Engineering Faculty Council
Meeting Agenda
January 16th, 2018
11:00 a.m.
202 Hammond Building (Stavely Conference Room)

1. Approval of minutes for the meeting of December 12th, 2017

2. Dean’s Report

3. Updates from Undergraduate Studies Committee
   - No updates

4. Updates from Graduate Studies Committee
   - GS&R Activity Summary
   - Proposal Report
   - ESC 518 - Bioprinting

5. Updates from Engineering Technology Committee

6. Updates from Faculty Senate

7. Other Business
Engineering Faculty Council
Meeting Agenda
December 12, 2017
11:00 a.m.
202 Hammond Building (Stavely conference room)
Present: Dan Hayes, Aly Said, Gary Tan, Doug Wolfe, Anthony Atchley, Chris Masters, Matt Parkinson, Peter Butler, Antonios Armaou, Minghui Zhu

1. Approval of minutes for the meeting of October 24th, 2017
   *Unanimously approved.*

2. Dean’s Report: The statement describing the criteria for promotion and tenure was last approved in 1994. The statement is currently being evaluated. EFC should consider evaluating the 1994 guidance for promotion and tenure, including the promotion criteria for non-tenure track faculty. A sub-committee to address revisions should be formed. The title ‘Lecturer’ will be added to the list of titles for fixed term faculty. There is currently a shortage of fixed term faculty for promotion committees that evaluate the career progression of fixed term faculty. Wick Keefer is guiding the search for a new Associate Dean of Diversity and Inclusion. There are at least 19 applicants. Peter Butler is currently the interim Associate Dean.

3. Undergraduate Studies Committee: No updates.

4. Graduate Studies Research Committee: Matt Presented. At the University level, there is increased scrutiny of 500 vs. 800 level graduate program courses to ensure an appropriate distinction. 800-level graduate courses are practicums. Additional guidance and/or primers on preparing correct 800-level graduate program course proposals should be prepared by the College of Engineering. Several new graduate faculty nominations were approved. Changes to the following graduate courses were approved:

   • IE 513 – Stochastic Optimization
   • ESC 529 – Neural Control Engineering
   • ESC 503 – Low Dimensional Nanoelectronics
   • CE 556 – Environmental Electrochemistry

5. EMET: Chris suggested Engineering option names should be included with the Major.

6. Faculty Senate: Provost Nick Jones discussed the Strategic Initiative funding program. There were changes to Senate voting procedures to elect new senators. There were policy changes to make undergraduate majors compliant with federal funding rules. There is a need to increase undergraduate representation on the Faculty Senate. There was a change in policy to address attendance concerns with respect to the National Guard and Army, Air Force, Navy, Marine Reserve services. There was a change in the email policy to make it more uniform.
Graduate Studies and Research Committee Activity Summary
for EFC Meeting - January 16, 2018

Course Proposals:

Approved:
- (ESC 518) Bioprinting - Add

Returned to Proposer for Revisions:
- (E MCH 501) Mechanics in Emerging Electronics - Add
- (IE 594) Capstone Design – Add

Program Proposals:

Returned to Proposer for Revisions:
- Nuclear Security Option - Masters of Science and Masters of Engineering Degrees in Nuclear Engineering - Add
<table>
<thead>
<tr>
<th>Proposal Type</th>
<th>Title</th>
<th>Action Requested (Add/Change/Drop)</th>
<th>Vote</th>
<th>GS&amp;R*</th>
<th>Justification</th>
<th>Summary of Discussion Points</th>
</tr>
</thead>
</table>
| Course       | (ESC 518) Bioprinting  | Add                                | Approve (comments returned to proposer) | GS&R* | The instructional objectives include effectively employing the usual vehicles of lectures, but also effectively utilizing classroom and laboratory demonstrations. Hands-on training and laboratory assignments in the area of biomedical image processing, 3D printing, and bioprinting will expose the students to multidisciplinary practices. The educational objectives include understanding the scientific and engineering basis and principles for bioprinting processes utilizing mechanical, electrical, sound, and thermal energy. The course will also convey the impact of bioprinting tissues on various areas such as tissue engineering and regenerative medicine, pharmacetics and drug testing, and disease modeling. The course objective is to develop engineers (a) who are fully cognizant of the scientific basis of bioprinting, of its current impact and future potential, and of its societal implications, and (b) who have experienced hands-on practices to solve multidisciplinary problems requiring technical and practical experiences in engineering, biology, and medicine. After successful completion of this course, a student will have both a theoretical and practical understanding of bioprinting, and will be able to use such knowledge in tissue biofabrication for a broad spectrum of applications. | *I agree - provide an overview and move the topics to the next section. Other than that I vote to approve.  
*The detailed listing of topics under "brief outline or overview" should be moved to the next section with the time breakdown. A few sentences providing an overview of the content should be substituted. Beyond that, I vote to approve.  
*The detailed listing of topics under "brief outline or overview" should be moved to the next section with the time breakdown. A few sentences providing an overview of the content should be substituted. Beyond that, I vote to approve. |
Graduate Council Subcommittee On New And Revised Programs and Courses

COURSE SUBMISSION AND CONSULTATION FORM

<table>
<thead>
<tr>
<th>Principal Faculty Member(s) Proposing Course</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
</tr>
<tr>
<td>IBRAHIM OZBOLAT</td>
</tr>
</tbody>
</table>

**Academic Home:** Engineering (EN)

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

**Course Designation**

(ESC 518) Bioprinting

**Justification of Course Number:**

**Course Information**

**Cross-Listed Courses:**

BIOE 518(EN)

**Prerequisites:**

**Corequisites:**

**Concurrents:**

**Recommended Preparations:**

**Abbreviated Title:** Bioprinting

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:** SP 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:

1. Introduction
2. Tissue Engineering and Regenerative Medicine
   i. Organ transplantation
   ii. Tissue engineering
   iii. Tissue scaffolding
   iv. Tissue scaffold requirements
3. 3D Printing, Layered Manufacturing and Rapid Tooling in Medicine
   i. Fundamentals in 3D printing
   ii. 3D printing techniques
   iii. Process planning for 3D printing
A listing of the major topics to be covered with an approximate length of time allotted for their discussion:

1. Introduction (1.5 hours)
2. Tissue Engineering and Regenerative Medicine (7.5 hours)
3. 3D Printing, Layered Manufacturing and Rapid Tooling in Medicine (6 hours)
4. Design for Bioprinting (4.5 hours)
5. The Bioink: Bioprintable Materials (6 hours)
6. Extrusion-based Bioprinting (6 hours)
7. Droplet-based Bioprinting (3 hours)
8. Laser-based Bioprinting (3 hours)
9. Bioprinters and their components (3 hours)
10. Application Areas of Bioprinting (3 hours)
11. New Frontiers in Tissue Engineering: Organ Printing (1.5 hours)

Course Description:
This course covers the principles of bioprinting in tissue engineering and regenerative medicine for use in fabrication of biomedical related products such as implants, tissue scaffolds, engineered tissues, organs, and biological systems. Topics include tissue engineering, 3D printing, layered manufacturing and rapid tooling in medicine, design for bioprinting, The Bioink, extrusion-based bioprinting, droplet-based bioprinting, laser-based bioprinting, bioprinters and their components, application areas of bioprinting, and new frontiers in tissue engineering such as organ printing. The course also includes hands-on laboratory assignments.

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

Name: IBRAHIM OZBOLAT (ito1)
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 instructional objectives include effectively employing the usual vehicles of lectures, but also effectively utilizing classroom and laboratory demonstrations. Hands-on training and laboratory assignments in the area of biomedical image processing, 3D printing, and bioprinting will expose the students to multidisciplinary practices.

The educational objectives include understanding the scientific and engineering basis and principles for bioprinting processes utilizing mechanical, electrical, sound, and thermal energy. The course will also convey the impact of bioprinting tissues on various areas such as tissue engineering and regenerative medicine, pharmaceutics and drug testing, and disease modeling.

The course objective is to develop engineers (a) who are fully cognizant of the scientific basis of bioprinting, of its current impact and future potential, and of its societal implications, and (b) who have experienced hands-on practices to solve multidisciplinary problems requiring technical and practical experiences in engineering, biology, and medicine.

After successful completion of this course, a student will have both a theoretical and practical understanding of bioprinting, and will be able to use such knowledge in tissue biofabrication for a broad spectrum of applications.

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 3 exams and 3 hands-on homework assignments. The exams will have a weight of 70% (Exam I~20%; Exam II~20%; Final Exam~30%) and the block of 3 homework assignments will have a weight of 30%. Homework assignments are equally weighted.

Relationship/Linkage of Course to Other Courses:
This statement should relate the course to existing or proposed new courses. It should provide a rationale for the level of instruction, for any prerequisites that may be specified, or for the course's role as a prerequisite for other courses.
E SC 518 is a highly unique course. There are no relevant/comparable courses existing.
E SC 518 is not a required prerequisite for any other course.

Relationship of Course to Major, Option, Minor, or General Education:
This statement should explain how the course will contribute to the major, option, or minor and indicate how it may function as a service course for other departments.
E SC 518 is an elective course for the Master of Science degree in Additive Manufacturing.

A description of any special facilities:
There will be a software tutorial on 3D printing, which will be covered in a computer lab at Maker Commons. In addition, the bioprinting laboratory in the Millennium Science Complex will be used for the bioprinting training and assignment.

Frequency of Offering and Enrollment:
It is anticipated that this course will be offered every Spring. The enrollment is anticipated to be 15 students/offering.

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: ALLISON BEESE
Department: Materials Science And Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: Assistant professor
Recipient Name: DANIEL HAYES  Department: Biomedical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: ASSOC PROF ASSOC PROF

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

Recipient Name: JEFFREY CATCHMARK  Department: Agricultural And Biological Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROF AG & BIO ENG

Recipient Name: JIAN YANG  Department: Biomedical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR BIOENGINEERING

Recipient Name: JIAN YANG  Department: Biomedical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR BIOENGINEERING

Recipient Name: JIAN YANG  Department: Biomedical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR BIOENGINEERING

Recipient Name: JIAN YANG  Department: Biomedical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR BIOENGINEERING
Recipient Name: **KAREN THOLE**  
**Position:** Consultation  
**Department:** Mechanical Engineering  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:** DEPT HEAD MNE  
---  
**Request sent:** 6/12/2017 at 4:25 PM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 6/12/2017 at 7:58 PM  

Recipient Name: **KULTEGIN AYDIN**  
**Position:** Consultation  
**Department:** Electrical Engineering  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:** DEPT HEAD/PROF ELECT ENGR  
---  
**Request sent:** 6/12/2017 at 4:25 PM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 6/18/2017 at 11:10 AM  

Recipient Name: **LAUREN ZARZAR**  
**Position:** Consultation  
**Department:** Materials Science And Engineering  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:** MATERIALS SCI&ENG  
---  
**Request sent:** 6/12/2017 at 4:25 PM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 6/13/2017 at 5:53 PM  

Recipient Name: **M PARFITT**  
**Position:** Consultation  
**Department:** Architectural Engineering  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:** PROFESSOR ARCH ENGR  
---  
**Request sent:** 6/12/2017 at 4:25 PM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 6/19/2017 at 7:30 AM  

Recipient Name: **PATRICK FOX**  
**Position:** Consultation  
**Department:** Civil And Environmental Engineering  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:** PROF AND DEPT HEAD  
---  
**Request sent:** 6/12/2017 at 4:25 PM
Recipient Name: PAUL HEINEMANN  
Department: Agricultural And Biological Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: DEPT HD/PROF AG & BIO ENG

Recipient Name: PHILIP MORRIS  
Department: Aerospace Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: BOEING PROFESSOR OF AERSP

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

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

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

Request sent: 6/12/2017 at 4:25 PM
Concur: Yes
Comments:
Reviewed On: 6/17/2017 at 12:59 PM

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

Request sent: 6/12/2017 at 4:25 PM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 6/27/2017 at 7:15 AM

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

Request sent: 6/12/2017 at 4:25 PM
Concur: Yes
Comments:
Reviewed On: 6/12/2017 at 10:25 PM

Recipient Name: TIMOTHY SIMPSON
Department: Mechanical Engineering
Position: Consultation
Title: PROF ME & IE
Campus: UNIVERSITY PARK CAMPUS

Request sent: 6/12/2017 at 4:25 PM
Concur: Yes
Comments:
Reviewed On: 6/26/2017 at 7:30 AM

Recipient Name: WILLIAM HANCOCK
Department: Bioengineering
Position: Consultation
Title: PROFESSOR BIOENGINEERING
Campus: UNIVERSITY PARK CAMPUS

Request sent: 6/12/2017 at 4:25 PM
Concur: Yes
Comments:
Reviewed On: 6/26/2017 at 7:30 AM
**Comments:** I think this looks a great course addition. A few comments (I have consulted by email with Ibrahim Ozbolat). First, it should be co-listed with BIOE and not BME since it is a grad course. This will be an excellent cross listing because it fits well with the existing biomaterials courses. Also, we discussed the possibility of both BIOE PhD students and BME 1 yr MS students taking the course because it will definitely be of interest. We agreed to discuss at a later date how to most efficiently co-align this course with existing biomaterials/tissue engineering/regenerative medicine courses to best set up series of courses for both MS and PhD students in different programs.

**Reviewed On:** 6/26/2017 at 7:57 AM

**Initiator Comments:** Thank you for your comments. The cross listing for the course has been changed from BME to BIOE. The course number was also changed to 518 since BIOE already had a 505 course.

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(20) **Request sent:** 6/30/2017 at 12:16 PM

Concur: Yes

**Comments:**

**Reviewed On:** 6/30/2017 at 12:23 PM

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**Head of Department**

**Recipient Name:** [Judith Todd](mailto:judith todd)

**Position:** Head of Department

**Department:** (Not Available)

**Campus:** UNIVERSITY PARK CAMPUS

**Concur:** [Not Yet Reviewed]

**Comments:** [Not Yet Reviewed]

**Reviewed On:** [Not Yet Reviewed]

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

**Recipient Name:** Matthew Parkinson

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

**Department:** (Not Available)

**Campus:** UNIVERSITY PARK CAMPUS

**Concur:** [Not Yet Reviewed]

**Comments:** [Not Yet Reviewed]

**Reviewed On:** [Not Yet Reviewed]

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Dean of the College
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<tr>
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<tbody>
<tr>
<td><strong>Review on Behalf of the Dean of the Graduate School</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Recipient Name:</strong> PETER BUTLER</td>
<td><strong>Department:</strong> (Not Available)</td>
<td><strong>Position:</strong> Dean of the College</td>
<td><strong>Campus:</strong> UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td><strong>Recipient Name:</strong> VICKI HEWITT</td>
<td><strong>Department:</strong> (Not Available)</td>
<td><strong>Position:</strong> Review on Behalf of the Dean of the Graduate School</td>
<td><strong>Campus:</strong> UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td><strong>Recipient Name:</strong> ROBERT BANNON</td>
<td><strong>Department:</strong> (Not Available)</td>
<td><strong>Position:</strong> Feedback from the Graduate Council Joint Curricular Committee</td>
<td><strong>Campus:</strong> UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td><strong>Recipient Name:</strong> ALLISON ALBINSKI</td>
<td><strong>Department:</strong> (Not Available)</td>
<td><strong>Position:</strong> Final Confirmation</td>
<td><strong>Campus:</strong> UNIVERSITY PARK CAMPUS</td>
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<tr>
<td><strong>Recipient Name:</strong> KADI CORTER</td>
<td><strong>Department:</strong> (Not Available)</td>
<td><strong>Position:</strong> Final Confirmation</td>
<td><strong>Campus:</strong> UNIVERSITY PARK CAMPUS</td>
</tr>
</tbody>
</table>
Recipient Name: JOY ROBERTSON
Position: Final Confirmation
Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

Request sent: 11/9/2017 at 1:51 PM
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Curricular Information
Blue Sheet Item #:
Review Date:

SCRID Numbers
(ESC 518):
(BIOE 518):
Proposal ID: 4847 created on 11/13/2017 10:09 AM