Maximum Credits: 3
Repeatable: NO

Department with Curricular Responsibility:

Short Description: Processing and characterization used in the engineering practice of top-down nano-technology. There are two broad approaches to fabrication and manufacturing at the nano-scale. These are bottom-up and top-down nanofabrication. These two approaches are complimentary, with the former having strong ties to biology and the
latter having very strong ties to traditional semiconductor processing. EC 522 focuses on top-down nanofabrication, which itself makes use of two distinct approaches: additive processes and subtractive processes. These are studied in detail in this course by first focusing on the additive processes which deposit or grow materials. The effort then shifts to the subtractive processes which remove materials with a mixture of chemistry and physics, in techniques varying from wet chemical etching to deep ion etching. Achieving nano-scale features with top down techniques is controllable and verifiable with today’s characterization techniques. This control and verification aspect is an integral part of top-down fabrication at the nano-scale. Characterization tools commonly used in top-down nanofabrication are discussed in this course in the context of process development and manufacturing. These tools include optical microscopies, electron and ion beam microscopies, spectroscopies, and scanning probe techniques.

Effective Semester: FA 2016
Travel Component: NO

Course Outline

A brief outline or overview of the course content:
1. Top-down nanofabrication
   1.1 Advantages
   1.2 Disadvantages

2. Additive Processing
   2.1 Attributes
   Crystal structure; Composition; Grains; Defects; Adhesion and Interfacial Properties; Stress; Thermodynamics; Kinetics; Nucleation; Phase Formation; Atomic Diffusion; Bonding.

   2.2 Growth and deposition
   2.2.1 Physical Vapor Deposition (PVD)
   Evaporation, Sputtering
   2.2.2 Chemical Vapor Deposition (CVD)
   Plasma Enhanced CVD (PECVD); Low Pressure CVD (LPCVD); Molecular Beam Epitaxy (MBE); Metal-Organic Epitaxy (MOE); Organo-Metallic Vapor Phase Epitaxy (OMVPE)
   2.2.3 Electroplating
   2.2.4 Atomic Layer Deposition
   2.2.5 Spin–On and spray processes

   2.3 Growth and Deposition Properties
   Deposition/growth rate; Thickness Control; Film Uniformity; Step coverage

3. Subtractive Processing
   3.1 Etching
   3.1.1 Nomenclature and Definitions
   Isotropic and Anisotropic effects; Selectivity; Etch Rate; Etch Uniformity; Aspect Ratio
   3.1.2 Wet etching
   Chemistries; Limitations; Doping-Selective Etching; Orientation- Dependent Etching
   3.1.3 Dry Etching
   Plasma and Plasma Parameters; Plasma Etching; Reactive Ion Etching; Sputter Etching; Focused Ion Beam (FIB) etching

4. Machining
   4.1 Bulk
   Wet and Dry Etching -Based Machining; Etch-Stop Techniques
   4.2 Surface Machining
   4.3 Bonding
   Fusion Bonding; Anodic Bonding

5. Characterization
   5.1 Basic Techniques
   Optical Microscopy; Profilometry; Ellipsometry; Contact Angle; Film Stress; Sheet Resistance
   5.2 Spectroscopy Techniques
Reflective Spectroscopy; Fourier transform infrared spectroscopy; UV-vis Spectrophotometry; X-Ray Photoelectron Spectroscopy; Raman Spectroscopy; Transient Capacitance/Current Spectroscopies; Energy Dispersive Spectroscopy; Auger Electron Spectroscopy; Photoelectron Spectroscopy

5.3 Microscopy Techniques
Scanning Electron Microscopy; Field Emission Scanning Electron Microscopy; Transmission Electron Microscopy; Scanning Tunneling Microscopy; Atomic Force Microscopy

5.4 Milling techniques
Secondary Ion Mass Spectrometry

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
1. Additive processes. (5 weeks)
2. Subtractive processes. (5 weeks)
3. Review and Midterm Exam (1 week)
4. Machining. (1 week)
5. Characterization. (3 weeks)

Long Course Description:
There are two broad approaches to fabrication and manufacturing at the nano-scale. These are bottom-up and top-down nanofabrication. These two approaches are complimentary, with the former having strong ties to biology and the latter having very strong ties to traditional semiconductor processing. E SC 522 focuses on top-down nanofabrication, which itself makes use of two distinct approaches: additive processes and subtractive processes. These are studied in detail in this course by first focusing on the additive processes which deposit or grow materials. The effort then shifts to the subtractive processes which remove materials with a mixture of chemistry and physics, in techniques varying from wet chemical etching to deep ion etching. Achieving nano-scale features with top down techniques is controllable and verifiable with today’s characterization techniques. This control and verification aspect is an integral part of top-down fabrication at the nano-scale. Characterization tools commonly used in top-down nanofabrication are discussed in this course in the context of process development and manufacturing. These tools include optical microscopies, electron and ion beam microscopies, spectroscopies, and scanning probe techniques.

The name(s) of the faculty member(s) responsible for the development of the course:
- Name: WOOK JUN NAM (wxn105)
  Title: Assistant Professor
  Phone: +1 814 865 9081
  Address: 303 EARTH & ENGR SCIENCES
  Campus: University Park
  City: University Park
  Fax:

- Name: OSAMA O AWADELKARIM (ooa1)
  Title: DIR. CTR NANO ED & UTILIZ
  Phone: +1 814 863 1773
  Address: 0212 EARTH & ENGR SCIENCES UNIVERSITY PARK UNIVERSITY PARK, PA 16802
  Campus: University Park
  City: University Park
  Fax:

- Name: STEPHEN JOSEPH FONASH (sjf2)
  Title: KUNKLECHAIR PROF EMERITUS
  Phone: +1 814 865 4931
  Address: 0118 RES BL WEST UNIVERSITY PARK UNIVERSITY PARK, PA 16802
  Campus: University Park
  City: University Park
  Fax:
Course Justification

Instructional, Educational, and Course Objectives:
This section should define what the student is expected to learn and what skills the student will develop.
The instructional objectives include effectively employing the usual vehicles of lectures and textbook assignments but also effectively utilizing cleanroom demonstrations and student hands-on work as well as journal literature as viable teaching instruments. The Teaching/Videoging Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and hands-on experiences. Students will be required to employ engineering and scientific journal articles in the readings, homework, and exams of this course. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the instructional objectives.

The educational objectives include conveying (1) the breadth of processing diversity provided by using top-down nanofabrication, (2) the advantages of top-down nano-scale processing in certain situations and (3) the importance of characterization in top-down processing control and verification.

The course objective is to develop engineers working at the nano-scale who are fully cognizant of the potential and of issues related to top-down nanofabrication techniques.

After successfully completing this course, a student will be able to deposit, etch and characterize nano-scale materials, devices, and systems made using top-down fabrication techniques.

Evaluation Methods:
Include a statement that explains how the achievement of the educational objective identified above will be assessed. The procedures for determining students’ grades should be specifically identified.
The course evaluation methods will be of two types: (1) two examinations (midterm and final); and (2) six written homework assignments. Each exam will have a weight of 20% (total 40%) and the block of 6 homework assignments will have a weight of 10% each (total 60%).

Relationship/Linkage of Course to Other Courses:
This statement should relate the course to existing or proposed new courses. It should provide a rationale for the level of instruction, for any prerequisites that may be specified, or for the course’s role as a prerequisite for other courses.
E SC 522 builds on the core courses E SC 412, 520, and 521, which are prerequisites for E SC 522.

While some of the topics in E SC 522 may be thought to overlap material in other MatSE and E SC courses, MatSE 450 and MatSE 545 do not provide significant hands-on practice at the nano-scale. Further, E SC 522 deals with the top-down fabrication and characterization of nano-scale engineering structures made from polymers, electronic, and biomaterials. The emphasis is not solely on semiconductors. E SC 522 has three distinguishing features from the above courses: deposition and etching applied to nano-scale structures, characterization of nano-scale structures (did you make what you are trying to make), and actual hands-on practice at the nano-scale.

The proposed one year, resident, non-thesis Master of Science degree program is designed such that a student may pursue a materials emphasis, if desired, by following the exemplary elective materials courses in the degree proposal or by substituting other elective material courses that are approved by the MS Nano Director. For example, MatSE 545 would be an appropriate elective course for students taking the Materials Emphasis.

Course descriptions highlighting the differences between E SC 522, E SC 577, E SC 523, MatSE 450/E SC 450 and MatSE 545/E E 545 are included below.

E SC 522 Fabrication and Characterization for top-down nano-manufacturing: Hands-on coverage of the various approaches to fabrication and characterization for top-down nanotechnology manufacturing.

E SC 577 Engineered Thin Films: Broad overview of the preparation-characterization-property relationships for thin films used in a wide range of industrial applications.

E SC 523 Fabrication and Characterization for bottom-up nano-manufacturing: Hands-on coverage of the various approaches to fabrication and characterization for bottom-up as well as bio-inspired nanotechnology.

E SC 450 (MATSE 450) Synthesis and Processing of Electronic and Photonic Materials: The materials science of applying thin film coatings, etching, and bulk crystal growth; includes materials transport, accumulation, epitaxy, and defects.
MATSE 545 (E E 545) Semiconductor Characterization: Physical principles and experimental methods used to characterize the electrical, optical, structural, and chemical properties of semiconductor materials.

Relationship of Course to Major, Option, Minor, or General Education:
This statement should explain how the course will contribute to the major, option, or minor and indicate how it may function as a service course for other departments.
This proposed E SC 522 is one of 5 courses required for the proposed one-year, resident, non-thesis Master of Science degree in Engineering at the Nano-scale.

A description of any special facilities:
The Teaching/Videoing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and hands-on experiences.

Frequency of Offering and Enrollment:
It is anticipated that this course will be offered every Spring. The enrollment is anticipated to be 20 students/offering.

Justification for Changing The Proposal:
Include a justification for each change to the course. Particular attention should be paid to the effects of the course change within the discipline and in other disciplines where the course may be required within a major or used as a service course. When a unit submits several course changes, with or without new course proposals, a general statement covering the programmatic effects of the changes should be submitted.
The Graduate Council Joint Curricular Committee requested the change to cross list this course with the new program code (NANO 522) created for the new Engineering at the Nano-scale M.S. program.

Review History
This section represents all consultation history that has occurred on this proposal

Legend
- Approve
- Rejected
- Waiting Review
- User Action Required
- Pending Action(s)
- Moved to Rejected Status
- Approved
- (#) - Review Order Sequence Number

Consultation

Recipient Name: WOOK JUN NAM
Department: Engineering Science And Mechanics
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: Assistant Professor

Request sent: 5/9/2016 at 10:12 AM
Concur: Yes
Comments:
Reviewed On: 5/9/2016 at 10:15 AM

Head of Department
Recipient Name: JUDITH TODD  
Position: Head of Department  
Title:  
Department: (Not Available)  
Campus: UNIVERSITY PARK CAMPUS  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

Recipient Name: JUDITH TODD  
Position: Head of Department  
Title:  
Department: (Not Available)  
Campus: UNIVERSITY PARK CAMPUS  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

SCCA Representative

Recipient Name: ERIC DONNELL  
Position: SCCA Representative  
Title:  
Department: (Not Available)  
Campus: UNIVERSITY PARK CAMPUS  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

Dean of the College

Recipient Name: PETER BUTLER  
Position: Dean of the College  
Title:  
Department: (Not Available)  
Campus: UNIVERSITY PARK CAMPUS  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]
Review on Behalf of the Dean of the Graduate School

Recipient Name: VICKI HEWITT  
Department: (Not Available)  
Position: Review on Behalf of the Dean of the Graduate School  
Campus: UNIVERSITY PARK CAMPUS

Title:

Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

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Feedback from the Graduate Council Joint Curricular Committee

Recipient Name: ROBERT BANNON  
Department: (Not Available)  
Position: Feedback from the Graduate Council Joint Curricular Committee  
Campus: (Not Available)

Title:

Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

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Publication in the Senate Curricular Report

Recipient Name: CORTNEY SMITH  
Department: (Not Available)  
Position: Publication in the Senate Curricular Report  
Campus: (Not Available)

Title:

Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

Recipient Name: KADI CORTER  
Department: (Not Available)  
Position: Publication in the Senate Curricular Report  
Campus: (Not Available)

Title:

Concur: [Not Yet Reviewed]
Curricular Information

Blue Sheet Item #: 
Review Date:

SCRID Numbers

(ESC 522):
(NANO 522):
Graduate Council Subcommittee On New And Revised Programs and Courses

COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
<th>Department</th>
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<tbody>
<tr>
<td>WOOK JUN NAM</td>
<td>wxn105</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
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College with curricular responsibility: Engineering (EN)

Type of Proposal: □ Add □ Change [X] Drop

Course Designation

(ESC 523) Fabrication and Characterization for Bottom-up Nano-manufacturing

Course Information

Cross-Listed Courses:

NANO 523(EN)

Prerequisites:

ESC 412, ESC 520, ESC 521

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Bottom-up Nano-MFG

This course will be delivered:

[□] in residence

[□] off-site

[□] online

Bulletin Listing

Minimum Credits: 3

Maximum Credits: 3

Repeatable: NO

Department with Curricular Responsibility: ()

Short Description:

Processing and characterization used in the engineering practice of bottom-up nanotechnology. There are two broad approaches to fabrication and manufacturing at the nano-scale: bottom-up and top-down nanofabrication. These are complimentary with the former having strong ties to biology and the latter having strong ties to...
traditional semiconductor processing. E SC 523 focuses on the bottom-up approaches, which provide an increasingly important alternative to top-down techniques. Bottom-up approaches to nano-scale fabrication mimic nature in harnessing fundamental chemical or physical forces operating at the nano-scale to assemble basic units into larger structures. The bottom-up, or self-assembly, techniques explored in this course cover material synthesis, structure fabrication, and material and structure characterization. The production of 0-D, 1-D, 2-D, and 3-D materials will be discussed and then the assembly of these materials into structures will be explored. Fabrication topics to be covered will include block co-polymer manipulation, vapor-liquid-solid growth, the Langmuir-Blodgett technique, surface functionalization, molecular self-assembly, DNA Origami, and bacterial and viral assembly. The characterization techniques to be covered will include those emerging tools capable of ultra-precise resolution such as tip-enhanced Raman scanning microscopy, scanning helium ion microscopy, and magnetic resonance sub-nanometer imaging.

Effective Semester: FA 2016
Travel Component: NO

Course Outline

A brief outline or overview of the course content:
1.0 Synthesis, Properties, Function
1.1 0-D, 1-D, 2-D, and 3-D materials
   1.1.1 Inorganic nano-particles, wires, sheets, and films
     1.1.1.1 Metal material synthesis
     1.1.1.2 Semiconductor material synthesis
     1.1.1.3 Dielectric material synthesis
     1.1.1.4 Carbon forms: bucky balls, nanotubes, graphene
     1.1.1.5 Sol-gels
   1.1.2 Organic nano-particles, wires, sheets, and films
     1.1.2.1 Viruses
     1.1.2.2 Proteins
     1.1.2.3 Liposome nano-particles
   1.2 Nanostructured composites

2.0 Bottom-up fabrication and functionalization
2.1 Block co-polymer manipulation
2.2 Vapor-liquid-solid growth
2.3 Langmuir-Blodgett technique
2.4 Surface functionalization—why and how
2.5 Molecular self-assembly
2.6 2-D material assembly

3.0 Bio-inspired bottom-up processing
3.1 Bacterial and viral processing
3.2 DNA Origami

4.0 Some tools for characterizing bottom-up materials and structures
4.1 Tip-Enhanced Raman Scanning microscopy
4.2 Scanning helium ion microscopy
4.3 Magnetic resonance sub-nanometer imaging

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
1. Synthesis, and properties of nano-scale materials and structures. (5 weeks)
2. Review and Midterm Exam (1 week)
3. Bottom-up fabrication and functionalization. (5 weeks)
4. Bio-inspired bottom-up processing. (2 weeks)
5. Tools for characterizing bottom-up materials and structure. (2 weeks)

Long Course Description:
There are two broad approaches to fabrication and manufacturing at the nano-scale: bottom-up and top-down nanofabrication. These are complimentary with the former having strong ties to biology and the latter having strong ties to traditional semiconductor processing. E SC 523 focuses on the bottom-up approaches, which provide an increasingly important alternative to top-down techniques. Bottom-up approaches to nano-scale fabrication mimic nature in harnessing fundamental chemical or physical forces
Course Justification

Instructional, Educational, and Course Objectives:
This section should define what the student is expected to learn and what skills the student will develop.

The instructional objectives include effectively employing the usual vehicles of lectures and textbook assignments but also effectively utilizing cleanroom demonstrations as well as student hands-on activities and journal literature as viable teaching instruments. The Teaching/Videing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and hands-on experiences. Students will be required to employ engineering and scientific journal articles in the readings, homework, and exams of this course. This is a 500-level course and consequently proficiency in journal article reading, understanding, and utilization will be integral to the instructional objectives.

The educational objectives include conveying (1) the unique attributes of the nano-scale and their causes, (2) the breath of processing diversity provided by using bottom-up nanotechnology, (3) the advantages of bottom-up nano-scale processing in certain situations, and (4) the ties between biology and bottom-up synthesis and fabrication.

The course objective is to develop engineers working at the nano-scale who are cognizant of bottom-up nanofabrication, of its ties to biology, and of its emerging characterization approaches.

After successfully completing this course, a student will be able to synthesize, functionalize, and characterize nano-scale materials, devices, and systems using bottom-up fabrication techniques.

Evaluation Methods:
Include a statement that explains how the achievement of the educational objective identified above will be assessed.
The procedures for determining students' grades should be specifically identified. The course evaluation methods will be of two types: (1) two in-class examinations/semester (60%) and (2) six written homework assignments/semester. (40%)

Relationship/Linkage of Course to Other Courses:
This statement should relate the course to existing or proposed new courses. It should provide a rationale for the level of instruction, for any prerequisites that may be specified, or for the course's role as a prerequisite for other courses. This course builds on the core courses E SC 412, 520, and 521. The students will take the equipment and materials safety, health, and environmental issues course (E SC 412), fundamental science background course (E SC 520), and the pattern generation course (E SC 521) concurrent with, or before, the proposed E SC 523.

Chem 511 Chemical Nanoscience covers the fundamental chemistry of nanoparticle synthesis. E SC 523 differs from this course in its engineering emphasis on bottom-up self-assembly and in its much broader range of materials and nanostructures covering inorganic as well as organic and biological nanostructures.

Relationship of Course to Major, Option, Minor, or General Education:
This statement should explain how the course will contribute to the major, option, or minor and indicate how it may function as a service course for other departments. This proposed E SC 523 is one of 5 core courses required for the proposed one-year, resident, non-thesis Master of Science degree in Engineering at the Nano-scale.

A description of any special facilities:
The Teaching/Videointing Nanotechnology cleanroom of the Center for Nanotechnology Education and Utilization (CNEU) will be extensively used in this course for material property and processing demonstrations and hands-on experiences.

Frequency of Offering and Enrollment:
It is anticipated that this course will be offered every Spring. The enrollment is anticipated to be 20 students/offering.

Justification for Changing The Proposal:
Include a justification for each change to the course. Particular attention should be paid to the effects of the course change within the discipline and in other disciplines where the course may be required within a major or used as a service course. When a unit submits several course changes, with or without new course proposals, a general statement covering the programmatic effects of the changes should be submitted. The Graduate Council Joint Curricular Committee requested the change to cross list this course with the new program code (NANO 523) created for the new Engineering at the Nano-scale M.S. program.

Review History
This section represents all consultation history that has occurred on this proposal

Legend

- Approve
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- Approved
- (#) - Review Order Sequence Number

Consultation

Recipient Name: WOOK JUN NAM
Department: Engineering Science And Mechanics
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: Assistant Professor

(1) Request sent: 5/9/2016 at 10:47 AM
Concur: Yes
Comments:
Reviewed On: 5/9/2016 at 10:51 AM

Head of Department

Recipient Name: JUDITH TODD
Department: (Not Available)
Position: Head of Department
Campus: UNIVERSITY PARK CAMPUS
Title:

Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

SCCA Representative

Recipient Name: ERIC DONNELL
Department: (Not Available)
Position: SCCA Representative
Campus: UNIVERSITY PARK CAMPUS
Title:

Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Dean of the College

Recipient Name: PETER BUTLER
Department: (Not Available)
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### Review on Behalf of the Dean of the Graduate School

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<th><strong>Recipient Name:</strong> VICKI HEWITT</th>
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### Feedback from the Graduate Council Joint Curricular Committee

<table>
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<th><strong>Recipient Name:</strong> ROBERT BANNON</th>
<th><strong>Department:</strong> (Not Available)</th>
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<td><strong>Position:</strong> Feedback from the Graduate Council Joint Curricular Committee</td>
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<td><strong>Concur:</strong> [Not Yet Reviewed]</td>
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<td><strong>Comments:</strong> [Not Yet Reviewed]</td>
<td><strong>Reviewed On:</strong> [Not Yet Reviewed]</td>
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### Publication in the Senate Curricular Report

<table>
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<th><strong>Recipient Name:</strong> CORTNEY SMITH</th>
<th><strong>Department:</strong> (Not Available)</th>
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<td><strong>Position:</strong> Publication in the Senate Curricular Report</td>
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<tr>
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<td><strong>Reviewed On:</strong> [Not Yet Reviewed]</td>
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</table>
Recipient Name: KADI CORTER
Position: Publication in the Senate Curricular Report
Department: (Not Available)
Campus: (Not Available)
Title:

Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Curricular Information
Blue Sheet Item #:
Review Date:

SCRID Numbers
(ESC 523):
(NANO 523):