Engineering Faculty Council
Meeting Agenda
August 21, 2018
11:00 a.m.
202 Hammond Building (Stavely Conference Room)

1. Approval of minutes for the meeting of April 17, 2018
2. Dean’s Report
3. Updates from Undergraduate Studies Committee
4. Updates from Graduate Studies Committee
5. Updates from Engineering Technology Committee
6. Updates from Faculty Senate
7. Other Business
Engineering Faculty Council  
Meeting Minutes  
April 17, 2018  
11:00 a.m.  
202 Hammond Building (Stavely Conference Room)

1. Revised multiple student policies on repeating courses, recovering from absences, successful interventions, warnings, suspensions,
2. Modifications to Faculty Senate constitution and bylaws on protocols for submitting amendments, minor modifications to proposals in subcommittees, new Vice-chair position,
3. Two permanent vice chair positions to handle approvals of policies for increased throughput
4. Modifications to 1.5% fee per month penalties on LionPath late payments. Proposed cap of $200 late fee.
5. Recommendations for standardizing teaching and research release for officer positions.
6. Updated language to clarify Senate faculty bylaws language
7. Retiring AC24 policy on professional titles. The newly approved AC21 policy states that positions have one rank and one corresponding title, precluding the need for AC24.
8. Number of high school students taking PSU courses have declined.
9. Presentation on Red Boulder initiative
10. All-In Video through World Campus program
11. Updates on travel health insurance & informational presentation
12. Report on Faculty salaries will be announced
13. Report on Supporting international students at Penn State will be released. There has been a reduction in the number of international applicants. Increase in the number of out-of-state domestic applications.
14. World Campus presentation (20th anniversary), 18000 students
15. Discussion of course buy-out policies. Non-conformal practices are being reviewed. A report will be released.
16. A presentation on student time management resources.

Dean’s Report
1. COE Master building plan for 5 years and 10 years out. Estimating the needs across research, teaching, and administrative. Square footage for each type.
2. Did not select candidate yet for multi-cultural engineering director. Hiring is on hold until the Associate Dean for Inclusion & Diversity has been selected, which is currently ongoing.

Graduate Council Update
1. Candidacy exam names are changed to qualifying exams. Annual Comp exam committee must meet with student with brief, written report. Dissertation committee must be created no later than one year before qualifying exam completion.

** Graduate Program Coordinators need to be notified about these proposed changes.
<table>
<thead>
<tr>
<th>ENGR 350 Computational Modeling Methods</th>
<th>Course Change</th>
<th>Description or Rationale for Curricular Actions</th>
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<tbody>
<tr>
<td>ENGR 350 is a required course for the BS in Engineering program offered by Abington, Brandywine, DuBois, and Hazleton campuses for the degree's three options: Alternative Energy and Power Generation, Applied Materials, and Multidisciplinary Engineering Design. This course requires knowledge of computer programming. A recent change in the curriculum allows students to take CMPSC 121, or CMPSC 200, or CMPSC 201 to satisfy the computer programming requirement. CMPSC 131 has been added since it is equivalent to CMPSC 121 and being offered at University Park and other campuses, such as Abington, are considering to teach it instead of CMPSC 121. Therefore, CMPSC 121 or CMPSC 131 is an acceptable course in the program and for the ENGR 350 course. The numerous programming courses allowed as prerequisites is because the course requires knowledge of computer programming. The particular programming language is not important and that is why any of the languages taught in these courses are allowed. Additionally, the Multidisciplinary Engineering Design Option added the course ME 201 as a required course to satisfy the Thermal Science requirement for the option as part of the recent curriculum changes. The ME 201 course also provides the required knowledge in thermal sciences for the ENGR 350 course. Thus, we are requesting to add CMPSC 121, CMPSC 131, and ME 201 as acceptable prerequisites for the ENGR 350 to satisfy the programming and thermal sciences requirements for the course.</td>
<td></td>
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SENATE COMMITTEE ON CURRICULAR AFFAIRS
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>ASAD AZEMI</td>
<td>AXA20</td>
<td>Engineering</td>
<td>Not Available</td>
</tr>
<tr>
<td>IVAN ESPARRAGOZA</td>
<td>IEE1</td>
<td>University</td>
<td>College (UC)</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)

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

I am requesting recertification of this course for the new Gen Ed and/or University Requirements Guidelines
This proposal is for prerequisite enforcement.

Message for Reviewers:

Course Designation

(ENGR 350) Computational Modeling Methods

Course Information

Cross-Listed Courses:

Prerequisites:
EMCH 213, AND ( ME 201; ME 300; EME 301 ) AND ( CMPSC 121; CMPSC 131; CMPSC 200; CMPSC 201; )

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Comp and Mod Meth
Discipline: None
Course Listing:

Special categories for Undergraduate (001-499) courses

Foundations

- Writing/Speaking (GWS)
- Quantification (GQ)

Knowledge Domains

- Health & Wellness (GHW)
- Natural Sciences (GN)
- Arts (GA)
- Humanities (GH)
- Social and Behavioral Sciences (GS)

Additional Designations

- Bachelor of Arts
- International Cultures (IL)
- United States Cultures (US)
- Honors Course
- Common course number - x94, x95, x96, x97, x99
Course Outline

A brief outline or overview of the course content:
This course is focused on mathematical modeling of physical phenomena, and the use of computer simulation for the analysis of solid mechanics and coupled thermal-solid problems. Students will learn basic strategies of computational modeling and the use of commercial computational software for the simulation and analysis of components and complex systems in engineering.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
The following topics are suggested for this course:
- Review of matrix algebra (1 week)
- Introduction to mathematical modeling in engineering (1 week)
- Introduction to computational simulation (1 week)
- One-dimensional problems and trusses (2 weeks)
- Beams and Frames (2 weeks)
- Two-dimensional solid mechanics problems (3 weeks)
- Three-dimensional solid mechanics problems (2 weeks)
- Coupled thermal-solid mechanics problems (2 weeks)
- Case studies in industrial applications (1 week)

Course Description:
Computational Modeling Methods is intended to introduce students to strategies in mathematical modeling of physical phenomena using modern computer simulation software. The course provides theoretical understanding and hands-on experience of the modeling techniques used in current engineering practice and allows students to apply these skills to engineering computational problems. Modeling of engineering processes requires users to have a working knowledge of computer simulation software and modeling techniques such as mesh construction and analysis. This course teaches the principles of mathematical modeling of various physical phenomena and allows students to learn the basic strategies of mathematical modeling and the proper use of computational tools for the analysis of topics involving structural, thermal, and materials engineering.

The name(s) of the faculty member(s) responsible for the development of the course:
- Name: ASAD AZEMI (AXA20)
  Title: Assoc Prof Engineering
  Phone: +1 610 892 1421
  Address: 207L Main Building
  Campus: BW
  City: Media
Instructional, Educational, and Course Objectives:
This section should define what the student is expected to learn and what skills the student will develop.
ENGR 350 is intended to introduce students to mathematical modeling of physical phenomena by utilizing computer simulation software to model and analyze selected engineering topics. Upon completion of the course, students will be able to:
- Compare and discuss modeling techniques.
- Recognize the mathematical and physical principles underlying the computational modeling and simulation.
- Apply basic strategies of mathematical modeling to solve engineering related problems.
- Write computer programs based on numerical methods for solving solid mechanics and coupled thermal-solid mechanics problems.
- Use commercial computer simulation software to solve basic engineering problems in solid mechanics and coupled thermal-solid mechanics.

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.
Achievement of educational outcomes will be through evaluation of homework problems or projects associated with real world engineering problems related to the course topics, and examinations, detailing students understanding of theoretical aspects of modeling topics. Achievement of each educational outcome will be defined through simple rubrics that directly correlate student performance to level of achievement, based upon a traditional point grading scheme. A recommended point-grading scheme follows:
Homework and/or projects (80%)
Exams (20%)

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 requires students to have prior knowledge of computer programming and a high level of understanding of math, physics, and chemistry. The course allows students to visit the theoretical aspects of selected engineering topics before moving onto in-depth courses involving these respective topics to fulfill their track degrees.

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.
ENGR 350 will be a required junior level course in the BS Engineering curriculum and is designed to introduce students to the mathematical modeling of various engineering topics covering fundamentals within designated track courses. The course will fill the gap between the physical sciences (math, physics and chemistry) and the application of these skills to engineering topics by demonstration of modeled outcomes. Additionally, the course will prepare the students in the use of modern computational tools for the solution of complex engineering problems.

A description of any special facilities:
A computer laboratory or other available classrooms with computer facilities operating mathematical modeling based software will be utilized.

Frequency of Offering and Enrollment:
Once a year.

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.
ENGR 350 is a required course for the BS in Engineering program offered by Abington, Brandywine, DuBois, and Hazleton campuses for the degree's three options: Alternative Energy and Power Generation, Applied Materials, and Multidisciplinary Engineering Design. This course requires knowledge of computer programming. A recent change in the curriculum allows students to take CMPSC 121, or CMPSC 200, or CMPSC 201 to satisfy the computer programming requirement. CMPSC 131 has been added since it is equivalent to CMPSC 121 and being offered at University Park and other campuses, such as Abington, are considering to teach it instead of CMPSC 121. Therefore, CMPSC 121 or CMPSC 131 is an acceptable course in the program and for the ENGR 350 course. The numerous programming courses allowed as prerequisites is because the course requires knowledge of computer programming. The particular programming language is not important and that is why any of the languages taught in
these courses are allowed. Additionally, the Multidisciplinary Engineering Design Option added the course ME 201 as a required
course to satisfy the Thermal Science requirement for the option as part of the recent curriculum changes. The ME 201 course also
provides the required knowledge in thermal sciences for the ENGR 350 course. Thus, we are requesting to add CMPSC 121,
CMPSC 131, and ME 201 as acceptable prerequisites for the ENGR 350 to satisfy the programming and thermal sciences
requirements for the course.

Campuses That Have Offered (ENGR 350) Over The Past 4 Years

| semester      | AB | AL | BK | BR | BW | CR | DS | ER | FE | GA | GV | HB | HN | HY | LV | MA | NK | PC | SH | SL | UP | WB | WC | WS | XC | XP | XS | YK |
|---------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Fall 2018     | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Spring 2018   |    | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Fall 2017     | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Spring 2017   |    | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Fall 2016     | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Spring 2016   |    | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Fall 2015     | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Spring 2015   |    | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Spring 2014   |    | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Spring 2013   |    | ☑  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

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: ERIC MARSH
- Department: Mechanical Engineering
- Position: Consultation
- Campus: UNIVERSITY PARK CAMPUS
- Title: PROFESSOR OF MECH ENGR
- Request sent: 3/1/2018 at 1:27 PM
  - Concur: Yes
  - Comments: Reviewed On: 3/1/2018 at 1:35 PM

- Recipient Name: SCARLETT MILLER
- Department: School of Engr Design, Technology and Prof Pgrms
- Position: Consultation
- Campus: UNIVERSITY PARK CAMPUS
- Title: ASST PROF ENGR DESIGN
- Request sent: 3/1/2018 at 1:27 PM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/16/2018 at 7:15 AM

Recipient Name: AB Shafaye
Department: Science, Engineering And Technology
Position: Consultation
Campus: PENN STATE HARRISBURG, THE CAPITAL COLLEGE
Title: EE/EET Programs Chair

Request sent: 3/1/2018 at 1:27 PM
Concur: Yes
Comments:
Reviewed On: 3/6/2018 at 8:46 AM

Recipient Name: AMIT BANERJEE
Department: Science, Engineering And Technology
Position: Consultation
Campus: PENN STATE HARRISBURG, THE CAPITAL COLLEGE
Title: ASSOC PROF OF MECH ENG

Request sent: 3/1/2018 at 1:27 PM
Last sent: 3/12/2018 at 7:30 AM
Concur: Yes
Comments:
Reviewed On: 3/15/2018 at 2:05 PM

Recipient Name: AZAR ESLAM PANAH
Department: Engineering, Business and Human Development
Position: Consultation
Campus: BERKS CAMPUS
Title: ASST PROF MECHANICAL ENG

Request sent: 3/1/2018 at 1:27 PM
Concur: Yes
Comments: This is a great course and very beneficial for the engineering students in all majors to increase their computational thinking. I have two comments regarding the prereqs:

1) As stated in the course description and objectives, "prior knowledge of computer programming is required" for ENGR 350. However, it is not clear if any specific programming language is required for this course. This may cause some problems for those students who take CMPSC 121 but not CMPSC 200, if the examples, HW assignments, and projects are based on MATLAB or any other specific languages. There is no other course that accepts CMPSC 121 instead of CMPSC 200 for the prereq in the engineering programs. Please clarify.

2) It seems ME 201 is accepted instead of ME 300 as the prereq for higher level courses in the ME or ENGR programs. However, the level of knowledge for the fluid dynamics and heat transfer assignments should be adjusted for the ENGR 350, so students with different background do not suffer.
Reviewed On: 3/11/2018 at 2:05 PM

Recipient Name: CHRISTINE MASTERS
Department: Engineering Administration
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASST DEAN
The last three weeks of the course lists the topic as 'Heat transfer, thermal and fluid problems'. However on the 'thermal' part of this is covered in the prerequisites if a student takes ME 300. These students will not have had a background course in fluid mechanics or in heat transfer. Will this put them at a disadvantage?

Also, the developers of this proposal should also consider whether or not CMPSC 131 should be listed as a possible alternative programming prerequisite.
Concur: Yes
Comments:
Reviewed On: 3/1/2018 at 4:26 PM

Recipient Name: IVAN ESPARRAGOZA
Department: UC Engineering
Position: Consultation
Campus: BRANDYWINE CAMPUS
Title: PROFESSOR ENGINEERING

Request sent: 3/1/2018 at 1:27 PM
Concur: Yes
Comments:
Reviewed On: 3/1/2018 at 1:30 PM

Recipient Name: JAMES NEMES
Department: Data Analytics
Position: Consultation
Campus: PENN STATE GREAT VALLEY
Title: PROFESSOR & DAA

Request sent: 3/1/2018 at 1:27 PM
Last sent: 3/12/2018 at 7:30 AM
Concur: Yes
Comments:
Reviewed On: 3/13/2018 at 12:53 PM

Recipient Name: JOSEPH RANALLI
Department: UC Engineering
Position: Consultation
Campus: HAZLETON CAMPUS
Title: ASST PROF ASST PROF ENGR

Request sent: 3/1/2018 at 1:27 PM
Concur: Yes
Comments:
Reviewed On: 3/1/2018 at 1:47 PM

Recipient Name: JUNGWOO RYOO
Department: Business And Engineering
Position: Consultation
Campus: ALTOONA CAMPUS
Title: PROFESSOR OF INFOSCI/TECH

Request sent: 3/1/2018 at 1:27 PM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/16/2018 at 7:15 AM

Recipient Name: KATHRYN JABLOKOW
Department: School of Engr Design, Technology and Prof Prgrms
Position: Consultation
Campus: PENN STATE GREAT
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**Recipient Name:** KENNETH DUDECK  
**Department:** UC Engineering  
**Position:** Consultation  
**Campus:** HAZLETON CAMPUS  
**Title:** ASSOC PROF ENGR

**Recipient Name:** LUCAS PASSMORE  
**Department:** Engineering Science And Mechanics  
**Position:** Consultation  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:** Assistant Professor

**Recipient Name:** Masataka Okutsu  
**Department:** (Not Available)  
**Position:** Consultation  
**Campus:** ABINGTON CAMPUS  
**Title:** Assistant Professor, Engineering

**Recipient Name:** OMID ANSARY  
**Department:** Capital Administration  
**Position:** Consultation  
**Campus:** PENN STATE HARRISBURG, THE CAPITAL COLLEGE  
**Title:** Senior Associate Dean for Academic Affairs

**Recipient Name:**  
**Department:**  
**Position:**  
**Campus:**  
**Title:**
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/16/2018 at 7:15 AM

Recipient Name: ZAFER HATAHET
Department: Abington College (Pre-Major)
Position: Consultation
Campus: ABINGTON CAMPUS
Title: DIV HEAD SCI & ENGINEER

Request sent: 3/1/2018 at 1:28 PM
Last sent: 3/5/2018 at 7:31 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/16/2018 at 7:15 AM

Recipient Name: JOHN HANNAN
Department: Computer Science And Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASC HEAD CMPSCI&ENG

Request sent: 3/14/2018 at 1:32 PM
Concur: Yes
Comments:
Reviewed On: 3/15/2018 at 8:52 AM

Recipient Name: ERIC MARSH
Department: Mechanical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR OF MECH ENGR

Request sent: 3/14/2018 at 1:32 PM
Concur: No, this proposal needs significant changes
Comments: The objectives appear optimistic for a one-semester course. According to items 3-5, students will learn multi-physics modeling, FEA/CFD code writing, usage of commercial FEA/CFD codes, as well as something about numerical methods in 15 weeks. The proposal should explain how this material can be condensed into one course effectively.
Reviewed On: 3/14/2018 at 2:00 PM
Initiator Comments: Thank you for your comments. This course was approved back in 2010 and offered since 2012, we are not requesting a change in the course content. We are only changing/adjusting the prerequisites to follow the program-approved changes and changes in CMPSC course offerings across Penn State. Hopefully, this answers your concerns.

Request sent: 3/14/2018 at 2:11 PM
Last sent: 3/26/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/29/2018 at 7:15 AM

Head of Department
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<tr>
<td>Sven G Bilen</td>
<td>(Not Available)</td>
<td>Head of Department</td>
<td>UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td>ROBERT MELTON</td>
<td>(Not Available)</td>
<td>SCCA Representative</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<tr>
<td>PETER BUTLER</td>
<td>(Not Available)</td>
<td>Dean of the College</td>
<td>UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td>ALLISON ALBINSKI</td>
<td>(Not Available)</td>
<td>SCCA Subcommittee Review</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<td>KADI CORTER</td>
<td>(Not Available)</td>
<td>SCCA Subcommittee Review</td>
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Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]
SCCA Review

Recipient Name: **ALLISON ALBINSKI**
Position: SCCA Review

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

Title:

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

Recipient Name: **KADI CORTER**
Position: SCCA Review

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

Title:

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

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Faculty Senate Review

Recipient Name: **ALLISON ALBINSKI**
Position: Faculty Senate Review

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

Title:

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

Recipient Name: **KADI CORTER**
Position: Faculty Senate Review

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

Title:

Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]
Curricular Information
Blue Sheet Item #:
Review Date:

SCRID Numbers
(ENGR 350):
Proposal ID: 6400 created on 8/16/2018 2:37 PM
Graduate Studies and Research Committee Report
Prepared for EFC Meeting: August 21, 2018

Graduate Faculty Nominations -- Non-Tenure (Informational Only):
Approved (unanimous):
• Micah Shepherd, CatR
• Robert William MacMurray Smith, CatR
• Michal Yukish, CatR
• Tyler Dare, CatR
• Seri Martinelli, CatR
• Christopher Griffin, CatR
• Daniel Brown, CatR-NT

Course Proposals:
Approved (unanimous):
• ME 590 Colloquium_Change (cross-list w/ AMD 590)
• ESC 546 Advanced Metallic Material Feedstocks for Additive Manufacturing_Add
• IE 894 Capstone Design_ADD (Peter Butler advanced to Grad School in May due to this being a common course, so as to not hold up the IE MEng degree proposal for Fall 2018 release)
• CE 522 Traffic Flow Theory and Simulation_Add
• EMCH 501 Mechanics in Emerging Electronics for Biomedicine_Add
• IE 525 to IE 585 Convex Optimization_Change

Program or Certificate Proposals:
Approved (unanimous):
• Additive Manufacturing and Design (AMD Grad Certificate) – forwarded to EFC 7/25/2018 via email for review and approval (no decision)
• Wind Energy (WINDE Grad Certificate)_Change – renewal of sunset date

Summary of Items Approved by the Graduate Studies and Research Committee

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>Justification for Action</th>
<th>NOTES</th>
</tr>
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<tbody>
<tr>
<td>Additive Manufacturing and Design</td>
<td>Certificate Add</td>
<td>The overall goal of the graduate AMD Certificate is to educate post-baccalaureate students and working engineers in the fundamental principles and applications of additive manufacturing. The AMD Certificate provides an entry for industry practitioners and existing workforce to gain knowledge and skills for additive manufacturing. Many workers may already have a graduate-level degree yet seek opportunities for professional development and education, particularly in additive manufacturing and</td>
<td></td>
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</tbody>
</table>
Graduate Studies and Research Committee Report  
Prepared for EFC Meeting: August 21, 2018

| Wind Energy | Certificate Change | Renewal of sunset date.  
The graduate certificate in Wind Energy is designed to provide technical depth in wind-turbine technology and the science of siting turbines. The program is offered by the Department of Aerospace Engineering and is available via enrollment at University Park as well as Penn State's World Campus. To be awarded the Certificate in Wind Energy, students must successfully complete 9 graduate credits with a grade of "C" or better in three required courses. Courses taken in the certificate program may be applied toward the Master of Professional Studies in Renewable Energy and Sustainability Systems (RESS) if the student has earned a B or better in each course, subject to restrictions outlined in the Transfer of Nondegree and Certificate Graduate Credits. Certificate students who wish to have certificate courses applied towards the M.P.S. in RESS must apply and be admitted to that degree program. Admission to the RESS graduate degree program is a separate step and is not guaranteed.  

| ME 590 Colloquium | Course Change | Cross-list w/ AMD 590.  

| ESC 546 Advanced Metallic Material Feedstocks for Additive Manufacturing | Course Add | This course will explore the theoretical frameworks for studying feedstock materials for additive manufacturing. Analytical thinking and creative skills will be emphasized, and the students will be exposed to the latest research literature and explore the frontiers of several disciplines. Skills obtained through this course will be utilized in further research in this field and provide the students with a knowledge base to pursue original research. Cross list with MATSE 546:  

| IE 894 Capstone Design | Course Add | The committee recommended that it be an 800 level course because this is a professional level masters degree. Also, the ultimate goal of this course is to contribute to the student's ability to generate creative approaches for improved professional practice.  
Students will apply the analytical and design skills learned in previous courses to solve an industrial problem based on their workplace or industrial partner.  
They will start with writing a proposal to clearly identify the problem and procedures to be used in solving the problem. The instructor will provide feedback on the approach and allow the students to proceed. Mid-way the
### CE 522 Traffic Flow Theory and Simulation

**Course Add**

This course includes both research-based (traffic flow theory) and practical (simulation) topics. However, the majority of the course will focus on the traffic flow theory and prepare students to conduct academic research into traffic flow on both uninterrupted and interrupted facilities. The simulation tools are presented as a method to study these systems and validate existing and new models and theories. For this research, a 500-level designation is more appropriate.

### EMCH 501 Mechanics in Emerging Electronics for Biomedicine

**Course Add**

The instructional objectives include effectively employing the usual vehicles of lectures and assignments as well as journal literature as a viable teaching instrument.

- Students will be required to employ engineering and scientific journal articles in the readings, homework, and project of this course. 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 mechanics strategies employed in design of emerging electronics.

- After successfully completing this course, a student will be able to design, simulate, and manufacture emerging electronics using mechanics principles (e.g., mechanics of thin film, perturbation method, bending and buckling, energy method, and fracture mechanics), finite element simulation tools, and micro-fabrication techniques (e.g., deposition, photolithography, and etching).

### IE 525 to IE 585 Convex Optimization

**Course Change**

To change the course number from IE 525 to IE 585 in order to cross list with EE 585 (which does not exist yet). This course covers the fundamentals of convex optimization needed for high-level research in theoretical operations research focusing on algorithm design and analysis for IE students, and for high-level research in control systems, signal processing for EE students.
This course will contribute to the student's ability in the aforementioned subdisciplines of IE and EE to expand the frontiers of knowledge, and therefore produce creative scholarly products in mathematical optimization related research.
Proposal Designation: Additive Manufacturing and Design

This is a proposed Add to Graduate Graduate Certificate

Initiators

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMOTHY SIMPSON</td>
<td>tws8</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
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</table>

Academic Home: Engineering (EN)

Outline

Short Title: AMD

Description:

The overall goal of the graduate AMD Certificate is to educate post-baccalaureate students and working engineers in the fundamental principles and applications of additive manufacturing. The AMD Certificate provides an entry for industry practitioners and existing workforce to gain knowledge and skills for additive manufacturing. Many workers may already have a graduate-level degree yet seek opportunities for professional development and education, particularly in additive manufacturing and design. The 12-credit curriculum will expose students to the knowledge and skills necessary to work effectively across AMD domains.

Certificate Type: PUBLIC

Department: Mechanical Engineering (UPEN_ME)

Entrance Requirements:

The admission requirements for the students enrolling in the online AMD Certificate will be based on a combination of academic records, GRE scores, resume and applicable work experience, personal statement of interests, and three letters of recommendation from a previous professor or supervisor who can attest to the applicant’s academic potential. GRE scores will be waived for applicants who have significant work experience (5 years) or completed an existing master’s degree. Applicants will be expected to have a Bachelor of Science or four-year Associate’s degree from an accredited institution in engineering, engineering technology, manufacturing, materials science, or related field. An undergraduate cumulative grade point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required. Each application will be closely reviewed by the AMD Admission Committee. This committee consists of one faculty member from each of the five participating departments: (1) Engineering Science and Mechanics, (2) Industrial and Manufacturing Engineering, (3) Material Science and Engineering, (4) Mechanical and Nuclear Engineering, and (5) School of Engineering Design, Technology, and Professional Programs. International applicants must take and submit scores for the TOEFL (Test of English as a Foreign Language). The minimum acceptable score for the TOEFL is 80 or higher on the internet-based test with a 19 or higher in the speaking section. An acceptable alternative to the TOEFL, which will be accepted, is the International English Language Testing System (IELTS) test, on which a minimum composite score of 6.5 will be required. International applicants are exempt from the TOEFL requirement if they have received a baccalaureate or graduate degree from a college, university, and/or institution in any of the following: Australia, Belize, British Caribbean and British West Indies, Canada (except Quebec), England, Guyana, Republic of Ireland, New Zealand, Northern Ireland, Scotland, the United States and Wales.

Effective Semester: FA 2018

Ending Semester: SU1 2023

Offering Campuses

- WC (WORLD CAMPUS)

Faculty Member(s) in Charge:

- Name: Judith Todd Copley (jat20)
  - Title:
  - Phone:
  - Address:
  - Campus: UP
  - City:
Fax:

Name: Janis P Terpenny (jpt5311)
Title:
Phone:
Address:
Campus: UP
City:
Fax:

Name: Karen Ann Thole (kat18)
Title:
Phone:
Address:
Campus: UP
City:
Fax:

Name: Susan B Sinnott (sbs5563)
Title:
Phone:
Address:
Campus: UP
City:
Fax:

Name: Sven G Bilen (sgb100)
Title:
Phone:
Address:
Campus: UP
City:
Fax:

Name: TIMOTHY SIMPSON (tws8)
Title: PROF ME & IE
Phone: +1 814 863 7136
Address: 0209 LEONHARD BUILDING
Campus:
City:
Fax:

Is not eligible for aid

CIP Code: 149999
IPEDs Type: Post Baccalaureate Certificate

REQUIREMENTS FOR THE CERTIFICATE: (12 Credits)

REQUIRED COURSES (12 credits)

(Choose 12 credits from the following course offerings: EDSGN 562 (4); ESC 545 (4); IE 527 (4); MATSE 567 (4))

Non-Course Requirements

N/A
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:** CATHY HOLISING
  - **Department:** (Not Available)
  - **Position:** Consultation
  - **Campus:** UNIVERSITY PARK CAMPUS
  - **Title:** DIRECTOR, Office for Digital Learning

  **Request sent:** 4/5/2018 at 9:04 AM
  - **Concur:** Yes
  - **Comments:**
  - **Reviewed On:** 4/6/2018 at 10:17 AM

- **Recipient Name:** JANIS TERPENNY
  - **Department:** Industrial And Manufacturing Engineering
  - **Position:** Consultation
  - **Campus:** UNIVERSITY PARK CAMPUS
  - **Title:** DEPT HEAD & PROF INDUSTL

  **Request sent:** 4/5/2018 at 9:04 AM
  - **Concur:** Yes
  - **Comments:**
  - **Reviewed On:** 4/5/2018 at 10:21 AM

- **Recipient Name:** JUDITH TODD
  - **Department:** Engineering Science And Mechanics
  - **Position:** Consultation
  - **Campus:** UNIVERSITY PARK CAMPUS
  - **Title:** HEAD/PROF ESM

  **Request sent:** 4/5/2018 at 9:04 AM
  - **Concur:** Yes
  - **Comments:**
Recipient Name: **KAREN POLLACK**  
Department: Learning And Performance Systems  
Position: Consultation  
Campus: WORLD CAMPUS  
Title: DIR UNDRGRAD ACAD AFFAIRS  
Request sent: 4/11/2018 at 9:24 AM  
Concur: Yes  
Reviewed On: 4/16/2018 at 2:33 PM

Recipient Name: **KAREN THOLE**  
Department: Mechanical Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: DEPT HEAD MNE  
Request sent: 4/5/2018 at 9:04 AM  
Concur: Yes  

Recipient Name: **SUSAN SINNOTT**  
Department: Materials Science And Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: Department Head  
Request sent: 4/5/2018 at 9:04 AM  
Concur: Yes  
Reviewed On: 4/9/2018 at 7:34 PM

Recipient Name: **SVEN BILEN**  
Department: School of Engr Design, Technology and Prof Prgrms  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: DEPT HEAD/SEDTAPP  
Request sent: 4/11/2018 at 9:24 AM  
Concur: Yes
College Administrator Review

Recipient Name: CoE Administrative Review
Position: College Administrator Review
Title: 
Department: (Not Available)
Campus: (Not Available)

Request sent: 4/4/2018 at 10:12 PM
Concur: Yes
Comments: 
- Obtain and show consultation within CRCS from department or program heads whose areas would have interest in or be affected by this certificate offering. Should also include Cathy Holsing (CoE Digital Learning) and Karen Pollack (World Campus).
- Bulletin - The Grad School is now using links to Graduate School admission requirements within Bulletin listings. Delete "International applicants..." paragraph and replace with: "Admission requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin. Applicants apply for admission to the program via the Graduate School application for admission."

The General Information link is: http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/
The Graduate School application for admission link is: http://gradschool.psu.edu/prospective-students/how-to-apply/
Proposal is being reset to a Level 2 for the proposer to address these changes. Resubmit when completed.
Reviewed On: 4/4/2018 at 10:12 PM

Associate Dean

Recipient Name: PETER BUTLER
Position: Associate Dean
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

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Curricular Information

Blue Sheet Item #: [Not Yet Reviewed]
Review Date: [Not Yet Reviewed]

Program Codes

Engineering:

Option Codes

Additive Manufacturing and Design:

Uploaded Documents:

Context Type: Graduate Certificate Assessment Plan
File Description: AMD Graduate Certificate Assessment Plan
File Name: 1. Undergraduate and Graduate Certificate Assessment Plan - AMD_tws.pdf

Context Type: Certificate Bulletin Listing
File Description: AMD Certificate Bulletin Listing
File Name: 2. AMD postbaccalaureate certificate_tws.pdf

Proposal ID: 6390 created on 4/26/2018 9:47 AM
uploaded documents follow:
ACADEMIC YEAR: 2018-2019
CERTIFICATE NAME: Penn State College of Engineering Graduate Credit Certificate in Additive Manufacturing and Design
CERTIFICATE LEVEL (UNDERGRADUATE OR GRADUATE OR NA): Graduate
CREDIT OR NON-CREDIT CERTIFICATE: Credit
COLLEGE/CAMPUS WHERE OFFERED: World Campus
FACULTY CONTACT: Timothy Simpson

I. Certificate Learning Objectives
The overall goal of the graduate AMD Certificate is to educate post-baccalaureate students and working engineers in the fundamental principles and applications of additive manufacturing and design. Specific objectives for online students taking the AMD Certificate are to:

1. Apply foundational knowledge, critical thinking, problem solving, and creativity in the uses of additive manufacturing across industries.
2. Become competent engineers in additive manufacturing while maintaining the highest ethical standards in applying additive manufacturing to industry-relevant problems.
3. Identify the barriers to industry adoption associated with additive manufacturing technologies.
4. Articulate the value proposition for additive manufacturing in a given industry.
II. Map of Certificate Learning Objectives and Certificate Curriculum

Directions:

A. List all certificate curriculum requirements including courses, internships or co-curricular experiences in general order that they are completed by students.

B. In table boxes, indicate whether each course or learning experience contributes to each of the certificate learning objectives.

C. Indicate whether each course or other experience is designed to address each certificate learning objective.

<table>
<thead>
<tr>
<th>Certificate Courses or Other Experiences</th>
<th>Certificate Learning Objectives</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Apply foundational knowledge, critical thinking, problem solving, and creativity in the uses of additive manufacturing across industries.</td>
</tr>
<tr>
<td>IE 527</td>
<td>Contributes/Addresses</td>
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<tr>
<td>E SC 545</td>
<td>Contributes/Addresses</td>
</tr>
<tr>
<td>MATSE 567</td>
<td>Contributes/Addresses</td>
</tr>
<tr>
<td>EDSGN 562</td>
<td>Contributes/Addresses</td>
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</tbody>
</table>
III. Certificate Assessment Plan for AY 2018-2019

A. **Certificate Learning Objective**: Which certificate learning objective will you assess this year?

B. **Assessment description**: Briefly describe the direct assessment that will be used to measure student learning. What is the format? What will it measure? Which group of students will participate in the assessment (eg. all seniors, sample of seniors)?

C. **Measure type**: Is this a direct or indirect measure?

D. **Implementation plan**: Describe the plan for implementation of the assessment. Who designs and reviews the assessment? Is this assessment embedded in a course or outside of courses? What is the plan for gathering samples of student work for review from each campus where certificate is offered? Also describe the formal process for review of student work (eg. assignment grade scale, grading rubric).

E. **Performance criterion**: Indicate the performance criterion or target level desired by the program that is used as part of the implementation of this assessment method (eg. 70% of all students will receive a grade of B or above on this assignment; 80% of all students will receive a score of 4 or 5 for each of item of the grading rubric used to score student work).

F. **Program review**: Describe how the faculty plan to review the results of this student assessment (eg. annual undergraduate studies retreat). Who will be responsible for acting on findings?

<table>
<thead>
<tr>
<th>Certificate Assessment Plan for AY2018-2019</th>
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</thead>
<tbody>
<tr>
<td>A. <strong>Certificate learning objective</strong></td>
</tr>
<tr>
<td>Apply foundational knowledge, critical thinking, problem solving, and creativity in the uses of additive manufacturing across industries.</td>
</tr>
<tr>
<td>B. <strong>Assessment description</strong></td>
</tr>
<tr>
<td>All students enrolled in IE 527 will complete a course project demonstrating the ability to do one or more of the following: identify a research topic and explore it in depth, develop software/algorithms for various steps in the process, design and prototype a product from concept to finished prototype demonstrating the benefits of additive manufacturing technology, or build a 3-D printing machine.</td>
</tr>
<tr>
<td>C. <strong>Measure type</strong></td>
</tr>
<tr>
<td>Direct</td>
</tr>
<tr>
<td>D. <strong>Implementation plan</strong></td>
</tr>
<tr>
<td>The assessment is implemented in the course IE 527. The course project will contribute to 35% of the student’s overall course grade.</td>
</tr>
<tr>
<td>E. <strong>Performance criterion</strong></td>
</tr>
<tr>
<td>80% of all students will receive a grade of B or above on the course project.</td>
</tr>
<tr>
<td>F. <strong>Program review and action plan</strong></td>
</tr>
<tr>
<td>The AMD Program Director and AMD faculty will review the outcome of the course projects which are graded by the course instructor. Both program faculty and support staff will take action on the findings.</td>
</tr>
</tbody>
</table>

**Definitions:**

*Direct student assessment*: Require students to display their knowledge and skills as they respond to the assessment instrument (eg. exam)

*Indirect student assessment*: Require students to provide reflection, feedback or perceptions of learning rather than to demonstrate it (eg. survey)

*Performance criterion/ target level*: Desired level of performance as measured by the assessment method. (eg. We expect that all students will receive a score of 7 or above out of 10 total points on their project presentations.)
Name of the Certificate Program:
Additive Manufacturing and Design

Person in Charge: Dr. Timothy Simpson

Address: 205 Leonhard Building University Park, PA 16802

Telephone: 814-863-7136  Fax: 814-863-4745  E-Mail: tws8@psu.edu

Description of the Certificate Program Including Purpose, Objectives, and Total Number of Credits Required:
The overall goal of the graduate AMD Certificate is to educate post-baccalaureate students and working engineers in the fundamental principles and applications of additive manufacturing. The AMD Certificate provides an entry for industry practitioners and existing workforce to gain knowledge and skills for additive manufacturing. Many workers may already have a graduate-level degree yet seek opportunities for professional development and education, particularly in additive manufacturing and design. The 12-credit curriculum will expose students to the knowledge and skills necessary to work effectively across AMD domains.

Admission Requirements:
The admission requirements for the students enrolling in the online AMD Certificate will be based on a combination of academic records, GRE scores, resume and applicable work experience, personal statement of interests, and three letters of recommendation from a previous professor or supervisor who can attest to the applicant’s academic potential. GRE scores will be waived for applicants who have significant work experience (5 years) or completed an existing master’s degree. Applicants will be expected to have a Bachelor of Science or four-year Associate’s degree form an accredited institution in engineering, engineering technology, manufacturing, materials science, or related field. An undergraduate cumulative grade point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

Each application will be closely reviewed by the AMD Admission Committee. This committee consists of one faculty member from each of the five participating departments: (1) Engineering Science and Mechanics, (2) Industrial and Manufacturing Engineering, (3) Material Science and Engineering, (4) Mechanical and Nuclear Engineering, and (5) School of Engineering Design, Technology, and Professional Programs.

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

List of Courses Included in the Certificate:
Complete three of the following four non-laboratory courses-
- EDSGN 562: Design for Additive Manufacturing (4 credits)
- E SC 545: The Engineering and Scientific Foundations of Additive Manufacturing (4 credits)
- IE 527: Additive Manufacturing Processes (4 credits)
- MATSE 567: Materials for Additive Manufacturing (4 credits)

Effective Semester: Fall 2018

Expiration Semester: (maximum of 5 years from effective date) Summer 2023
Proposal Designation: WINDE_GCT - Wind Energy (GCT)
This is a proposed Change to Graduate Graduate Certificate

Initiators

<table>
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<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
<th>Department</th>
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<tbody>
<tr>
<td>Susan W Stewart</td>
<td>sjw147</td>
<td>Engineering(EN)</td>
<td>Not Available</td>
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</tbody>
</table>

Academic Home: Engineering (EN)

Outline

Justification for Change:
Extending sunset clause.

Short Title: WINDE_GCT

Description:
The graduate certificate in Wind Energy is designed to provide technical depth in wind-turbine technology and the science of siting turbines. The program is offered by the Department of Aerospace Engineering and is available via enrollment at University Park as well as Penn State's World Campus. To be awarded the Certificate in Wind Energy, students must successfully complete 9 graduate credits with a grade of "C" or better in three required courses. Courses taken in the certificate program may be applied toward the Master of Professional Studies in Renewable Energy and Sustainability Systems (RESS) if the student has earned a B- or better in each course, subject to restrictions outlined in the Transfer of Nondegree and Certificate Graduate Credits. Certificate students who wish to have certificate courses applied towards the M.P.S. in RESS must apply and be admitted to that degree program. Admission to the RESS graduate degree program is a separate step and is not guaranteed.

Certificate Type: PUBLIC
Department: Aerospace Engineering (UPEN_AERSP)

Entrance Requirements:
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. In addition, a background in incompressible fluid mechanics, statics, and dynamics is strongly encouraged.

Effective Semester: SP 2019
Ending Semester: SP 2024

Offering Campus
- UP (UP)
- WC (WORLD CAMPUS)

Faculty Member(s) in Charge:
- Name: Susan W Stewart (sjw147)
  Title: Associate Teaching Professor
  Phone: 8148630138
  Address: 233 E Hammond
  Campus: UP
  City: University Park
  Fax:

Is *not* eligible for aid

CIP Code: 149999
IPEDs Type: Post Baccalaureate Certificate

**REQUIREMENTS FOR THE CERTIFICATE:** (9 Credits)

**REQUIRED COURSES** (3 credits)

AERSP 583 (3), AERSP 880 (3), AERSP 886 (3)

**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**

**Associate Dean**

**Recipient Name:** GEORGE LESIEUTRE  **Department:** (Not Available)

**Position:** Associate Dean  **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]

**Registrar Data Entry**

**Recipient Name:** PAULA HAMATY  **Department:** (Not Available)
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<tbody>
<tr>
<td><em><strong>ALLISON ALBINSKI</strong></em></td>
<td>Publication Of Approval Information By Faculty Senate</td>
<td>(Not Available)</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<tr>
<td><strong>JOY ROBERTSON</strong></td>
<td>Publication Of Approval Information By Faculty Senate</td>
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<tr>
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<td>Publication Of Approval Information By Faculty Senate</td>
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</table>
Program Codes

Engineering: WINDE_GCT

Option Codes

WINDE_GCT - Wind Energy (GCT):

uploaded Documents:

Context Type: Graduate Certificate Assessment Plan
File Description: Wind Certificate Assessment Plan
File Name: Wind certificate assessment.pdf

Context Type: Certificate Bulletin Listing
File Description: Wind Certificate Bulletin
File Name: Wind Energy Bulletin.pdf

Proposal ID: 7136 created on 5/18/2018 2:34 PM
Uploaded Documents Follow:
CERTIFICATE
ASSESSMENT PLAN

Certificate: Graduate Certificate in Wind Energy
College: Engineering
Campus where offered: World Campus and University Park
Faculty in Charge: Susan Stewart

The following list defines the learning objectives for the Wind Energy Certificate.

1. Evaluate wind energy systems using techno-economic, performance and/or cost/benefit analyses.
2. Demonstrate fundamental understanding of the principles of wind energy science, including resource availability and conversion technologies.
3. Demonstrate an appreciation for the commercialization process relative to project and product development.
4. Demonstrate the ability to make sound decisions in complex situations.
5. Evaluate project development, product design and/or sustainability decisions in the broader context of society's interests.

<table>
<thead>
<tr>
<th>Certificate Learning Objectives</th>
<th>AERSP 583 - Wind Turb Aero</th>
<th>AERSP 880 - Wind Turb Sys</th>
<th>AERSP 886 - Eng of Wind Project Dev</th>
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<td>LO #3</td>
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<td>LO #4</td>
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</tr>
<tr>
<td>LO #5</td>
<td>I</td>
<td>P/D</td>
<td>I/P</td>
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</table>

Learning objective number 4 is going to be evaluated this year by looking at data collected from AERSP 886, case study for Lesson 6. This case study involved anemometer data quality control. The students in this lesson are required to analyze a complex set of data and use their best judgement to filter out what they determine to be potentially erroneous data points based on what they’ve learned in the lesson. They have the opportunity to ask questions of an industry professional in the process to help them further in making sound decisions. Grades from the assignment, notes from the webinar session with the industry professional, as well as a focus group discussion on the use of case studies will be used to evaluate this learning objective.
Name of the Certificate Program: Wind Energy

Person in Charge: Dr. Susan W Stewart

Address: Department of Aerospace Engineering, 233E Hammond, University Park, PA 16802

Telephone: 814-863-0138      Fax: 814-865-7092      E-Mail: sjw147@engr.psu.edu

Description of the Certificate Program Including Purpose, Objectives, and Total Number of Credits Required:

The graduate certificate in Wind Energy is designed to provide technical depth in wind-turbine technology and the science of siting turbines. The program is offered by the Department of Aerospace Engineering and is available via enrollment at University Park as well as Penn State’s World Campus. To be awarded the Certificate in Wind Energy, students must successfully complete 9 graduate credits with a grade of "C" or better in three required courses. Courses taken in the certificate program may be applied toward the Master of Professional Studies in Renewable Energy and Sustainability Systems (RESS) if the student has earned a B- or better in each course, subject to restrictions outlined in the Transfer of Nondegree and Certificate Graduate Credits. Certificate students who wish to have certificate courses applied towards the M.P.S. in RESS must apply and be admitted to that degree program. Admission to the RESS graduate degree program is a separate step and is not guaranteed.

Admission Requirements:
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. In addition, a background in incompressible fluid mechanics, statics, and dynamics is strongly encouraged.

List of Courses* Included in the Certificate:
AERSP 583
AERSP 880
AERSP 886

Effective Semester: SP 2019

Expiration Semester: (maximum of 5 years from effective date) SP 2024

*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>
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<tbody>
<tr>
<td>TIMOTHY SIMPSON</td>
<td>Tws8</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)

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

Course Designation

(ME 590) Colloquium

Justification of Course Number:

n/a

Course Information

Cross-Listed Courses:

AMD 590(EN)

Prerequisites:

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Colloquium

This course will be delivered:

[ ] in residence

[ ] off-site

[X] online

Bulletin Listing

Minimum Credits: 1

Maximum Credits: 1

Repeatable: NO

Department with Curricular Responsibility:

Mechanical Engineering (UPEN_ME)

Effective Semester:

After approval, the Faculty Senate will notify proposers of the effective date for this course change. Please be aware that the course change may not be effective until between 12 to 18 months following approval.

Travel Component:

NO

Campuses That Have Offered (ME 590) Over The Past 4 Years

| semester | AB | AL | BK | BR | BW | CR | DS | ER | GA | GV | HB | HN | HY | LV | MA | NK | PC | SL | UP | WB | WC | WS | XC | XP | XS | YK |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Spring 2018 | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |
| Fall 2017  | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |
| Spring 2017 | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |
| Fall 2016  | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |
| Spring 2016 | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |
Course Outline

A brief outline or overview of the course content:
n/a

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
n/a

Course Description:
Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

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

Name: TIMOTHY SIMPSON (tws8)
Title:
Phone:
Address:
Campus: UP
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.
n/a

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.
n/a

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.
n/a

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.
n/a

A description of any special facilities:
n/a

Frequency of Offering and Enrollment:
n/a

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.
n/a

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

**Legend**

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

**Head of Department**

**Recipient Name:** Karen Ann Thole  
**Position:** Head of Department  
**Department:** (Not Available)  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:**

- [Concur: [Not Yet Reviewed]](image)  
- [Comments: [Not Yet Reviewed]](image)  
- [Reviewed On: [Not Yet Reviewed]](image)

**College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses**

**Recipient Name:** Karen Ann Thole  
**Position:** College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses  
**Department:** (Not Available)  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:**

- [Concur: [Not Yet Reviewed]](image)  
- [Comments: [Not Yet Reviewed]](image)  
- [Reviewed On: [Not Yet Reviewed]](image)

**Dean of the College**

**Recipient Name:** GEORGE LESIEUTRE  
**Position:** Dean of the College  
**Department:** (Not Available)  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:**

- [Concur: [Not Yet Reviewed]](image)  
- [Comments: [Not Yet Reviewed]](image)  
- [Reviewed On: [Not Yet Reviewed]](image)
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: UNIVERSITY PARK CAMPUS
Title: 


Final Confirmation

Recipient Name: ALLISON ALBINSKI  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS
Title: 


Recipient Name: JOY ROBERTSON  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS
Title: 


Recipient Name: KADI CORTER  Department: (Not Available)
Curricular Information

Blue Sheet Item #: 
Review Date: 

SCRID Numbers

(ME 590):
(AMD 590):
Proposal ID: 6389 created on 4/26/2018 10:06 AM
Principal Faculty Member(s) Proposing Course

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<th>Name</th>
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<tr>
<td>TODD PALMER</td>
<td>tap103</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
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</tbody>
</table>

Academic Home: Engineering (EN)
Type of Proposal: ☑ Add  ☐ Change  ☐ Drop

Course Designation

(ESC 546) Advanced Metallic Material Feedstocks for Additive Manufacturing

Justification of Course Number:

This course will explore the theoretical frameworks for studying feedstock materials for additive manufacturing. Analytical thinking and creative skills will be emphasized, and the students will be exposed to the latest research literature and explore the frontiers of several disciplines. Skills obtained through this course will be utilized in further research in this field and provide the students with a knowledge base to pursue original research.

Course Information

Cross-Listed Courses:
MATSE 546(EN)

Prerequisites:

Corequisites:

Concurrents:
MATSE 567, IE 527

Recommended Preparations:

Students in this course should have a basic understanding (undergraduate level) of physical metallurgy principles, including solidification, solid-state phase transformations, heat treatment, and thermomechanical processing.

Abbreviated Title: Feedstocks for AM

This course will be delivered:

☑ in residence
☐ off-site
☑ online

Bulletin Listing

Minimum Credits: 4
Maximum Credits: 4
Repeatable: NO

Department with Curricular Responsibility: Engineering Science And Mechanics (UPEN_ESCM)

Effective Semester: SP 2019
Travel Component: NO

Campuses That Have Offered ( ) Over The Past 4 Years

| semester | AB | AL | BK | BR | BW | CR | DS | ER | FE | GA | GV | HB | HN | HY | LV | MA | NK | PC | SH | SL | UP | WB | WC | WS | XC | XP | XS | YK |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

Course Outline

A brief outline or overview of the course content:
1. Definition of Feedstock Forms for Additive Manufacturing
2. Metal Powder Production and Impact on Particle Size and Shape
3. Fundamentals of Particle Characterization
4. Rheological Principles and Application to Metal Powders
5. Powder Mixing and Blending
6. Binder-Metal Powder Interactions
7. Particle Packing and Consolidation
8. Beam-Material Interactions
9. Solidification, Sintering, and Densification
10. Post-Processing and Solid-State Transformations

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
1. Metal powder production and particle size effects (6 hours)
2. Particle Characterization (9 hours)
3. Rheology and Metal Powders (6 hours)
4. Interactions between metal powders and binders (6 hours)
5. Particle Packing and Consolidation (6 hours)
6. Beam Material Interactions (9 hours)
7. Solidification (6 hours)
8. Sintering (6 hours)
9. Solid State Transformations (6 hours)

Course Description:
Additive manufacturing (AM) processes use a variety of metallic material forms to produce complex components. These material forms can vary from metallic powders with a rather wide range of size distributions to metal wire to sheet and other more complex composite material types. Knowledge of the processing of these different feedstock forms along with means to characterize them is needed to develop AM processes and procedures capable of being more widely used, particularly in critical applications. In this course, the fundamentals of producing, handling, blending, and characterizing common metallic and composite feedstock materials will be covered. Feedstock forms to be addressed include metal and metal-ceramic composite powders, wire, and sheets, along with new product forms becoming available. A multi-disciplinary approach will be taken to elucidate the connections between production, characterization, and handling to develop a fundamental understanding of the role of feedstocks on the resulting process-structure-property relationships for AM processes and products.

The name(s) of the faculty member(s) responsible for the development of the course:
- Name: TODD PALMER (tap103)
- Title:
- Phone:
- Address:
- Campus: UP
- 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.

At the completion of this course, students will be expected to have a fundamental knowledge of metal powders and their rheological characteristics. This knowledge will then be applied to beam-material interactions and how different powder characteristics impact the resulting component properties.

After completion of the course, students will be expected to:
- Analyze how force and energy are used to fabricate powders and how powders are transformed into useful engineering products.
- Identify methods for characterizing the characteristics of particulate materials and how these impact additive manufacturing processes.
- Define rheological characteristics of metal powders and how these characteristics impact the additive manufacturing process.
- Identify important interactions occurring between high energy density beams and metal powder feedstocks and describe the physical processes governing these interactions.
- Analyze role of feedstock composition and processing on solidification and solid-state transformations governing material structure and properties.
- Identify important sintering and post-processing mechanisms governing densification and defect formation in AM components.

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.

Student performance will be evaluated using graded assignments, exams, and a final report and presentation. Grades will be determined by the following breakdown:
- Mid-Term Exam: 100 points (25%)
- Final Exam: 150 points (37.5%)
- Homework: 50 points (12.5%)
- Term Project and Presentation: 100 points (25%)
Total: 400 points (100%)
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. Feedstock materials used for Additive Manufacturing are critical to the process but not extensively studied in other AM directed courses. This course is designed to provide the students with fundamental knowledge of the nature of powder feedstocks used in additive manufacturing and how they behave during processing and how they will impact the process. The course material will go further in depth with powder characterization and rheology and give the students sufficient background to understand the role of powder feedstocks on various AM processes and how to specify appropriate powder characteristics for use in the AM fabrication of critical components.

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 course will be offered as an elective required for the Master of Science and Master of Engineering (World Campus) degrees in Additive Manufacturing and Design. In addition to supporting this program, it will also support graduate education for students in the Departments of Engineering Science and Mechanics, Materials Science and Engineering, Mechanical and Nuclear Engineering, Industrial and Manufacturing Engineering, and School of Engineering Design, Technology, and Professional Programs.

A description of any special facilities:
A laboratory demonstration for powder particle characterization will be included in the course. The facilities are available within the Center for Innovative Sintered Products as well as the Materials Characterization Laboratory.

Frequency of Offering and Enrollment:
This course will be offered each spring semester as an elective in the Additive Manufacturing and Design MS curriculum and as a resident course. Expected enrollment each semester is estimated to be 15 to 20 students.

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: ABDALLA NASSAR  Department: Engineering Science And Mechanics
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: RES ASSOC ENGR SCI & ME

Last sent: 12/11/2017 at 7:30 AM
Concur: Yes
Comments: This appears to be a well-planned course that is quite relevant for students interested in additive manufacturing.
Reviewed On: 12/11/2017 at 11:31 AM

Recipient Name: ALBERT ELIOT SEGALL  Department: (Not Available)
Position: Consultation  Campus: (Not Available)
Title: PROFESSOR ENGR SCI & MECH
Recipient Name: EDWARD REUTZEL
Department: Engineering Science And Mechanics
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: SENIOR RESEARCH ASSOCIATE

Request sent: 12/4/2017 at 11:39 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 12/19/2017 at 7:15 AM

I think this will be a great class. Some additional topics for consideration (perhaps folded in to other planned lectures):

1. Consider adding brief introduction to powder simulation/modelling at some point
2. Suggest you consider devoting some time to wire as feedstock.
3. Please consider addressing powder reuse and/or recycling at some point.
4. Please consider addressing forms and pathways for contamination (powder and wire).
5. Consider briefly addressing storage and powder safety.

Reviewed On: 12/7/2017 at 8:56 AM
Initiator Comments: Thank you for your comments. Responses to your comments are:

1. I will build powder simulation (both packing and beam-material interactions) in the appropriate sections of the course outline. The two areas include Rheological Principles and Application to Metal Powders and Beam-Material Interactions. The numerical modeling aspects of these topics are based on the fundamental principles that are included in these course objectives, and both will be covered.
2. I will include wire feedstock in the binder-metal powder and related sections of the course. The areas of solidification and solid-state transformations in the course outline will cover these areas.
3. Powder reuse and recycling will be included with powder mixing and blending.
4. I will include powder handling as part of the powder mixing and blending portion of the course outline.
5. I will address storage in the powder mixing and blending sections. These topics are closely related and fundamental to powder metallurgy processes. As for safety, I will address that throughout the course.

Reviewed On: 1/8/2018 at 4:32 PM
Initiator Comments: Thank you for your comments. Responses to your comments are:

Recipient Name: REGINALD HAMILTON
Department: Engineering Science And Mechanics
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASSOC PROF ENGR SCI MECH

Request sent: 12/4/2017 at 11:39 AM
Recipient Name: ALLISON BEESE  
Department: Materials Science And Engineering  
Position: Consultation  
Title: Assistant professor

Recipient Name: AMY PRITCHETT  
Department: Aerospace Engineering  
Position: Consultation  
Title: DEPT HEAD/PROF AEROSPACE

Recipient Name: JANIS TERPENNY  
Department: Industrial And Manufacturing Engineering  
Position: Consultation  
Title: DEPT HEAD & PROF INDUSTL

Recipient Name: Jingjing Li  
Department: Industrial And Manufacturing Engineering  
Position: Consultation  
Title: Assoc. Professor of Ime

Recipient Name:  
Department:  
Position:  
Title: 
Recipient Name: KAREN THOLE  Department: Mechanical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: DEPT HEAD MNE

(9) Request sent: 1/8/2018 at 4:53 PM
Concur: Yes
Comments:
Reviewed On: 1/8/2018 at 10:32 PM

Recipient Name: PHILLIP SAVAGE  Department: Chemical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROF/DEPT HEAD CHEM ENGR

(14) Request sent: 1/8/2018 at 4:53 PM
Last sent: 1/15/2018 at 7:31 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 1/23/2018 at 7:15 AM

Recipient Name: SANJAY JOSHI  Department: Industrial And Manufacturing Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR I & MSE

(15) Request sent: 1/8/2018 at 4:53 PM
Last sent: 1/15/2018 at 7:31 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 1/23/2018 at 7:15 AM

Recipient Name: SUSAN SINNOTT  Department: Materials Science And Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: Professor and Department Head

(7) Request sent: 1/8/2018 at 4:53 PM
Concur: Yes
Comments:
Reviewed On: 1/8/2018 at 7:34 PM

Recipient Name: SVEN BILEN  Department: School of Engr Design, Technology and Prof Prgrms
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: DEPT HEAD/SEDTAPP

(8) Request sent: 1/8/2018 at 4:53 PM
Recipent Name: TIMOTHY SIMPSON  Department: Mechanical Engineering  
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS  
Title: PROF ME & IE

Request sent: 1/8/2018 at 4:53 PM  
Concur: Yes  
Comments: I like the proposed course and its content. Very relevant/useful to students in AMD program and others interested in additive manufacturing. Does the course really need ESC 545 as a pre-req? I would think IE 527 and MATSE 567 would be sufficient background for this course given its focus on feedstocks (i.e., the input to AM process), ESC 545 really dives deep into what happens in the AM process, and I think the proposed course would actually be more useful as a precursor to ESC 545 rather than the other way around. So, please consider dropping the ESC 545 pre-req while keeping the other two. Otherwise, looks great!  
Reviewed On: 1/9/2018 at 8:56 AM  
Initiator Comments: Thank you for your suggestion. ESC 545 has been removed as a prerequisite.

Request sent: 1/23/2018 at 12:20 PM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 2/7/2018 at 7:15 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]

Recipient Name: SUSAN SINNOTT  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]

College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses

Recipient Name: MATTHEW PARKINSON  Department: (Not Available)  
Position: College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses  Campus: UNIVERSITY PARK CAMPUS  
Title: 

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

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

Dean of the College

Recipient Name: GEORGE LESIEUTRE  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: UNIVERSITY PARK CAMPUS

Title:

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

Final Confirmation

Recipient Name: ALLISON ALBINSKI  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS

Title:

Concur: [Not Yet Reviewed]
Recipient Name: KADI CORTER  
Department: (Not Available)  
Position: Final Confirmation  
Campus: UNIVERSITY PARK CAMPUS  
Title: 

Curricular Information  
Blue Sheet Item #:  
Review Date:  
SCRID Numbers  
(ESC 546):  
(MATSE 546):  
Proposal ID: 5132 created on 3/7/2018 3:50 PM
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>ANDRIS FREIVALDS</td>
<td>AXF</td>
<td>Engineering</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)

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

Course Designation

(IE 594) Capstone Design

Justification of Course Number:

The committee recommended that it be an 800 level course because this is a professional level masters degree. Also, the ultimate goal of this course is to contribute to the student’s ability to generate creative approaches for improved professional practice.

Course Information

Cross-Listed Courses:

Prerequisites:

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Capstone Design

This course will be delivered:

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

Bulletin Listing

Minimum Credits: 3
Maximum Credits: 3
Repeatable: NO

Department with Curricular Responsibility: Industrial And Manufacturing Engineering (UPEN_IME)

Effective Semester: Upon Approval
Travel Component: NO

Campuses That Have Offered ( ) Over The Past 4 Years

| semester | AB | AL | BK | BR | BW | CR | DS | ER | FE | GA | GV | HB | HN | HY | LV | MA | NK | PC | SH | SL | UP | WB | WC | WS | XC | XP | XS | YK |
Course Outline
A brief outline or overview of the course content:
Students will apply the analytical and design skills learned in previous courses to solve an industrial problem.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
Prepare a proposal describing the problem and the approach used to solve it (2 weeks)
Work on solving the problem and prepare progress report (5 weeks)
Continue working and write report (8 weeks)

Course Description:
Students will apply the analytical and design skills learned in previous courses to solve an industrial problem based on their workplace or industrial partner. They will start with writing a proposal to clearly identify the problem and procedures to be used in solving the problem. The instructor will provide feedback on the approach and allow the students to proceed. Mid-way the students will write a progress report. Again based on the instructor feedback, the students will continue working and then summarizing the work in a final report. This will be submitted both to the instructor for a course grades, as well as to the sponsor of the project. Those students that do not have an identifiable work-related problem, will be able to choose among several case studies with data. This is an individual project. No physical prototypes are needed. This is a single semester course. No financial sponsorship is necessary.

The name(s) of the faculty member(s) responsible for the development of the course:
- Name: ANDRIS FREIVALDS (AXF)

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.
This course is the culminating experience for the on-line Master of Engineering in Industrial Engineering degree. It will demonstrate whether the students can apply the analytical and design skills learned in the courses leading up to this point to an industrial problem of their choosing. After successfully completing this course, a student should be able to do similar work at their workplace.

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.
Proposal: 10%
Progress Report: 20%
Final Report: 70%

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 is meant for Industrial Engineering students to complete their MEng degree. A prior course in industrial engineering is necessary for this class.

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 course is the culminating experience for industrial engineering students to complete their MEng degree.

A description of any special facilities:
None

Frequency of Offering and Enrollment:
Not specified
Curricular Information

Blue Sheet Item #: 
Review Date: 

SCRID Numbers

(IE 594)894:
Proposal ID: 4707 created on 5/22/2018 3:10 PM

Review History (not subject to comparison)

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: ANDRIS FREIVALDS  Department: Industrial And Manufacturing Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR INDUSTRIAL ENG

(1)  Request sent: 5/9/2017 at 3:43 PM
Last sent: 5/22/2017 at 7:30 AM
Concur: Yes
Comments: 
Reviewed On: 5/22/2017 at 10:36 AM

Recipient Name: CHITARANJAN DAS  Department: Computer Science And Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: DISTINGUISHED PROF CSE

(5)  Request sent: 5/24/2017 at 8:25 AM
Last sent: 6/5/2017 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 6/8/2017 at 7:15 AM

Recipient Name: DAVID HUNTER  Department: Statistics
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: DEPT HEAD STATISTICS

(2)  Request sent: 5/24/2017 at 8:25 AM
### Concur: Yes
### Comments:
### Reviewed On: 5/24/2017 at 10:44 AM

<table>
<thead>
<tr>
<th>Recipient Name: KULTEGIN AYDIN</th>
<th>Department: Electrical Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position: Consultation</td>
<td>Campus: UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td>Title: DEPT HEAD/PROF ELECT ENGR</td>
<td></td>
</tr>
</tbody>
</table>

| Request sent: 5/24/2017 at 8:25 AM |
| Concur: Yes                        |
| Comments:                          |
| Reviewed On: 6/1/2017 at 5:05 PM   |

<table>
<thead>
<tr>
<th>Recipient Name: RUSSELL WARLEY</th>
<th>Department: Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position: Consultation</td>
<td>Campus: PENN STATE ERIE, THE</td>
</tr>
<tr>
<td>Title: Interim Director, School of Engineering</td>
<td>BEHREND COLLEGE</td>
</tr>
</tbody>
</table>

| Request sent: 5/24/2017 at 8:25 AM |
| Last sent: 6/5/2017 at 7:30 AM     |
| Concur: Yes                        |
| Comments:                          |
| Reviewed On: 6/5/2017 at 7:56 AM   |

### College Administrator Review

<table>
<thead>
<tr>
<th>Recipient Name: Lori Long (on behalf of GS&amp;R and EFC)</th>
<th>Department: (Not Available)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position: College Administrator Review</td>
<td>Campus: (Not Available)</td>
</tr>
<tr>
<td>Title:</td>
<td></td>
</tr>
</tbody>
</table>

| Request sent: 1/30/2018 at 11:15 PM |
| Concur: Yes                          |
| Comments: The course proposal for (IE 594) Capstone Design has been reviewed by the Graduate Studies and Research Committee, who request response to the following feedback prior to moving forward to EFC. The proposal will be reset to a Level 2 so that you can make changes. Upon re-submission for CoE Administrative Review, please respond to the Administrative Comment in CRCS and reply to my email message containing the following feedback items, your response, and where within the proposal any changes have been made.
|                               |
| o This appears to be an 800-level course. If it's not, there is already a 500-level course that does this. |
| o Provide additional details on what they mean by an industrial problem. Do they mean a project proposed by an industry partner. Other than that I am ok with it. |
| o This should be an 800-level course. http://gradschool.psu.edu/gradcouncil/graduate-council-policies /graduate-course-definitions/ When that change is made, I will vote to approve. |
| o My understanding is that for capstone courses, it is important to explain whether the projects are to be done solo or in teams, whether industry involvement is required or optional, whether the projects need to culminate in physical prototypes or not, whether a single semester is sufficient or a two-semester sequence is needed, and whether financial sponsorship is necessary for the projects' success. A brief discussion on these topics would be much appreciated, but otherwise, I support this proposal. |
| Thank you. |
| Reviewed On: 1/30/2018 at 11:15 PM |
Concur: Yes
Comments: These are the changes that I made to the attached document. I will have Lisa send it through the system. I just wanted to make sure you and Peter saw the key changes that I made:
1) I had mentioned the COE Office for Digital Learning in several places before, I think Peter may have been reading the original April, 2017 document before I knew that Cathy Holsing was coming on board. You can do a search for CDE and it never appears.
2) I expanded a paragraph to include: To assist faculty members in converting existing course material to a fully online environment, we will primarily utilize the COE Office for Digital Learning, which will assist with course or program design and course or program implementation and delivery. Note, that the current streaming videos will be updated with more innovative approaches being developed by the COE Office for Digital Learning.
3) On first page “A professional master's degree with a culminating industrial experience rather than a research master's degree (with a thesis or paper requirement)' addresses the professional experience. I hope these changes are OK. I also changed all IE 594 to IE 894 per the requested changes in capstone design.
Hope this is all you need.
Reviewed On: 5/22/2018 at 2:33 PM

Initiator Comments: We concur.

Concur: Yes
Comments: I have reviewed the proposal and it will be submitted to GS&R for further review, after which point it will go to EFC, submitted for final signatories, and then the Grad School for final approval.
Reviewed On: 5/22/2018 at 2:40 PM

Initiator Comments: We concur.

Concur: Yes
Comments: Response to Committee Comments for course proposal changes.
- This appears to be an 800-level course. If it's not, there is already a 500-level course that does this.
- Provide additional details on what they mean by an industrial problem. Do they mean a project proposed by an industry partner. Other than that I am ok with it.
- This should be an 800-level course. http://gradschool.psu.edu/gradcouncil/graduate-council-policies/graduate-course-definitions/ When that change is made, I will vote to approve. Done
- My understanding is that for capstone courses, it is important to explain whether the projects are to be done solo or in teams, whether industry involvement is required or optional, whether the projects need to culminate in physical prototypes or not, whether a single semester is sufficient or a two-semester sequence is needed, and whether financial sponsorship is necessary for the projects' success. A brief discussion on these topics would be much appreciated, but otherwise, I support this proposal. Done – further explained within proposal.
Reviewed On: 5/22/2018 at 3:07 PM

Initiator Comments: We concur.
<table>
<thead>
<tr>
<th>Recipient Name</th>
<th>Department: (Not Available)</th>
<th>Position</th>
<th>Campus: UNIVERSITY PARK CAMPUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>JANIS TERPENNY</td>
<td></td>
<td>Head of Department</td>
<td></td>
</tr>
<tr>
<td>MATTHEW PARKINSON</td>
<td></td>
<td>College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses</td>
<td></td>
</tr>
<tr>
<td>GEORGE LESIEUTRE</td>
<td></td>
<td>Dean of the College</td>
<td></td>
</tr>
<tr>
<td>VICKI HEWITT</td>
<td></td>
<td>Review on Behalf of the Dean of the Graduate School</td>
<td></td>
</tr>
</tbody>
</table>

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: UNIVERSITY PARK CAMPUS
Title:
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Final Confirmation

Recipient Name: ALLISON ALBINSKI  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS
Title:
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Recipient Name: KADI CORTER  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS
Title:
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Recipient Name: JOY ROBERTSON  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS
Title:
Request sent: 11/9/2017 at 1:51 PM
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]
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>VIKASH GAYAH</td>
<td>vvg104</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)
Type of Proposal: Add □ Change □ Drop □

Course Designation

(CE 522) Traffic Flow Theory and Simulation

Justification of Course Number:
This course includes both research-based (traffic flow theory) and practical (simulation) topics. However, the majority of the course will focus on the traffic flow theory and prepare students to conduct academic research into traffic flow on both uninterrupted and interrupted facilities. The simulation tools are presented as a method to study these systems and validate existing and new models and theories. For this research, a 500-level designation is more appropriate.

Course Information

Cross-Listed Courses:

Prerequisites:

Corequisites:

Concurrents:

CE 423

Recommended Preparations:

Abbreviated Title: Traffic Flow Theory

This course will be delivered:

□ in residence
□ off-site
□ online

Bulletin Listing

Minimum Credits: 3
Maximum Credits: 3
Repeatable: NO

Department with Curricular Responsibility: Civil And Environmental Engineering (UPEN_CEE)
Effective Semester: FA 2018
Travel Component: NO

Campuses That Have Offered ( ) Over The Past 4 Years

| semester | AB | AL | BK | BR | BW | CR | DS | ER | FE | GA | GV | HB | HN | HY | LV | MA | NK | PC | SH | SL | UP | WB | WC | WS | XC | XP | XS | YK |
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

Course Outline

A brief outline or overview of the course content:
The course will be divided into two major subject areas: 1) operations on uninterrupted facilities, such as freeways; and, 2) operations on interrupted facilities, such as urban streets and large urban networks. Topics in the former area include kinematic wave theory, cell and link transmission models, variational theory, moving-bottlenecks, bottleneck identification and incident management. Topics in the latter include signal coordination, macroscopic fundamental diagrams, multimodal conflicts and their impacts. The course also includes an introduction into traffic microsimulation software and its applications to both areas.
A listing of the major topics to be covered with an approximate length of time allotted for their discussion:

<table>
<thead>
<tr>
<th>Topic</th>
<th># Hours for discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Freeway traffic</td>
<td></td>
</tr>
<tr>
<td>Fundamental traffic relationships</td>
<td>3</td>
</tr>
<tr>
<td>Identifying bottlenecks</td>
<td>3</td>
</tr>
<tr>
<td>Kinematic wave theory</td>
<td>3</td>
</tr>
<tr>
<td>Simplified theory of kinematic waves</td>
<td>1.5</td>
</tr>
<tr>
<td>Variational theory</td>
<td>1.5</td>
</tr>
<tr>
<td>Cell and link transmission models</td>
<td>3</td>
</tr>
<tr>
<td>Diverge and moving bottlenecks</td>
<td>3</td>
</tr>
<tr>
<td>Incident management</td>
<td>3</td>
</tr>
<tr>
<td>Vickrey morning commute model</td>
<td>3</td>
</tr>
<tr>
<td>II. Urban traffic</td>
<td></td>
</tr>
<tr>
<td>Signal coordination</td>
<td>3</td>
</tr>
<tr>
<td>Multimodal traffic</td>
<td>3</td>
</tr>
<tr>
<td>Macroscopic fundamental diagrams</td>
<td>3</td>
</tr>
<tr>
<td>MFD modeling frameworks and control</td>
<td>3</td>
</tr>
<tr>
<td>Street directionality</td>
<td>3</td>
</tr>
<tr>
<td>III. Simulation</td>
<td>6</td>
</tr>
</tbody>
</table>

Course Description:

This course will cover advanced topics related to traffic operations and traffic flow theory. Students will be exposed to a variety of theories, methodologies and principles that are used to assess traffic operations on surface transportation systems, as well as their applications. The course will be divided into two major subject areas: 1) operations on uninterrupted facilities, such as freeways; and, 2) operations on interrupted facilities, such as urban streets and large urban networks. Topics in the former area include kinematic wave theory, cell and link transmission models, variational theory, moving-bottlenecks, bottleneck identification and incident management. Topics in the latter include signal coordination, macroscopic fundamental diagrams, multimodal conflicts and their impacts. The course also includes an introduction into traffic microsimulation software and its applications to both areas.

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

- Name: VIKASH GAYAH (vvg104)

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.

Upon the completion of this course, you should be able to:

1. Identify freeway bottlenecks using loop detector data and estimate their relevant properties;
2. Use the first-order LWR continuum model to predict traffic dynamics on highway facilities;
3. Use cumulative curves to directly assess traffic dynamics on highway facilities;
4. Derive and apply the cell transmission model as a numerical solution to the first-order LWR continuum model;
5. Assess the impacts of diverge and moving bottlenecks;
6. Apply tools to real-world applications like incident management;
7. Use Vickrey's bottleneck model to examine endogenous traffic demand;
8. Coordinate signal timings on arterials;
9. Apply tools to study multimodal interactions on urban streets;
10. Use the Macroscopic Fundamental Diagram and Network Exit Function describe dynamics of large-scale urban networks and compare street network configurations;
11. Apply traffic simulation to solve real-world problems

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.

Students will be assessed based on their comprehension of the course material. Assessment will be via homework assignments (65%), regular quizzes (10%) and a course project/presentation (25%).

The quizzes are designed to ensure students have read and adequately understand the research papers that will be assigned prior to each class. The homework assignments will test student ability to apply the concepts learned in class to problems that were discussed. The course project offers students an opportunity to apply these concepts to new problems that may contribute to the research literature.

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 will serve as an elective course for students pursuing a graduate degree in the transportation engineering field. The course complements and builds upon material currently taught in an entry-level graduate course, CE 525 Transportation Operations.

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 course can be used to satisfy part of the 500-level course requirements for students in the transportation emphasis within the Civil Engineering program.

A description of any special facilities:
The simulation portion of this course will require the use of the Civil Engineering CAD Lab (228 Sackett) where students will have an opportunity use the traffic microsimulation software.

Frequency of Offering and Enrollment:
This course is anticipated to be offered in the Spring semester every two years.

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

Legend

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

Consultation

Recipient Name: JOSEPH CECERE
Department: Science, Engineering And Technology
Position: Consultation
Campus: PENN STATE HARRISBURG, THE CAPITAL COLLEGE
Title: ASSOC PROF ENGR

Request sent: 3/2/2018 at 8:47 AM
Last sent: 3/12/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: SEROJ MACKERTICH-SENGERDY
Department: Science, Engineering And Technology
Position: Consultation
Campus: PENN STATE HARRISBURG, THE CAPITAL COLLEGE
Title: ASSOC PROF ENGR

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/6/2018 at 11:03 AM
Recipient Name: ALEKSANDRA Z RADLINSKA
Department: Civil And Environmental Engineering
Position: Consultation
Title: ASST PROF CIVIL ENGR
Campus: UNIVERSITY PARK CAMPUS

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/2/2018 at 11:02 AM

Recipient Name: ALFONSO IGNACIO MEJIA
Department: Civil And Environmental Engineering
Position: Consultation
Title: ASST PROF CIVIL ENGR
Campus: UNIVERSITY PARK CAMPUS

Request sent: 3/2/2018 at 8:47 AM
Last sent: 3/12/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: ALI MEMARI
Department: Civil And Environmental Engineering
Position: Consultation
Title: HANKIN PROF/DIR PHRC
Campus: UNIVERSITY PARK CAMPUS

Request sent: 3/2/2018 at 8:47 AM
Last sent: 3/12/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: BRIAN JOSEPH NABEREZNY
Department: Civil Engineering
Position: Consultation
Title: INSTR SURVEYING
Campus: UNIVERSITY PARK CAMPUS

Request sent: 3/2/2018 at 8:47 AM
Last sent: 3/12/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: BRUCE ERNEST LOGAN
Department: Civil And Environmental Engineering
Position: Consultation
Title: EVAN PUGH/KAPPE PROF
Campus: UNIVERSITY PARK CAMPUS
Recipient Name: CAITLIN A GRADY  Department: Civil Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: ASSISTANT PROFESSOR

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: CHAOPENG SHEN  Department: Civil And Environmental Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: ASST PROF CIVIL ENGR

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/5/2018 at 5:08 PM

Recipient Name: CHRISTOPHER AARON GORSKI  Department: Civil And Environmental Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: ASST PROF CIVIL ENGR

Request sent: 3/2/2018 at 8:47 AM
Last sent: 3/12/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: ERIC TODD DONNELL  Department: Civil And Environmental Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR CIVIL&ENVIR

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/2/2018 at 9:12 AM
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<td>Civil And Environmental Engineering</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<td>Civil And Environmental Engineering</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<td>(Not Available)</td>
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<td><strong>HASSAN EL-CHABIB</strong></td>
<td>Civil And Environmental Engineering</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
<td>3/2/2018 at 8:47 AM</td>
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<td><strong>JEFFREY A LAMAN</strong></td>
<td>Civil And Environmental Engineering</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
<td>3/2/2018 at 8:47 AM</td>
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Title: PROF CIVIL & ENVIR ENGR

(1)
Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/2/2018 at 8:53 AM

Recipient Name: JOHN MICHAEL REGAN
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR CIVL & ENV ENGR

(5)
Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/2/2018 at 10:03 AM

Recipient Name: KONSTANTINOS PAPAKONSTANTIÂNOU
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASST PROF ASST PROFESSOR

(7)
Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/2/2018 at 12:03 PM

Recipient Name: LI LI
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASSOC PROF

(24)
Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: MARTIN T PIETRUCHA
Department: Civil Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROF CEE

(25)
Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM
Recipient Name: MICHAEL CHARLES HILLMAN  
Department: Civil And Environmental Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: ASST PROF

Request sent: 3/2/2018 at 8:47 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: MING XIAO  
Department: Civil And Environmental Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: ASSOCIATE PROFESSOR

Request sent: 3/2/2018 at 8:47 AM  
Concur: Yes  
Comments: The new course lists CE423 as concurrent course. This may create difficulty in automatic enrollment of CE 522 for international graduate students, who may have the knowledge but may not have CE423 in their transcript. Just a suggestion for consideration. Whatever the instructor deems appropriate is fine with me.  
Reviewed On: 3/2/2018 at 9:51 AM

Initiator Comments: The instructor will accept equivalent background which should not prevent student enrollment in course.

Request sent: 3/20/2018 at 11:37 AM  
Last sent: 4/2/2018 at 7:30 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 4/4/2018 at 7:15 AM

Recipient Name: NATHANIEL RICHARD WARNER  
Department: (Not Available)  
Position: Consultation  
Campus: (Not Available)  
Title: ASST PROF ASST PROFESSOR

Request sent: 3/2/2018 at 8:47 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: PARISA SHOKOUHI  
Department: Civil And Environmental Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: ASSOCIATE PROFESSOR

Request sent: 3/2/2018 at 8:47 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)
Recipient Name: PATRICK JOSEPH FOX
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROF AND DEPT HEAD

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: RACHEL ALICE BRENNAN
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASSOC PROF ENVIRONMENTAL ENGR

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: SHELLEY MARIE STOFFELS
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR CIVIL

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: Excellent proposal for a valuable addition to our program. Appropriate at the 500-level.
Reviewed On: 3/2/2018 at 8:53 AM

Recipient Name: SUKRAN ILGIN GULER
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASST PROF CIVIL ENGINEER

Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/2/2018 at 3:30 PM

Recipient Name: THOMAS SKIBINSKI
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: INSTRUCTOR
(31) Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: TONG QIU
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASSOC PROF CIVIL ENGR

(32) Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Recipient Name: VIKASH GAYAH
Department: Civil Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASST PROF CIVIL ENGR

(8) Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments:
Reviewed On: 3/2/2018 at 12:24 PM

Recipient Name: WILLIAM D BURGOS
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR CIVIL & ENV EN

(9) Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: Proposal was collectively reviewed by all members of the Graduate Committee and unanimously approved.
Reviewed On: 3/2/2018 at 2:52 PM

Recipient Name: XIAOFENG LIU
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASSISTANT PROFESSOR OF CE

(33) Request sent: 3/2/2018 at 8:47 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/17/2018 at 7:15 AM

Head of Department
College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses

Recipient Name: MATTHEW PARKINSON
Department: (Not Available)
Position: College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses
Campus: UNIVERSITY PARK CAMPUS
Title:

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

Dean of the College

Recipient Name: GEORGE LESIEUTRE
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)
Final Confirmation

Recipient Name: ALLISON ALBINSKI  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS
Title:

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

Recipient Name: KADI CORTER  Department: (Not Available)
Position: Final Confirmation  Campus: UNIVERSITY PARK CAMPUS
Title:

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

Curricular Information

Blue Sheet Item #:
Review Date:

SCRID Numbers

(CE 522):
Proposal ID: 5323 created on 7/2/2018 5:51 PM
COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

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<th>Name</th>
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<tr>
<td>HUANYU CHENG</td>
<td>huc24</td>
<td>Engineering</td>
<td>Not Available</td>
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Academic Home: Engineering (EN)

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

Course Designation
(E MCH 501) Mechanics in Emerging Electronics for Biomedicine

Course Information

Cross-Listed Courses:

Prerequisites:

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Mech Emerging Elec

This course will be delivered: [ ] in residence  [ ] off-site  [ ] online

Bulletin Listing

Minimum Credits: 3
Maximum Credits: 3
Repeatable: NO

Department with Curricular Responsibility: Engineering Science And Mechanics (UPEN_ESCM)

Effective Semester: FA 2017
Travel Component: NO

Campuses That Have Offered ( ) Over The Past 4 Years

Course Outline

A brief outline or overview of the course content:
1. Introduction of emerging electronics
1.1 Bio-integrated electronics (e.g., wearable tattoo sensors)
1.2 Green devices toward sustainable environment (e.g., dissolvable sensors)
1.3 3D structures assembled from advanced materials (e.g., semiconductors)
2. Introduction to manufacturing techniques for biomedical devices
2.1 Micro-fabrication of thin film devices
2.1. Deposition
2.1.1. Deposition
2.1.2. Photolithography
2.1.3. Etching (Isotropic vs. anisotropic etching, etching techniques)
2.2 Assembly of heterogeneous materials for multilayer devices
2.2.1. Microrobotic assembly
2.2.2. Guided self-assembly
2.2.3. Additive manufacturing (digital light projection, inkjet printing, laser sintering, direct laser writing, and screen printing)
2.2.4. Transfer printing (conventional vs. advanced techniques)
2.3 Design example: stretchable temperature sensor array
3. Mechanics of thin films for flexible electronics
3.1 Thin film definitions
3.2 Stoney formula
3.3 Multiple layers
3.4 Failure modes
4. Perturbation method for stretchable electronics
4.1 Regular perturbation method
4.2 Singular perturbation method
4.3 Design example: strain isolation in stretchable electronics
5. Bending and buckling analysis in the design of flexible and stretchable electronics
5.1 Neutral mechanical plane, bending stiffness
5.2 Critical buckling load of a beam
5.2.1 Fixed-free boundary conditions
5.2.2 Fixed-fixed boundary conditions
5.3 Finite rotation theory
6. Energy method for stretchable electronics
6.1 Total energy: membrane energy, bending energy, and substrate energy
6.2 Energy minimization
6.3 Dimensional analysis
6.4 Design example: buckling of a stiff thin film on a compliant substrate
7. Introduction to fracture mechanics for transfer printing
7.1 Basic concepts
7.1.1 Brittle vs. ductile materials
7.1.2. Three modes of failure: Mode I, II, and III
7.1.3. Stress field (asymptotic field)
7.1.4. Plastic zone
7.1.5. Computational fracture mechanics
7.2 Fracture energy and J-integral
7.3 Advanced topics: elastic-plastic, dynamic, interfacial fracture mechanics
7.4 Design example: interfacial delamination in transfer printing

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
1. Introduction (3 hours)
2. Introduction to manufacturing techniques (12 hours)
3. Mechanics of thin films. (3 hours)
4. Perturbation method. (6 hours)
5. Bending and buckling. (3 hours)
6. Energy method. (5 hours)
7. Introduction to fracture mechanics. (10 hours)
8. Project presentation (3 hours)

Course Description:
Recent advances in electronics enable powerful biomedical devices that have greatly reduced therapeutic risks by monitoring vital signals and providing means of treatment. Implantable devices can help us better understand the behavior and effects of various diseases. However, an additional procedure is required to remove the device after an initial implantation. Conventional electronics today are formed on the planar surfaces of brittle wafer substrates and are not compatible with the complex topology of body tissues. Therefore, stretchable and absorbable electronics are the two missing links in the design process of implantable monitors and in-vivo therapeutics. Mechanics design strategies present unique opportunities to address the challenges in such a potential medical device that (a) integrates with human physiology, and (b) dissolves completely after its effective operation. In this course, we will apply mechanics strategies to address challenging issues in emerging electronics, with examples ranging from sensors for temperature/strain/hydration/electrophysiological monitoring to integrated systems that can serve as human-machine interfaces.

This course covers a broad range of topics related to the mechanics strategies for the emerging electronics in biomedicine, including manufacturing techniques for biomedical devices, mechanics of thin films for flexible electronics, perturbation method for stretchable electronics, bending and buckling analysis in the design of flexible and stretchable electronics, energy method for stretchable electronics, and introduction to fracture mechanics for transfer printing.

The name(s) of the faculty member(s) responsible for the development of the course:
- Name: HUANYU CHENG (huc24)
Title: Assistant Professor Engineering Science and Mechanics
Phone: 814-863-5945
Address: 307D EES Building
Campus: UP
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 assignments as well as journal literature as a viable teaching instrument.

Students will be required to employ engineering and scientific journal articles in the readings, homework, and project of this course. 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 mechanics strategies employed in design of emerging electronics.

After successfully completing this course, a student will be able to design, simulate, and manufacture emerging electronics using mechanics principles (e.g., mechanics of thin film, perturbation method, bending and buckling, energy method, and fracture mechanics), finite element simulation tools, and micro-fabrication techniques (e.g., deposition, photolithography, and etching).

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 three types: (1) five written homework assignments (equally weighted) (2) one project (in-class presentation with final project report) and (3) class participation. The block of 5 homework assignments, in-class presentation, and final project report will each have a weight of 30%. Class participation will account for 10%.

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 MCH 501 is not a prerequisite for any other course. E MCH 501 is related to other courses, such as MATH 597-003 Asymptotic and Perturbation Methods, E MCH 500 (M E 560) Solid Mechanics, E MCH 532 Fracture Mechanics, and E SC 481 Elements of Nano/Micro-electromechanical Systems Processing and Design. Many basic concepts from these courses will contribute to the design and manufacturing of emerging electronics. However, students are not required to take all of these courses. Therefore, E MCH 501 is designed to have certain overlaps with these courses to provide students the basic background from these courses, but particularly with the information directly relevant to the design and manufacturing of emerging electronics, such as stretchable sensors or dissolvable devices.

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 MCH 501 is an elective course for students taking the M. Eng., M.S., or Ph.D. degree programs in Engineering Science and Mechanics.

A description of any special facilities:
None

Frequency of Offering and Enrollment:
It is anticipated that this course will be offered every fall semester. The first offering is proposed for fall 2017. The enrollment is anticipated to be 5-10 students/offering.

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

Legend

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Consultation

Recipient Name: MELIK C DEMIREL Department: Engineering Science And
Recipient Name: MICHAEL LANAGAN  
Department: Engineering Science  And Mechanics

Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS

Title: PROF ESM/MSE
(1) Request sent: 1/19/2017 at 12:57 PM
Concur: Yes
Comments:
Reviewed On: 1/19/2017 at 5:16 PM

Respond To Comments

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

(3) Request sent: 1/30/2017 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 2/3/2017 at 7:15 AM

Respond To Comments

Recipient Name: SULIN ZHANG
Department: (Not Available)
Position: Consultation
Campus: (Not Available)
Title: PROFESSOR ENGRSCI & MECH

(4) Request sent: 1/30/2017 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 2/3/2017 at 7:15 AM

Respond To Comments

Recipient Name: CHITARANJAN DAS
Department: Computer Science And Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: DISTINGUISHED PROF CSE

(12) Request sent: 2/17/2017 at 12:41 PM
Concur: Yes
Comments:
Reviewed On: 2/22/2017 at 5:08 PM

Respond To Comments

Recipient Name: JANIS TERPENNY
Department: Industrial And Manufacturing Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: DEPT HEAD & PROF INDUSTL

(13) Request sent: 2/17/2017 at 12:41 PM
Concur: Yes
Comments:
Reviewed On: 2/23/2017 at 10:31 AM

Respond To Comments
Recipient Name: KAREN THOLE
Department: Mechanical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: DEPT HEAD MNE

Request sent: 2/17/2017 at 12:41 PM
Concur: Yes
Comments:
Reviewed On: 2/17/2017 at 5:46 PM

Recipient Name: KULTEGIN AYDIN
Department: Electrical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: DEPT HEAD/PROF ELECT ENGR

Request sent: 2/17/2017 at 12:41 PM
Concur: Yes
Comments:
Reviewed On: 2/24/2017 at 4:30 PM

Recipient Name: M PARFITT
Department: Architectural Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR ARCH ENGR

Request sent: 2/27/2017 at 7:37 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 3/4/2017 at 7:15 AM

Recipient Name: PATRICK FOX
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROF AND DEPT HEAD

Request sent: 2/17/2017 at 12:41 PM
Concur: Yes
Comments:
Reviewed On: 2/17/2017 at 1:35 PM

Recipient Name: PAUL HEINEMANN
Department: Agricultural And Biological Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: DEPT HD/PROF AG & BIO ENG
Respond To Comments

Recipient Name: WILLIAM HANCOCK  Department: (Not Available)
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title:

(7)  Request sent: 2/17/2017 at 12:41 PM
Concur: Yes
Comments: I approve the course. I have a few suggestions for possible improvement. First, the mechanical aspects of these materials seems covered well, but not so much on the electronic aspects. Second, I didn't think the evaluation methods were very rigorous. These are comments for improvement only.
Reviewed On: 2/17/2017 at 3:54 PM
Initiator Comments: Thank you for your comments. After careful thought, I will continue with the current proposal. Improvements can be made after I gather feedback from the first batch of students.

Recipient Name: THOMAS LAPORTA  Department: Computer Science And Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: LNHRDCHAIRPROF & DIR EECS

(11)  Request sent: 2/17/2017 at 3:28 PM
Concur: Yes
Comments: 
Reviewed On: 2/19/2017 at 10:37 PM

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]

College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses

Recipient Name: MATTHEW PARKINSON  Department: (Not Available)
Position: College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses  Campus: UNIVERSITY PARK CAMPUS
Title:
<table>
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<tr>
<td>Dean of the College</td>
<td>PETER BUTLER</td>
<td>(Not Available)</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<tr>
<td>Review on Behalf of the Dean of the Graduate School</td>
<td>VICKI HEWITT</td>
<td>(Not Available)</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<td>Feedback from the Graduate Council Joint Curricular Committee</td>
<td>ROBERT BANNON</td>
<td>(Not Available)</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<td>Final Confirmation</td>
<td>CORTNEY SMITH</td>
<td>(Not Available)</td>
<td>UNIVERSITY PARK CAMPUS</td>
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</table>
Recipient Name: KADI CORTER  
Department: (Not Available)  
Position: Final Confirmation  
Campus: UNIVERSITY PARK CAMPUS  
Title: 

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

Recipient Name: ALLISON ALBINSKI  
Department: (Not Available)  
Position: Final Confirmation  
Campus: UNIVERSITY PARK CAMPUS  
Title: 

Request sent: 2/17/2017 at 2:01 PM  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

Curricular Information
Blue Sheet Item #: 
Review Date: 

SCRID Numbers 
(E MCH 501):
Graduate Council Subcommittee On New And Revised Programs and Courses

COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

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<th>Name</th>
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<td>Engineering (EN)</td>
<td>Not Available</td>
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<td>CATHERINE HARZONOSKY</td>
<td>C1H</td>
<td>Engineering (EN)</td>
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Academic Home: Engineering (EN)

Type of Proposal: ☐ Add ☑ Change ☐ Drop

Current Bulletin Listing

Abbreviation: IE

Number: 525

Course Designation

(IE 525) Convex Optimization

Justification of Course Number:

To change the course number from IE 525 to IE 585 in order to cross list with EE 585 (which does not exist yet). This course covers the fundamentals of convex optimization needed for high-level research in theoretical operations research focusing on algorithm design and analysis for IE students, and for high-level research in control systems, signal processing for EE students. This course will contribute to the student’s ability in the aforementioned subdisciplines of IE and EE to expand the frontiers of knowledge, and therefore produce creative scholarly products in mathematical optimization related research.

Course Information

Cross-Listed Courses:

EE 585(EN)

Prerequisites:

IE 505

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Convex Optimizatn

This course will be delivered:

☑ in residence

☐ off-site

☐ online

Bulletin Listing

Minimum Credits: 3

Maximum Credits: 3

Repeatable: YES

Maximum Total Credits: 999

Department with Curricular Responsibility: Industrial And Manufacturing Engineering (UPEN IME)

Effective Semester: After approval, the Faculty Senate will notify proposers of the effective date for this course change. Please be aware that the course change may not be effective until between 12 to 18 months following approval.

Travel Component: NO

Campuses That Have Offered (IE 525) Over The Past 4 Years

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
<th>Department</th>
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<tr>
<td>NECDET AYBAT</td>
<td>nsa10</td>
<td>Engineering</td>
<td>Not Available</td>
</tr>
<tr>
<td>CATHERINE HARZONOSKY</td>
<td>C1H</td>
<td>Engineering</td>
<td>Not Available</td>
</tr>
</tbody>
</table>
Course Outline

A brief outline or overview of the course content:
This is a course in convex optimization, focusing on properties of convex sets and convex functions. In the lectures, recognizing convex optimization problems, their solution techniques and real life applications will be discussed. Assignments will be mainly theoretical and there will be a small course project on implementation of an optimization algorithm to solve a practical problem.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
PART I: Convex Sets (3 weeks)
1. Important examples of convex sets
2. Operations that preserve convexity
3. Separating and supporting hyperplanes
4. Dual cones and generalized inequalities

PART II: Convex Functions (3 weeks)
5. Properties of convex functions
6. Important examples of convex functions
7. Operations that preserve convexity
8. Convexity with respect to generalized inequalities

PART III: Convex Optimization (3 weeks)
9. Important examples of convex optimization problems
10. Lagrange duality
11. Optimality conditions
12. Theorems of alternatives
13. Lagrange duality for problems with generalized inequalities

PART IV: Algorithms (4 weeks)
14. Unconstrained minimization
15. Constrained optimization – penalty and augmented Lagrangian methods
16. Constrained optimization – interior point methods

PART V: Real-Life Applications (2 week)
17. Various applications of convex optimization (paper discussion)

Course Description:
Recognizing and solving convex optimization problems that arise in real life applications. This course is designed to provide students with necessary skills to recognize or build convex optimization problems coming from diverse application areas and to solve them efficiently. It consists of five parts: 1) convex sets, 2) convex functions, 3) convex optimization, 4) algorithms and 5) real life applications. In the first part, important examples of convex sets will be given and the operations that preserve convexity of sets will be discussed. The second part will focus on convex functions, their basic properties, and the operations that preserve convexity of functions. In the third part, which is built on the first two parts, convex optimization problems will be formally introduced along with important examples ranging from linear and quadratic to semi-definite programming; second, Lagrange duality and optimality conditions will be covered. The fourth part will focus on the algorithms to solve convex problems and on their computational complexity. In the fifth part, various applications will be covered through paper discussions. Assignments will be used to reinforce learning and supplement extra information for each section. A final course project will allow students to integrate all the first four course sections to solve a practical problem.

The name(s) of the faculty member(s) responsible for the development of the course:
- Name: CATHERINE HARMONOSKY (C1H)
  Title:
  Phone:
  Address:
  Campus: UP
  City:
  Fax:
- Name: NECDET AYBAT (nsa10)
  Title:
  Phone:
  Address:
  Campus: UP
  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 course objectives are to supply students with the techniques to model and solve convex optimization problems through interactive lectures, theoretical assignments and a small project. After completing this course, students should be able to understand how to: 1) model or recognize convex problems and 2) solve them efficiently.

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.
Evaluation will be determined as follows:

- Midterm (30%)
- Final Exam (30%)
- Course Project (20%)
- Homework (20%)

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.
The course is an elective course for all Industrial Engineering MS and PhD degrees in Industrial Engineering. This course requires an understanding of linear optimization and non-measure theoretic real analysis. It builds upon material in IE 505 or equivalent background. Working knowledge of non-measure theoretic real analysis is highly desired.

This course is valuable for EE graduate students in the control area to prepare them for EE 581, EE 584 and EE 587. The course is also helpful for preparing EE graduate students in the signal processing and communications area for other classes such as EE 562, EE 551 and EE 561.

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 course is to be listed in Industrial & Manufacturing Engineering and the department will sign the cover form. This course is to be cross-listed with EE 585, which does not exist yet.

A description of any special facilities:
This course does not require any special facility.

Frequency of Offering and Enrollment:
This course will be offered in spring semesters, alternating between IE and EE. The expected enrollment is approximately 20 students each time it is offered.

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.
Changing course number from IE 525 to IE 585 to cross list with EE 585, which does not yet exist.

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: AB Shafaye
Department: Science, Engineering And Technology
Position: Consultation
Campus: PENN STATE HARRISBURG, THE CAPITAL COLLEGE
Recipient Name: CONSTANTINO LAGOA
Department: Electrical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR_ELECTRICAL ENGR

Request sent: 3/20/2018 at 3:23 PM
Concur: Yes
Comments: This course will provide the necessary background for many of the optimization tools used in many areas in several engineering fields.
I believe that it will be of great value for graduate students.
Reviewed On: 3/21/2018 at 8:26 AM

Recipient Name: DAVID SALVIA
Department: Electrical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASST PROF ELECT. ENGR.

Request sent: 3/20/2018 at 3:23 PM
Concur: Yes
Comments: The EE Department is in support of this number change and cross-listing. The number 585 was selected because it works for both IE and EE. The EE and IE Departments will share teaching responsibilities for this course.
Reviewed On: 3/20/2018 at 5:47 PM

Recipient Name: MINGHUI ZHU
Department: Electrical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASST PROF ELECTRICAL ENG

Request sent: 3/21/2018 at 5:51 PM
Concur: Yes
Comments: This course will be valuable for many graduate students in Electrical Engineering and Industrial Engineering.
Recipient Name: RAM NARAYANAN  
Department: Electrical Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: PROFESSOR ELECT ENGR

Request sent: 3/21/2018 at 5:51 PM 
Concur: Yes  
Comments:  
Reviewed On: 3/22/2018 at 8:18 AM

Recipient Name: THOMAS HEMMINGNER  
Department: Engineering  
Position: Consultation  
Campus: PENN STATE ERIE, THE BEHREND COLLEGE  
Title: PROFESSOR ELEC & COMP ENG

Request sent: 3/21/2018 at 5:51 PM 
Last sent: 4/2/2018 at 7:31 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 4/5/2018 at 7:15 AM

Recipient Name: VISHAL MONGA  
Department: Electrical Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: ASSOC PROF ELECTRICAL ENG

Request sent: 3/21/2018 at 5:51 PM 
Last sent: 4/2/2018 at 7:31 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 4/5/2018 at 7:15 AM

Head of Department

Recipient Name: JANIS TERPENNY  
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]  

Recipient Name: KUNITEGIN AYDIN  
Department: (Not Available)  
Position: Head of Department  
Campus: UNIVERSITY PARK CAMPUS  
Title:
College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses

Recipient Name: Matt Parkinson
Department: (Not Available)
Position: College/School Representative to the Graduate Council Subcommittee on New and Revised Programs and Courses
Campus: UNIVERSITY PARK CAMPUS

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

Dean of the College

Recipient Name: GEORGE LESIEUTRE
Department: (Not Available)
Position: Dean of the College
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

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: UNIVERSITY PARK CAMPUS

Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]
## Final Confirmation

<table>
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<tbody>
<tr>
<td>ALLISON ALBINSKI</td>
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<td>UNIVERSITY PARK CAMPUS</td>
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<tr>
<td>JOY ROBERTSON</td>
<td>(Not Available)</td>
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<tr>
<td>KADI CORTER</td>
<td>(Not Available)</td>
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## Curricular Information

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## SCRID Numbers

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Proposal ID: 6868 created on 4/26/2018 10:42 AM