1. Approval of minutes for the meeting of August 21, 2018

2. Dean’s Report

3. Updates from Undergraduate Studies Committee

4. Updates from Graduate Studies Committee

5. Update from the Graduate Council

6. Updates from Engineering Technology Committee

7. Updates from Faculty Senate

8. Other Business
   - Importance of Non-Major Courses in a Curriculum – Alok Sinha
1. Approval of minutes for the meeting of April 17, 2018
   a. Approved Unanimously

2. Dean’s Report
   a. UP freshman up 200. commonwealth down 400. Net 200 down
   b. Separate Mech and Nuclear department project. MNE taskforce committee chaired by Chris Rahn. Draft report is expected soon. Final report will be public with non-public addendum. Dean’s office will prepare proposal to faculty senate council. Committee for Faculty affairs and circular committee. Targeting Oct 9th for senate. Target for implementation is July 1, 2019. Focus on promotion and tenure process for current junior nuclear faculty.
   c. Master planning for facilities. Projected for two new buildings on West campus. Renovation of Sackett BLDG. Zero sum sq ft is current plan. Hammond may remain in part for GPC.
   d. Gender equity initiative- aligning college efforts with university recruiting

3. Updates from Undergraduate Studies Committee: Gary Gray
   a. ENG 350 course change. Request change of prerequisites.
      i. Unanimous approval.

4. Updates from Graduate Studies: Committee Ester Obonyo
   a. Seven candidates for graduate faculty status (non-tenure). Unanimous approval
   b. AMD certificate- unanimous approval
   c. Wind Energy- unanimous approval
   d. Course approval
      i. ME 590- cross listed with AMD 590. Approved
      ii. ESC 546- approved
      iii. IE 894 – approved
      iv. CE 522- approved
      v. EMCH 501- approved
      vi. IE 525- cross listed with EE. Approved.

5. Updates from Engineering Technology Committee
   a. Change in curriculum prerequisites coming.

6. Updates from Faculty Senate- Alok
   a. Circulated engineering members committee assignment

7. Other Business
   a. Hosam- Concerns with graduate appointment and pay. Stipend tables were delayed coupled with an early date for appointment (Aug 1st). Now a two-step process. HR is working through the process.
   b. Anthony- 300+ tenure/track faculty. 33% fewer than 4 four years of service.
   c. Smoke free campus initiative timing for initiation.
<table>
<thead>
<tr>
<th>Type and Description of Change</th>
<th>Description or Rationale for Curricular Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedical Engineering Program Proposal</td>
<td>List of newly created courses:</td>
</tr>
<tr>
<td>Submitted by: Siu Leung</td>
<td>• BME 408 - Solid Mechanics of Biological Materials (This course has offered in SP 2018) - This course presents advanced topics in solid mechanics that are important for understanding the behavior and function of biological materials. Building upon prior courses, students will learn the principles of strain energy, composite materials, plasticity, poroelasticity, viscoelasticity, and contact mechanics. These concepts will be used to describe the mechanical properties of biological materials spanning a large range of length scales (including joints, tissues, and cells) with emphasis on the musculoskeletal system.</td>
</tr>
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</tr>
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<td></td>
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1. Replace BIOL 142 by one of the new A&P labs (BIOL 162 or 164) – this is due to biology department will discontinue BIOL 142.

2. Biomaterial option: BME 409 is replaced as BME 409 or BME 413 or BME 408 - Biomaterials are now applied to a wide range of application, for example, bone plates, joint replacements, drug delivery mechanism, blood vessel prostheses etc. The importance of fluid mechanics, mass transport, and solid mechanics knowledge varies depends on the application. Therefore, we decide to change the fluid mechanic course requirement to a selected option between fluid mechanics, mass transport, and solid mechanics. So, students can choose the option which best fits their career needs.

3. Biomechanics option: 3 credits of related technical elective course is replaced by BME 408 - In our curriculum, basic solid mechanics knowledge is introduced in BME 303. BME 408 Solid Mechanics of Biological Materials is a continuous course followed by BME 303. This course will provide more advanced solid mechanics training to students who focus on biomechanics studies.

To incorporate with the BME and ME concurrent major option, BME 408 will replace the existing BME Related and ME Engineering Technical (ET) Elective which requires a BME 400 level or BIOE 500 level course NOT required for both majors.

4. BME Program Educational Objectives is updated based on the change from ABET.

---

**Engineering Leadership Development Minor Proposal**

Submitted by: Meredith Handley

<table>
<thead>
<tr>
<th>Minor Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>There has been a change in the course offerings for the program and it needs to be reflected accurately for effective program management and the communication via the bulletin. These changes will also assist our campus students in being able to complete the minor.</td>
</tr>
</tbody>
</table>

Reflecting that ENGR 408 (Engineering Leadership Principles - 2 credits) has been combined with the sister, co-requisite course, ENGR 493 (Engineering Leadership Practicum – 1 credit) to become ENGR 408 (3 credits). (this change in the course completed the course change process in 2016) ENGR 493 needs to be dropped as a requirement.

Some courses listed in the bulletin as being prescribed should be listed in additional courses.
- ENGR 409 Leadership in Organizations- should be listed as an additional course.
- STS 460 is no longer offered and should be removed. |
A course listed in the bulletin as additional course:
- BA 250 is no longer offered and should be removed.

Some courses are listed as additional that should be listed as prescribed:
- ENGR 407- technology of business management should be listed as prescribed

Many of our courses are not included in the additional course section. We would like to provide specific options in the additional course section that align with our curriculum and give students the flexibility to complete the minor based on their career goals. The additional course section should include the following courses (students would need to complete 6 credit)
- ENGR 409 Leadership in Organizations
- ENGR 422 Leadership of International Virtual Engineering Teams
- ENGR 405 Project Management
- ENGR 496 Independent Study

Therefore the updated list of prescribed and additional courses that should be reflected in the ELD minor include the following:
The Prescribed course section needs to be edited to have only 6 credits to include ENGR 408 and ENGR 407
The Additional courses section needs to be edited to have 6 credits to include: ENGR 409, 422, 405, 496

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDSGN 485 Engineering Design Portfolio</td>
<td>Charles Cox</td>
<td></td>
</tr>
<tr>
<td>ENGR 467 Robots and Their Role in Society</td>
<td>Alan Wagner</td>
<td></td>
</tr>
</tbody>
</table>
analyzing how the technical, computational, and systems role of the machine effect the behavior and values of individuals and segments of society.

The course is not technical in its treatment of robots and robotics, rather the focus is on critically investigating how the development of robotic technologies have impacted society in the past, present, and future. The course will not require programming or the development of an implemented project. Instead the course will focus on reading, analyzing and communicating about the issues and topics raised in class.

Participation is critical for this course. Students will be expected to actively participate and attend class, keep up with reading assignments, and complete written analysis of the discussed topics.
Proposal Designation: Biomedical Engineering
This is a proposed Change to Undergraduate Stand Alone Major

Initiators

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIU LEUNG</td>
<td>szl12</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)

Program Definition
Degree Offered: Bachelor of Science (BS)
Effective Semester: Summer 2010

Options
- None
- None
- None
- None

Offering College(s)
- Engineering

Entrance and/or Retention Policies

Entrance Requirement

Requested Policy: In addition to the minimum grade point average (GPA) requirements* described in the University Policies, all College of Engineering entrance to major course requirements must also be completed with a minimum grade of C: CHEM 110 (GN), MATH 140 (GQ), MATH 141 (GQ), MATH 250 or MATH 251, PHYS 211 (GN) and PHSY 212 (GN). All of these courses must be completed by the end of the semester during which the admission to major process is carried out.

*In the event that the major is under enrollment control, a higher minimum cumulative grade-point average is likely to be needed and students must be enrolled in the College of Engineering or Division of Undergraduate Studies at the time of confirming their major choice.

Justification: Entrance Requirements remain unchanged.
Objectives and Justification

Objectives:

Justification:

Justification For The Change Proposal:

List of newly created courses;

• BME 408 - Solid Mechanics of Biological Materials (This course has offered in SP 2018) - This course presents advanced topics in solid mechanics that are important for understanding the behavior and function of biological materials. Building upon prior courses, students will learn the principles of strain energy, composite materials, plasticity, poroelasticity, viscoelasticity, and contact mechanics. These concepts will be used to describe the mechanical properties of biological materials spanning a large range of length scales (including joints, tissues, and cells) with emphasis on the musculoskeletal system.

List of current courses, which are being added to the program;

• BIOL 162, BIOL 164, BME 413, BME 408

List of changed courses;

1. All option: BIOL 162 and BIOL 164 is added as a biology lab option.

2. Biomaterial option: BME 409 is replaced as BME 409 or BME 413 or BME 408

3. Biomechanics option: 3 credits of related technical elective course is replaced by BME 408

List of courses that will be removed from the program.

• Biomechanics option: 3 credits of related technical elective course

Justification:

1. Replace BIOL 142 by one of the new A&P labs (BIOL 162 or 164) – this is due to biology department will discontinue BIOL 142.

2. Biomaterial option: BME 409 is replaced as BME 409 or BME 413 or BME 408 - Biomaterials are now applied to a wide range of application, for example, bone plates, joint replacements, drug delivery mechanism, blood vessel prostheses etc. The importance of fluid mechanics, mass transport, and solid mechanics knowledge varies depends on the application. Therefore, we decide to change the fluid mechanic course requirement to a selected option between fluid mechanics, mass transport, and solid mechanics. So, students can choose the option which best fits their career needs.

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To incorporate with the BME and ME concurrent major option, BME 408 will replace the existing BME Related and ME Engineering Technical (ET) Elective which requires a BME 400 level or BIOE 500 level course NOT required for both majors.

4. BME Program Educational Objectives is updated based on the change from ABET.

Proposal Outline

CIP Code: 140501

Faculty Member(s) in Charge:

<table>
<thead>
<tr>
<th>Name: CHENG DONG (CXD23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: DEPT HEAD/DIST. PROF BIO</td>
</tr>
</tbody>
</table>
Program Description:
The Biomedical Engineering curriculum emphasizes the continuous integration of classical and modern engineering principles with the life sciences and health care. Biomedical Engineers apply these skills to innovation in the health care industry, basic biological sciences, and the underpinning of medical practice.

Consistent with the mission of Penn State University and the College of Engineering, the Penn State Bachelor of Science program in Biomedical Engineering aims to create world-class engineers who will, after graduation, contribute to social and economic development through the application of engineering to the solution of problems in medicine and biology.

Program Educational Objectives

Three to five years after graduation, we expect our graduates to be:

employed in industry and government positions which include, but are not limited to, research and development, regulation, manufacturing, quality assurance and sales and marketing, or,
enrolled in graduate school, continuing education, or other professional development programs related to biomedical sciences and engineering, or,
enrolled in medical school, dental school, or other health-related professional training programs.

Program Outcomes (Student Outcomes)

Upon graduation from the Biomedical Engineering program, students will have:

• an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
• an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
• an ability to communicate effectively with a range of audiences
• an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
• an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
• an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
• an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
• an ability to apply principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations), and statistics;
• an ability to solve bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems;
• an ability to analyze, model, design and realize bio/biomedical engineering devices, systems, components, or processes; and
• an ability to making measurements on and interpreting data from living systems

ENTRANCE TO MAJOR -- In addition to the minimum grade point average (GPA) requirements* described in the University Policies, all College of Engineering entrance to major course requirements must also be completed with a minimum grade of C: CHEM 110 (GN), MATH 140 (GQ), MATH 141 (GQ), MATH 250 or MATH 251, PHYS 211 (GN) and PHYS 212 (GN). All of these courses must be completed by the end of the semester during which the admission to major process is carried out.

*In the event that the major is under enrollment control, a higher minimum cumulative grade-point average is likely to be needed and students must be enrolled in the College of Engineering or Division of Undergraduate Studies at the time of confirming their major
choice.

For the B.S. degree in Biomedical Engineering, a minimum of 130-131 credits are required. The baccalaureate program in Biomedical Engineering at University Park is accredited by the Engineering Accreditation Commission of ABET, Inc., www.abet.org.

Students in residence at the Commonwealth campuses may satisfy the course requirements for semesters 1-3. They should then transfer to University Park to begin studies in their major beginning with semester 4.

For a Bachelor of Science in Biomedical Engineering a minimum of 130 credits are required.

*Scheduling Recommendation by Semester Standing Given Like (Sem: 1-2)*

**Options**

- **Name: Biochemical Engineering**
  - Description: None

- **Name: Biomaterials**
  - Description: None

- **Name: Biomechanics**
  - Description: None

- **Name: Medical Imaging and Devices**
  - Description: None

**Academic Outline**

**REQUIREMENTS FOR THE MAJOR:**
112 - 113 credits are required
(This includes 27 credits of General Education courses: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.)

**GENERAL EDUCATION:** 45 Credits
(27 of these 45 credits are included in REQUIREMENTS FOR THE MAJOR)

**FIRST-YEAR SEMINAR:**
Included in Requirements for the Major

**UNITED STATES CULTURES AND INTERNATIONAL CULTURES:**
Included in General Education Requirements

**WRITING ACROSS THE CURRICULUM:**
Included in Requirements for the Major

**COMMON REQUIREMENTS FOR THE MAJOR (ALL OPTIONS):** (94 Credits)

**PRESCRIBED COURSES** (72 Credits)

- EDSGN 100 (3)(Sem: 1-2)
- CHEM 110 GN(3)[1], CHEM 111 GN(1), CHEM 112 GN(3), CHEM 113 GN(1)(Sem: 1-2)
- MATH 140 GQ(4)[1], MATH 141 GQ(4)[1], PHYS 211 GN(4)[1](Sem: 1-2)
- CMPSC 200 GQ(3), EMCH 210 (5)(Sem: 3-4)
- MATH 230 (4), MATH 251 (4)[1], PHYS 212 GN(4)(Sem: 3-4)
- BME 201 (3)(Sem: 4)
- BME 301 (4)[1], BME 303 (3), BME 313 (3)[1], BME 401 (3)[1], BME 402 (3)[1], BME 403 (1), ENGL 202C GWS(3)(Sem: 5-6)
- BME 429 (2), BME 440 (1), BME 450W (3)(Sem: 7-8)

**ADDITIONAL COURSES** (14 Credits)
Select 1 credit of First-Year Seminar (Sem: 1-2)

ENGL 15 GWS(3); ENGL 30 GWS(3)(Sem: 1-2)
ECON 102 (3); ECON 104 (3)(Sem: 1-2)
BIOL 141 (3)[1], BIOL 142 (1)[1], BIOL 162 (1)[1], BIOL 164 (1)[1], BIOL 240W (4)[1](Sem: 3-4)
CAS 100A (3); CAS 100B (3)(Sem: 4-8)

SUPPORTING COURSES (3 Credits)

Select 3 credits of Science or Engineering Elective courses (Sem: 7-8)

COMMON REQUIREMENTS FOR THE OPTION: Biochemical Engineering (24 Credits)

PRESCRIBED COURSES (9 Credits)

BME 409 (3), BME 413 (3)(Sem: 5-6)
BME 423 (3)(Sem: 7-8)

ADDITIONAL COURSES (3 Credits)

CHEM 202 (3); CHEM 210 (3)(Sem: 6-8)

SUPPORTING COURSES (12 Credits)

Select 9 credits from Biochemical Option department list (Sem: 6-8)
Select 3 credits from Related Electives department list (Sem: 6-8)

COMMON REQUIREMENTS FOR THE OPTION: Biomaterials (24 Credits)

PRESCRIBED COURSES (9 Credits)

MATSE 201 (3), BME 443 (3)(Sem: 5-6)
BME 446 (3)(Sem: 7-8)

ADDITIONAL COURSES (6 Credits)

BME 408 (3); BME 409 (3); BME 413 (3)(Sem: 5-6)
CHEM 202 (3); CHEM 210 (3)(Sem: 406)

SUPPORTING COURSES (9 Credits)

Select 3 credits from Related Electives department list (Sem: 6-8)
Select 6 credits from Biomaterials Option department list (Sem: 7-8)

COMMON REQUIREMENTS FOR THE OPTION: Biomechanics (24 Credits)

PRESCRIBED COURSES (12 Credits)

EMCH 212 (3), EMCH 315 (2), EMCH 316 (1)(Sem: 4-6)
BME 408 (3)(Sem: 7-8)
BME 409 (3)(Sem: 5-6)

SUPPORTING COURSES (12 Credits)

Select 9 credits from Biomechanics Option department list (Sem: 6-8)
Select 3 credits from Related Electives department list (Sem: 6-8)
COMMON REQUIREMENTS FOR THE OPTION: Medical Imaging and Devices (23 Credits)

PRESCRIBED COURSES (7 Credits)

EE 210 (4)(Sem: 3-4)
BME 406 (3)(Sem: 7-8)

ADDITIONAL COURSES (4 Credits)

CMPEN 271 (3), CMPEN 275 (1); CMPEN 270 (4); EE 310 (4); EE 330 (4)(Sem: 5-6)

SUPPORTING COURSES (12 Credits)

Select 6 credits from the Related Electives department list (Sem: 6-8 )
Select 6 credits from Medical Imaging and Device Option department list (Sem: 7-8)

[1] A student enrolled in this program must receive a grade of C or better, as specified in Senate Policy 82-44.

Courses modified by this proposal
ECON 104 (3); BIOL 141 (3)[1]; BIOL 240W (4)[1]

Courses added by this proposal
BIOL 162; BIOL 164; BME 408; BME 408

Existing Courses Added to or Moved Within Requirements for This Program
BME 408 ; BME 408 ; BME 409 ; BME 413 ; BIOL 162 ; BIOL 164

Existing Courses Removed from or Moved Within Requirements for This Program
BME 409

Academic Program Costing Analysis Form
Anticipated Costs: No costs are anticipated.

Academic Program Admissions Form

Baccalaureate (4-year) programs
First-year: N/A
Transfer: N/A
Non-Degree: N/A
Already graduated: N/A

Associate (2-year) programs
First-year: N/A
Transfer: N/A
Non-Degree: N/A
Already graduated: 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: **BARBARA DEHART**  
Department: Biology  
Position: Consultation  
Title: ASST. TEACHING PROFESSOR  
Campus: UNIVERSITY PARK CAMPUS

Request sent: 6/28/2018 at 1:36 PM  
Last sent: 7/9/2018 at 7:30 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 7/13/2018 at 7:15 AM

Recipient Name: **CARLA HASS**  
Department: Biology  
Position: Consultation  
Title: SENIOR LECTURER II  
Campus: UNIVERSITY PARK CAMPUS

Request sent: 6/28/2018 at 1:36 PM  
Last sent: 7/9/2018 at 7:30 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 7/13/2018 at 7:15 AM

Recipient Name: **JOHN WATERS**  
Department: Biology  
Position: Consultation  
Title: Assoc Dept Head, Biol Undergraduate Education  
Campus: UNIVERSITY PARK CAMPUS

Request sent: 6/28/2018 at 1:36 PM  
Last sent: 7/9/2018 at 7:30 AM  
Concur: Yes  
Comments:  
Reviewed On: 7/10/2018 at 10:28 AM

Recipient Name: **CHENG DONG**  
Department: Biomedical Engineering  
Position: Consultation  
Title: DEPT HEAD/DIST. PROF BIO  
Campus: UNIVERSITY PARK CAMPUS

Request sent: 6/28/2018 at 1:36 PM  
Concur: Yes
Recipient Name: ARTHUR MOTTA  
Department: Nuclear Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: PROF & CHAIR OF NUCL ENGR

Request sent: 6/28/2018 at 1:36 PM  
Last sent: 7/9/2018 at 7:30 AM  
Concur: Yes  
Comments: (Completed By Default - Exceeded Time Limit)  
Reviewed On: 7/13/2018 at 7:15 AM

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

Request sent: 6/28/2018 at 1:36 PM  
Concur: Yes  
Comments:  

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

Request sent: 6/28/2018 at 1:36 PM  
Concur: Yes  
Comments:  
Reviewed On: 6/29/2018 at 2:36 PM

Head of Department

Recipient Name: Cheng Dong  
Department: (Not Available)  
Position: Head of Department  
Campus: UNIVERSITY PARK CAMPUS  
Title:  
Concur: [Not Yet Reviewed]
# SCCA Representative

**Recipient Name:** ROBERT MELTON  
**Department:** (Not Available)  
**Position:** SCCA Representative  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:**  

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

---

# Dean of the College

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

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

---

# SCCA Subcommittee Review

**Recipient Name:** ALLISON ALBINSKI  
**Department:** (Not Available)  
**Position:** SCCA Subcommittee Review  
**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:** SCCA Subcommittee Review  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:**
SCCA Review

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

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

Faculty Senate Review

Recipient Name: ALLISON ALBINSKI
Department: (Not Available)
Position: Faculty Senate Review
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: Faculty Senate Review
Campus: UNIVERSITY PARK CAMPUS
Title:
Registrar Data Entry

Recipient Name: PAULA HAMATY
Position: Registrar Data Entry
Title:

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

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

Final Confirmation

Recipient Name: ALLISON ALBINSKI
Position: Final Confirmation
Title:

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

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

Recipient Name: KADI CORTER
Position: Final Confirmation
Title:

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

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

Curricular Information

Blue Sheet Item #:
Review Date:
Program Codes
Engineering: BME_BS

Option Codes
Biomedical Engineering:
Biochemical Engineering: BICHL
Biomaterials: BIMTL
Biomechanics: BIMCH
Medical Imaging and Devices: MIMDV

Uploaded Documents:
Context Type: Prospectus Memo
File Description: BME Prospectus Memo
File Name: Prospectus-BME-Table.pdf

Context Type: Supporting Documents
File Description: ACUE Consultation Results
File Name: ACUE Consultation Results for BME Program Change .pdf

Context Type: Prospectus Memo
File Description: Prospectus Memo
File Name: BME BS Biomedical Engineering Revisions.pdf

Proposal ID: 7596 created on 9/10/2018 3:28 PM
## P-2: Curricular Changes in Undergraduate Degrees/Majors, Options, IUGs, and Minors

<table>
<thead>
<tr>
<th>Submission Date</th>
<th>06/26/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate Dean Submitting This Prospectus</td>
<td>Peter J. Butler</td>
</tr>
<tr>
<td>Associate Dean Email</td>
<td><a href="mailto:pjb28@psu.edu">pjb28@psu.edu</a></td>
</tr>
<tr>
<td>Staff Assistant Email</td>
<td><a href="mailto:bvm4@psu.edu">bvm4@psu.edu</a></td>
</tr>
<tr>
<td>College and Campus</td>
<td>Engineering, UP campus</td>
</tr>
<tr>
<td>Department with Responsibility for the Program</td>
<td>Biomedical Engineering</td>
</tr>
</tbody>
</table>

### What type of program action is under consideration?
Curricular Change in Major

### Name of major, option, IUG or minor
Biomedical Engineering, all options

### Brief description of program
This proposal is to change the biology laboratory and prescribed courses requirements in the degree of Bachelor of Science (B.S.) in Biomedical Engineering. List of changes include:

1. Replace BIOL 142 by one of the new A&P lab (BIOL 162 or 164).
2. In Biomaterials option: BME 409 will be replaced by BME 409 or BME 413 or BME 408*.
3. In Biomechanics option: 3 credits of a related technical elective course will be replaced by BME 408*.

### Briefly provide the rationale for changing this program.

1. Replace BIOL 142 by one of the new A&P labs (BIOL 162 or 164) – this is due to the fact that the Biology department will discontinue BIOL 142.
2. Replace BME 409 in biomaterials option by BME 409 or BME 413 or BME 408* - Biomaterials are now applied to a wide range of applications, for example: bone plates, joint replacements, drug delivery mechanism, blood vessel prostheses, etc. The importance of fluid mechanics, mass transport, and solid mechanics knowledge varies depending on the application. Therefore, we decided to change the fluid mechanics course requirement to a selected option between fluid mechanics, mass transport, and solid mechanics. So, students can choose the option which best fits their career needs.
3. Replace 3 credits of a related technical elective by BME 408* - In our curriculum, basic solid mechanics knowledge is introduced in BME 303. BME 408* Solid Mechanics of Biological Materials is a continuation of material covered by BME 303. This course will provide more advanced solid mechanics training to students who focus on biomechanics studies.

*BME 408 - Solid Mechanics of Biological Materials, is a new course which had been offered once in Fall 2017 as BME 497.
Course description: This course presents advanced topics in solid mechanics that are important for understanding the behavior and function of biological materials, including cardiovascular tissues (e.g., blood vessels, myocardium, epicardium), musculoskeletal tissues (e.g., tendon, bone, articular cartilage), synthetic biomaterials (e.g., hydrogels, composites), and cells. The course will begin with a review of basic concepts in mechanics and mathematics, followed by a detailed discussion of the principles of stress and strain for infinitesimal deformations. Since most biological materials undergo large deformation, the limits of our definitions for stress and strain will be discussed along with alternative methods if these limits are violated. Constitutive equations for linear elastic homogenous isotropic, orthotropic, and transversely isotropic materials will be presented. These concepts will then be applied to various mechanics problems that are relevant to biology, physiology, and medicine. The second half of the course will cover fiber-reinforced composite materials, which are relevant for both engineering prostheses as well as understanding the behavior of numerous native biological materials (e.g., tendon, epicardium, intervertebral disc). The course will conclude with a brief introduction to poroelasticity and its role in the function of articular cartilage and hydrogels.

Describe briefly how this action supports-or requires an exception to-the University's commitment to curricular integrity and to disciplinary unity. Please also indicate if program accreditation is involved.

The change in the biology lab course requirement is to make sure the ABET BME program requirement: “making measurements on and interpreting data from living systems” will still be fulfilled after the discontinuation of BIOL 142.

Resources

Check all that apply

- No new resources required

How will the changing of this program affect other programs or other Penn State campuses and colleges?

To accommodate the BME and ME concurrent major option, we propose to have BME 408 replace the existing BME Related and ME Engineering Technical (ET) Elective, which requires a BME 400 level or BIOE 500 level course NOT required for both majors.
Good morning, ACUE Colleagues—Attached is a proposal for the College of Engineering proposed change to the Biomedical Engineering Stand Alone Major. Please share the proposal with faculty, staff and administrators in your departments that may have an interest and forward any questions, comments, concerns, or statements of support to LeChelle Earl LTE3@PSU.EDU no later than Thursday, August 23, 2018. No response will be interpreted as concurrence and the college will move ahead with the proposal. Thank you in advance for your review.

Peter J. Butler
Associate Dean for Undergraduate and Professional Graduate Education
Professor of Biomedical Engineering
Penn State University
102A Hammond Building
University Park, PA 16802
office: (814) 863-3750
e-mail: pbutler@psu.edu

Behrend concurs
LeChelle,

In consultation with the biology department, I am confirming support of this program change by the Eberly College of Science.

Mary Beth

No other replies were received, which indicates concurrence.
DATE: July 18, 2018
FROM: Jeff Adams
TO: Peter J. Butler

Thank you for the submission of your P-2 prospectus to make curricular revisions to the Bachelor of Science in Biomedical Engineering. In line with AAPPM P-2 criteria and consultation, you may now move to the formal P-2 submission process.

cc: Dawn Blasko
    David J. Christiansen
    Kadi K. Corter
    Michele L. Duffey
    Melissa J. Kunes
    Robert N. Pangborn
    Dennis G. Shea
Proposal Designation: Engineering Leadership Development Minor
This is a proposed Change to Undergraduate Stand Alone Minor

Initiators

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
<th>College</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEREDITH HANDLEY</td>
<td>mhh11</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)

Program Definition

Effective Semester: Upon Approval
- Offering College(s)
  - Earth and Mineral Sciences
  - Engineering

Entrance and/or Retention Policies

Entrance Requirement
Requested Policy: ENGR 408, C or better.

Justification: We need the minor to reflect the evolution of the constituent courses that have been added or dropped and provides additional options for electives.
Objectives and Justification

Objectives:

The overall objective of the Engineering Leadership Development Minor is to develop the pragmatic leadership skills of Penn State engineering students. The minor addresses those requirements posed by industry, emphasizing the important principles and skills required for a successful engineering career.

More specific objectives are the development and enhancement of the following skills/areas:

- Written and oral communication
- Business and legal issues
- Team building and project management
- Entrepreneurship
- Interdisciplinary and international awareness
- Ethical, environmental and societal issues
- Manufacturing quality and TQM
- Interpersonal and conflict management

Justification:

Technical competence alone will no longer guarantee success for graduates from engineering programs. Engineering graduates of the future must demonstrate the ability to communicate in a competitive global society. There are increasing demands for engineers to be able to deal effectively with other people, including the ability to work in teams, to interact with customers and other corporate departments on both national and international levels.

The Engineering Leadership Development Minor addresses these needs. The Minor has been approved by the Electrical Engineering Undergraduate Curriculum Committee and by the Electrical Engineering faculty.

To ensure we are accomplishing our goals and to provide adjustments as needed to the minor, we plan the following evaluation strategies. Listed below are strategies for both the entire minor as well as individual courses in the minor. A more detailed description of the evaluation plan is available upon request.

- Individual courses: over and above standardized semester-end evaluations, conduct mid-course evaluations to determine if students feel they are achieving the course goals (and the minor goals) previously established. Instructors are encouraged to process this information and take action in the current semester to respond to student feedback.

- Overall minor: convene minor faculty, coordinator of the minor, minor committee, Leonhard Center personnel to evaluate minor program based on individual course evaluations as well as general impressions. Produce a brief document summarizing the strengths, weaknesses and areas for improvement for the minor program. Make document available to minor course instructors, minor students, and other interested parties.

- Overall minor: follow progress of minor students in developments of such skills as communication and ability to work in a team. Establish skill level benchmarks at the beginning of the minor and compare those to skills levels at minor completion. Potentially compare minor students to engineering students not enrolled in the minor regarding the same skill set.

- Placement data: compare placement rates for minor students to placement rates for engineering students not in the minor.

- Post-graduation data: for a subset of students who have completed the minor, conduct interviews with the former students as well as their employers. Determine how the skills developed in the minor have helped in the job as well as what skills not covered in the minor that would be helpful.

Justification For The Change Proposal:

There has been a change in the course offerings for the program and it needs to be reflected accurately for effective program management and the communication via the bulletin. These changes will also assist our campus students in being able to complete the minor.

Reflecting that ENGR 408 (Engineering Leadership Principles - 2 credits) has been combined with the sister, co-requisite course, ENGR 493 (Engineering Leadership Practicum – 1 credit) to become ENGR 408 (3 credits). (this change in the course completed the course change process in 2016) ENGR 493 needs to be dropped as a requirement.

Some courses listed in the bulletin as being prescribed should be listed in additional courses.

- ENGR 409 Leadership in Organizations - should be listed as an additional course.
- STS 460 is no longer offered and should be removed.

A course listed in the bulletin as additional course:

- BA 250 is no longer offered and should be removed.
Some courses are listed as additional that should be listed as prescribed:
• ENGR 407 - technology of business management should be listed as prescribed

Many of our courses are not included in the additional course section. We would like to provide specific options in the additional course section that align with our curriculum and give students the flexibility to complete the minor based on their career goals. The additional course section should include the following courses (students would need to complete 6 credit)
• ENGR 409 Leadership in Organizations
• ENGR 422 Leadership of International Virtual Engineering Teams
• ENGR 405 Project Management
• ENGR 496 Independent Study

Therefore the updated list of prescribed and additional courses that should be reflected in the ELD minor include the following:
The Prescribed course section needs to be edited to have only 6 credits to include ENGR 408 and ENGR 407
The Additional courses section needs to be edited to have 6 credits to include: ENGR 409, 422, 405, 496

Proposal Outline

CIP Code: 499999

Faculty Member(s) in Charge:

1. Name: MEREDITH HANDLEY (mhh11)
   Title: ASSOC DIR OF ENG LEADERSH
   Phone: 814-863-5728
   Address: 213G Hammond
   Campus: UP
   City:
   Fax:

2. Name: ANDREW ERDMAN (ame17)
   Title: WALTER ROBB DIRECTOR ELDM
   Phone: +1 814 863 9074
   Address: 213E HAMMOND BLDG
   Campus: UP
   City:
   Fax:

3. Name: TERESA LANG (tcl133)
   Title: ASSOC DIR ENGR LDRSHP
   Phone: +1 814 863 9077
   Address: 213G HAMMOND BLDG
   Campus: UP
   City:
   Fax:

Program Description:

This interdisciplinary minor is designed to provide engineering students with critical principles and skills. Engineering graduates must demonstrate the ability to assume leadership roles in a competitive technologically complex global society. There are increasing demands for engineers to be able to deal effectively with other people, including the ability to work in teams and to interact with customers and other organizations on both national and international levels. Students will employ engineering case studies in active and collaborative classroom settings to develop these skills. The minor consists of 18 semester hours. A grade of C or better is required in all minor courses. Students in all majors are eligible. For admission to the minor, students must have completed ENGR 408(3).

For a MINOR in Engineering Leadership Development Minor a minimum of 18 credits are required.

Scheduling Recommendation by Semester Standing Given Like (Sem: 1-2)

Academic Outline
REQUIREMENTS FOR THE MINOR:
A minimum of 18 credits are required

COMMON REQUIREMENTS FOR THE Minor: (18 Credits)

PRESCRIBED COURSES (6 Credits) [1]

ENGR 408 US(3)(Sem: 3-8)
ENGR 407 (3)

ADDITIONAL COURSES (6 Credits) [1]

(ENGR 409 US(3); ENGR 422 IL(3)(Sem: 5-8)
ENGR 405 (3), ENGR 496 (3);
Students should choose 2 out of the 4 options.

)

SUPPORTING COURSES (6 Credits) [1]

Select 6 credits in consultation with the coordinator of the Engineering Leadership Development Minor (Sem: 5-8)

Courses modified by this proposal
ENGR 422 IL(3); ENGR 405 (3); ENGR 496 (3)

Existing Courses Added to or Moved Within Requirements for This Program
ENGR 405 ; ENGR 407 ; ENGR 409 ; ENGR 422 ; ENGR 496

Existing Courses Removed from or Moved Within Requirements for This Program
BA 250 ; ENGR 407 ; ENGR 409 ; ENGR 493 ; STS 460

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: MOSES LING
Department: Architectural Engineering

Position: Consultation
Campus: UNIVERSITY PARK CAMPUS

Title: ASSOC PROF

Request sent: 8/2/2018 at 3:13 PM
Last sent: 8/13/2018 at 7:30 AM
Concur: Yes
Recipient Name: ROBERT MELTON
Department: Aerospace Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROF AEROSPACE ENGR

Request sent: 8/2/2018 at 3:13 PM
Last sent: 8/13/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 8/17/2018 at 7:15 AM

Recipient Name: MEGAN MARSHALL
Department: Agricultural And Biological Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: INSTR AG & BIO ENG

Request sent: 8/2/2018 at 3:13 PM
Last sent: 8/13/2018 at 7:30 AM
Concur: Yes
Comments: I am very glad to see these updates to the official listing for the minor, so the requirements are clear to students. However, I think there is an error with the WAC designation. According to the bulletin, none of these courses meet Writing Across the Curriculum -- ENGR 407, 408, 409, 422. Either proposals needs to be submitted to update these courses to be WAC or this is a typo in the proposal.
Reviewed On: 8/13/2018 at 5:24 PM

Initiator Comments: Megan, I'm not sure how all those designations got selected, however I did update them to reflect what they should be listed as, and are listed as in the bulletin. Thank you!!

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

Request sent: 8/14/2018 at 3:15 PM
Concur: Yes
Comments:
Reviewed On: 8/14/2018 at 5:18 PM
Recipient Name: **SIU LING LEUNG**  
Department: Biomedical Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: Assistant Teaching Professor

**Concur:** Yes  
**Comments:**  
**Reviewed On:** 8/3/2018 at 8:31 AM

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**Request sent:** 8/2/2018 at 3:13 PM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 8/4/2018 at 8:17 AM

Recipient Name: **FARSHAD RAJABIPOUR**  
Department: Civil And Environmental Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: ASSOC PROF CIVIL ENGINEER

**Request sent:** 8/2/2018 at 3:13 PM  
**Last sent:** 8/13/2018 at 7:30 AM  
**Concur:** Yes  
**Comments:** (Completed By Default - Exceeded Time Limit)  
**Reviewed On:** 8/17/2018 at 7:15 AM

Recipient Name: **MICHAEL JANIK**  
Department: Chemical Engineering  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  
Title: PROFESSOR CHEMICAL ENGR

**Request sent:** 8/2/2018 at 3:13 PM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 8/2/2018 at 3:46 PM

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

**Title:** EECS Director of Academic Affairs  

---

Recipient Name: **GARY GRAY**  
Department: Engineering Science And Mechanics  
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS  

**Title:** ASSOC PROF ENGR SCI & MEC  

---

**Initiator Comments:**  
I'm not sure how all those designations got selected, however I did update them to reflect what they should be listed as, and are listed as in the bulletin. Thank you!!
<table>
<thead>
<tr>
<th>Recipient Name</th>
<th>Department</th>
<th>Position</th>
<th>Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>JUDITH TODD</td>
<td>Engineering Science And Mechanics</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td>LUCAS PASSMORE</td>
<td>Engineering Science And Mechanics</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td>CATHERINE HARMONOSKY</td>
<td>Industrial And Manufacturing Engineering</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
</tr>
<tr>
<td>ELENA JOSHI</td>
<td>Industrial And Manufacturing Engineering</td>
<td>Consultation</td>
<td>UNIVERSITY PARK CAMPUS</td>
</tr>
</tbody>
</table>
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 8/17/2018 at 7:15 AM

Recipient Name: ARTHUR MOTTA
Department: Nuclear Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROF & CHAIR OF NUCL ENGR

Request sent: 8/2/2018 at 3:13 PM
Last sent: 8/13/2018 at 7:30 AM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 8/13/2018 at 8:25 AM

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

Request sent: 8/2/2018 at 3:13 PM
Concur: Yes
Comments: (Completed By Default - Exceeded Time Limit)
Reviewed On: 8/2/2018 at 5:02 PM

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

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

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

Dean of the College

Recipient Name: PETER BUTLER
Position: Dean of the College
Title:

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

SCCA Subcommittee Review

Recipient Name: KADI CORTER
Position: SCCA Subcommittee Review
Title:

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

Recipient Name: ALLISON ALBINSKI
Position: SCCA Subcommittee Review
Title:

Request sent: 2/17/2017 at 2:02 PM
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

SCCA Review

Recipient Name: KADI CORTER
Department: (Not Available)
Faculty Senate Review

Recipient Name: ALLISON ALBINSKI
Position: SCCA Review
Campus: UNIVERSITY PARK CAMPUS
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Request sent: 2/17/2017 at 2:02 PM

Recipient Name: KADI CORTER
Position: Faculty Senate Review
Campus: UNIVERSITY PARK CAMPUS
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
Reviewed On: [Not Yet Reviewed]

Registrar Data Entry

Recipient Name: PAULA HAMATY
Department: (Not Available)
Position: Registrar Data Entry  
Campus: UNIVERSITY PARK CAMPUS

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

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**Final Confirmation**

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

Request sent: 2/17/2017 at 2:03 PM  
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

Request sent: 11/9/2017 at 1:52 PM  
Concur: [Not Yet Reviewed]  
Comments: [Not Yet Reviewed]  
Reviewed On: [Not Yet Reviewed]

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**Curricular Information**

Blue Sheet Item #:  
Review Date:

---

**Program Codes**

Earth and Mineral Sciences:  
Engineering: E L D
Option Codes

Engineering Leadership Development Minor:

**UPLOADED DOCUMENTS:**

Context Type: Prospectus Memo
File Description: Prospectus Memo for ELD Minor Aug2018
File Name: Minor in Engineering Leadership Development revisions.pdf MEMO for CRCS Su2018.pdf

Context Type: Supporting Documents
File Description: ACUE Consultation Results
File Name: ACUE Consultation Results for ELD Minor Change.pdf

Context Type: Prospectus Memo
File Description: Prospectus Memo
File Name: Minor in Engineering Leadership Development revisions.pdf

Proposal ID: 3082 created on 9/10/2018 3:34 PM
UPLOADED DOCUMENTS FOLLOW:
DATE: August 8, 2018
FROM: Jeff Adams
TO: Peter Butler

Thank you for the submission of your P-2 prospectus to make curricular revisions to the Minor in Engineering and Leadership Development. In line with AAPPM P-2 criteria and consultation, you may now move to the formal P-2 submission process.

cc: Dawn Blasko
Pingjuan Werner
Kadi K. Corter
Michele L. Duffey
Melissa J. Kunes
Robert N. Pangborn
Dennis G. Shea
Good morning, ACUE Colleagues—Attached is a proposal for the College of Engineering proposed change to the Undergraduate Engineering Leadership Development Stand Alone Minor. Please share the proposal with faculty, staff and administrators in your departments that may have an interest and forward any questions, comments, concerns, or statements of support to LeChelle Earl LTE3@PSU.EDU no later than Thursday, August 23, 2018. No response will be interpreted as concurrence and the college will move ahead with the proposal. Thank you in advance for your review.

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

No replies were received, which indicates concurrence.
DATE: August 8, 2018
FROM: Jeff Adams
TO: Peter Butler

Thank you for the submission of your P-2 prospectus to make curricular revisions to the Minor in Engineering and Leadership Development. In line with AAPPM P-2 criteria and consultation, you may now move to the formal P-2 submission process.

cc: Dawn Blasko
Pingjuan Werner
Kadi K. Corter
Michele L. Duffey
Melissa J. Kunes
Robert N. Pangborn
Dennis G. Shea
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>CHARLES COX</td>
<td>cxc655</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)
Type of Proposal: [X] Add  [ ] Change  [ ] Drop

Course Designation
(EDSGN 485) Engineering Design Portfolio

Course Information

Cross-Listed Courses:

Prerequisites:
(EDSGN 100 7th Semester standing or higher)

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Eng Dsgn Portfolio
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
- Writing Across the Curriculum

First-Year Engagement Program

- First-Year Seminar

Miscellaneous
Course Outline

A brief outline or overview of the course content:
Each student in the course will work with the course instructor to create a portfolio showcasing his or her engineering design projects and experiences. The portfolio will consist of images, graphics and text that organize and present significant engineering design experiences which the students have participated in. Specifically, the objectives of this course include organizing a collection of graphics and text to effectively communicate engineering design experiences and development, summarizing both the depth and breadth of design experiences, analyzing and interpreting information for presentation to third party readers, and using modern engineering graphics and text communication methods to present information. Students will be evaluated on their ability to visually, textually, and sequentially present their design work as a portfolio. This course is required for the Engineering Design Certificate.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
Investigation of Precedents: Discovery (Analysis) – 3 hrs
Critique of exemplar design portfolios from a variety of engineering disciplines
Discussion with instructor of what makes a successful design portfolio, including logistical considerations of editing online platforms and hard copy
Main Body Content: Organization (Application, Synthesis) – 3 hrs
Generating images and graphics for a portfolio
How to coordinate text, images, and graphics for a third-party reader to follow
Presentation Details: Assembly (Application, Analysis, Synthesis) – 4 hrs
How to generate front and back matter of portfolio including the title page, student bio, page numbering, table of contents, and resume
How to develop content both to maintain thematic continuity and to facilitate third-party readers’ understanding
Portfolio Critique and Reflection: (Formative Assessment) – 1 hr
Presentation of initial portfolio as electronic file for face-to-face critique by course instructor
Portfolio Iteration (Analysis, Synthesis) – 1 hrs
How to use design critique to modify portfolio
Iterate on design portfolio
Reflection of Design Experiences (Analysis, Synthesis) – 2 hrs
How to generate a reflective statement on the development of engineering design competencies as results of the projects presented in the portfolio
Generation of reflective statement
Final Presentation of Portfolio (Summative Assessment) – 1 hr
Presentation of final portfolio as both electronic file and hard copy for face-to-face graded critique by course instructor.

Course Description:
Positions in engineering design typically require a portfolio representing an applicant’s best work. In preparation for this requirement, students in this course will develop the skills needed to design a portfolio that represents the depth and breadth of their engineering design training, by collecting, sorting, and sequencing visual information from relevant previous design experiences. The material will be presented through a series of Web-based modules.

The objectives of this course include organizing a collection of graphics and text to effectively communicate engineering design experiences and development, summarizing both the depth and breadth of design experiences, analyzing and interpreting information for presentation to third party readers, and using modern engineering graphics and text communication methods to present information. Students will be evaluated on their ability to visually, textually, and sequentially present their design work in a design portfolio.

The course will be taught once a semester as an online-course. The course is required for students pursuing the Engineering Design Certificate.
Design Certificate.

The name(s) of the faculty member(s) responsible for the development of the course:
- Name: CHARLES COX (cxc655)
- Title: Assistant Teaching Professor
- Phone: 814-867-4864
- Address: 124 Hammond 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.
Upon completing this course, students will be able to:
- Organize a collection of graphics and text as an effective communication of information about their design experiences and development in completion of a degree program
- Summarize both the depth and breadth of those design experiences
- Analyze and interpret the information for presentation to third party readers (e.g., prospective employers)
- Choose a platform for online presentation based on ease of editing and third party reader usage
- Use modern engineering graphics and text communication methods in order to present the information

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 evaluated by the quality of their course deliverables, some of which will be submitted iteratively (e.g., the deliverables for the first submittal are formatively assessed at the time of the first submittal, but are also to be developed for later assessment as part of subsequent submittals throughout the course) and cumulatively (e.g., the mid-term submittal will include another assessment of the first submittal, as well)
- First Submittal – 30%
  - Presentation of Electronic Files to Instructor, Depicting Images and Text Collected
  - Images and Text to Describe Courses, Projects, and Student’s Roles in Projects
- Second Submittal: Mid-Term Design Portfolio – 30%
  - Presentation of Electronic Files to Instructor to Show Organization of Images to Show Sequence and Detail of Project Activities Within Each Course
  - Coordination of Descriptive Text with Sequenced Images
  - Organization of Projects to Show Development of a Student’s Roles and Design Capabilities over the Range of Projects
- Final Submittal: Completed Design Portfolio – 40%
  - Presentation of Website and Hard Copy to Instructor to Show Visual Summaries of Design Projects and Experiences
  - Inclusion of Explanatory Elements and Elements Supplementary to Projects: Table of Contents, Student Biography, Reflection on Design Experiences, and Resume
  - Overall Formatting of all Portfolio Elements and Projects to Show Consistent Thematic Elements and Cues to Aid Third Party Comprehension
  - Website Demonstrates Ease of Editing Portfolio Elements and Projects and Ease of Third Party Navigation

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 required as the culminating activity for the Engineering Design Certificate, but may be taken by other students who have completed EDSGN 100 and simply wish to create a portfolio of their design work without earning the certificate. The prerequisite of 7th semester standing ensures that enough work will have been accomplished in order to warrant a portfolio’s construction.

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.
The course is a required course for students pursuing the Engineering Design Certificate.

A description of any special facilities:
NA

Frequency of Offering and Enrollment:
The course will be offered once per semester to support the Engineering Design Certificate.

Campuses That Have Offered ( ) Over The Past 4 Years
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:** MOSES LING
  - **Department:** Architectural Engineering
  - **Position:** Consultation
  - **Campus:** UNIVERSITY PARK CAMPUS
  - **Title:** ASSOC PROF
  - **Request sent:** 7/10/2018 at 3:58 PM
  - **Last sent:** 7/23/2018 at 7:30 AM
  - **Concur:** Yes
  - **Comments:** (Completed By Default - Exceeded Time Limit)
  - **Reviewed On:** 7/25/2018 at 7:15 AM

- **Recipient Name:** ROBERT MELTON
  - **Department:** Aerospace Engineering
  - **Position:** Consultation
  - **Campus:** UNIVERSITY PARK CAMPUS
  - **Title:** PROF AEROSPACE ENGR
  - **Request sent:** 7/10/2018 at 3:58 PM
  - **Last sent:** 7/23/2018 at 7:30 AM
  - **Concur:** Yes
  - **Comments:** (Completed By Default - Exceeded Time Limit)
  - **Reviewed On:** 7/25/2018 at 7:15 AM

- **Recipient Name:** MEGAN MARSHALL
  - **Department:** Agricultural And Biological Engineering
  - **Position:** Consultation
  - **Campus:** UNIVERSITY PARK CAMPUS
  - **Title:** INSTR AG & BIO ENG
  - **Request sent:** 7/10/2018 at 3:58 PM
  - **Concur:** Yes
  - **Comments:** If approved, will EDSGN 485 replace EDSGN 496 as a requirement in the certificate program? I am assuming that there is a separate proposal underway to update the certificate requirements.
  - **Reviewed On:** 7/16/2018 at 12:48 PM

- **Recipient Name:** PAUL HEINEMANN
  - **Department:** Agricultural And Biological Engineering
  - **Position:** Consultation
  - **Campus:** UNIVERSITY PARK CAMPUS
Recipient Name: SIU LING LEUNG
Department: Biomedical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: Assistant Teaching Professor

Recipient Name: FARSHAD RAJABIPOUR
Department: Civil And Environmental Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASSOC PROF CIVIL ENGINEER

Recipient Name: MICHAEL JANIK
Department: Chemical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR CHEMICAL ENGR

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

Request sent: 7/10/2018 at 3:58 PM
Concur: No, this proposal needs significant changes
Comments: The only prerequisite is EDSGN 100 but the course description expects students to have significant design experience. You should include additional prerequisites, perhaps semester standing, otherwise you could have first-year students signing up for this. A 400-level course should require significant preparation, which I'm sure this course expects. Please make this explicit.
Your point is well made. I will add the prerequisite of "semester standing 7 or higher."

Request sent: 7/21/2018 at 10:24 AM
Concur: Yes
Comments: Approve pending the addition of 7th semester standing to prerequisites
Reviewed On: 7/21/2018 at 11:30 AM

Recipient Name: DAVID SALVIA  
Department: Electrical Engineering
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS
Title: EECS Director of Academic Affairs

Your points are both well taken. With regard to the superfluous "in," I have removed it. Now, if I change the prerequisites to include all the certificate requirements then only those who pursue the certificate can take the course. Whereas if I change the prerequisites to include "semester standing 7 or higher" others not interested in the design certificate may then take the course in order to learn about portfolio making, and will still have had opportunities to generate sufficient content for inclusion in a portfolio. The difference for them is that their choice of content would not be as constricted as it would have been when completing the certificate.

Request sent: 7/21/2018 at 10:24 AM
Concur: Yes
Comments:
Reviewed On: 7/29/2018 at 8:46 AM

Recipient Name: JUDITH TODD  
Department: Engineering Science And Mechanics
Position: Consultation  
Campus: UNIVERSITY PARK CAMPUS
Title: HEAD/PROF ESM
Recipient Name: LUCAS PASSMORE
Department: Engineering Science And Mechanics
Position: Consultation
Title: Assistant Professor
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: CATHERINE HARMONOSKY
Department: Industrial And Manufacturing Engineering
Position: Consultation
Title: ASSOC PROF I & MSE
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: ELENA JOSHI
Department: Industrial And Manufacturing Engineering
Position: Consultation
Title: INSTR
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: ARTHUR MOTTA
Department: Nuclear Engineering
Position: Consultation
Title: PROF & CHAIR OF NUCL ENGR
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: ARTHUR MOTTA
Department: Nuclear Engineering
Position: Consultation
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Campus: UNIVERSITY PARK CAMPUS

Recipient Name: ARTHUR MOTTA
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Campus: UNIVERSITY PARK CAMPUS

Recipient Name: ARTHUR MOTTA
Department: Nuclear Engineering
Position: Consultation
Title: PROF & CHAIR OF NUCL ENGR
Campus: UNIVERSITY PARK CAMPUS
Recipient Name: ERIC MARSH  Department: Mechanical Engineering
Position: Consultation  Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR OF MECH ENGR

Request sent: 7/10/2018 at 3:58 PM
Concur: Yes
Comments:
Reviewed On: 7/11/2018 at 10:47 AM

Head of Department

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

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

SCCA Representative

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

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

Dean of the College

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

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

SCCA Subcommittee Review

Recipient Name: ALLISON ALBINSKI  Department: (Not Available)
Position: SCCA Subcommittee Review  Campus: UNIVERSITY PARK CAMPUS
Recipient Name: **KADI CORTER**  
Department: (Not Available)  
Position: SCCA Subcommittee Review  
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: **ALLISON ALBINSKI**  
Department: (Not Available)  
Position: SCCA Review  
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: **KADI CORTER**  
Department: (Not Available)  
Position: SCCA Review  
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: **ALLISON ALBINSKI**  
Department: (Not Available)  
Position: Faculty Senate Review  
Campus: UNIVERSITY PARK CAMPUS

Recipient Name: **KADI CORTER**  
Department: (Not Available)  
Position: Faculty Senate Review  
Campus: UNIVERSITY PARK CAMPUS
Curricular Information
Blue Sheet Item #:
Review Date:

**SCRID Numbers**
(EDSGN 485):
Proposal ID: 5353 created on 9/11/2018 2:00 PM
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>ALAN WAGNER</td>
<td>azw78</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)
Type of Proposal: [ ] Add [ ] Change [ ] Drop
Message for Reviewers:

Course Designation

(ENGR 467) Robots and Their Role in Society

Course Information

Cross-Listed Courses:

Prerequisites:
5th Semester standing because the topics that will be examined in the course, possibility of killer robots in military applications, sex robots and an examination of robots as objects of affection

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Robots & Society
Discipline: General Education
Course Listing: Inter-Domain

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
[ ] Writing Across the Curriculum
First-Year Engagement Program
First-Year Seminar

Miscellaneous

Common Course

GE Learning Objectives

- GenEd Learning Objective: Effective Communication
- GenEd Learning Objective: Creative Thinking
- GenEd Learning Objective: Crit & Analytical Think
- GenEd Learning Objective: Global Learning
- GenEd Learning Objective: Integrative Thinking
- GenEd Learning Objective: Key Literacies
- GenEd Learning Objective: Soc Resp & Ethic Reason

Bulletin Listing

Minimum Credits: 3
Maximum Credits: 3
Repeatable: NO

Department with Curricular Responsibility: Aerospace Engineering (UPEN_AERSP)
Effective Semester: Upon Approval
Travel Component: NO

Course Outline

A brief outline or overview of the course content:
This course explores and critically analyzes the growing influence and impact of robots and automation on society. The course is not technical in its treatment of robots and robotics, rather the focus is on critically investigating how the development of robotic technologies have impacted society in the past, present, and future. The course will not require programming or the development of an implemented project. Participation is critical for this course. Students will be expected to actively participate and attend class, keep up with reading assignments, and complete written analysis of the discussed topics.

Because the course depends heavily on student interaction and participation, I strongly believe that having a diverse group of students hailing from different corners of PSU will be critical for making this course a success.

This course does not cover the technical methods for developing or programming robots. The overarching area of treatment in this course will be on how the development of robotic and artificial intelligence technologies will impact and influence society and people, organizations, and institutions. Much of the basis for this course is in recent events. The purpose of the course will be to train students to think critically about the impact of their professional work and their ethical responsibilities as a professional. The students will be asked to read, write, critically analyze, and evaluate (both in written and verbally) current, previous, and upcoming ethics related dilemmas and problems posed by the advent of intelligent robots. Some of these issues are unique to robotics; others arise in the context of computing in general as well as in other technologies; still others are new manifestations of more general ethical, political and constitutional law issues.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
Topic 1. (1 week) Techniques of Rhetoric and Logical Argumentation: Arguments as claims supported by reasons. Types of argument concerning the social consequences of robotics and the aptness of robotics-related policies. Evidence, authority, and the anticipation and rebuttal of objections. Formal and informal fallacies.
Topic 4. (1 week) Societal and Cultural Variations in Robotics Acceptance and Usage
Topic 5. (1 week) Robots, Automation, and Economics
Topic 6 (1 week) Military Robots: Military drones, targeted killings, robots as ethical soldiers
Topic 7. (1 week) Robots and Privacy. Personal information, its disclosure and misuse. Surveillance and changing interpretations of the Fourth Amendment.
Topic 8. (1 week) Group Position Paper Presentation: Automated Policing
Topic 15 (2 weeks) Research project presentations.

Course Description:
This course explores and critically analyzes the growing influence and impact of robots and automation on society. In particular, the course introduces students to the ever widening role that intelligent robots are playing and will come to play in our workplaces, on our battlefields, and in our homes. Emphasis will be placed on understanding and critically analyzing how the technical, computational, and systems role of the machine effect the behavior and values of individuals and segments of society.

The course is not technical in its treatment of robots and robotics, rather the focus is on critically investigating how the development of robotic technologies have impacted society in the past, present, and future. The course will not require programming or the development of an implemented project. Instead the course will focus on reading, analyzing and communicating about the issues and topics raised in class.

Participation is critical for this course. Students will be expected to actively participate and attend class, keep up with reading assignments, and complete written analysis of the discussed topics.

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

Name: ALAN WAGNER (azw78)
Title: Associate Professor
Phone: 814-865-3138
Address: 229 Hammond
Campus: UP
City: University Park
Fax:

Instructional, Educational, and Course Objectives:
This section should define what the student is expected to learn and what skills the student will develop.
The primary objective of this course is to get students to think critically about how technology and robots currently impact their lives and how these systems may impact their lives in the future. Engineering programs are increasingly being called upon to include ethics related components into their curriculum. This course is meant to serve as an ethics and society focused course covers both general science and social material. As an integrative general education course the hope is that students will learn to consider the future ramifications of the problems they are addressing.

By the end of this course students will be able to:

- Discuss how robots will impact a number of society level issues including economics, safety, and privacy.
- Critically read and argue a position verbally in and in writing related to the class topics.
- Identify common rhetorical fallacies.
- Make connections between the scientific development of a technology and the social, ethical, and philosophical implications of that technology.
- Reflect and explain how technology and robots will or is impacting their role in society

Honors Course: This course is also offered as an honors course. For the honors component of the course the student will choose a project focused either on technical aspects of human-robot interaction or on the societal ramifications of these system. If the student chooses a technical honors project they will be expected to develop and demonstrate hardware or software related to the use, communication, and/or interaction of robots with people. For technical projects, the students must have the skills needed to perform the work. This course will not be able to train students to develop software or hardware. If the student chooses a societal implications honors project they will be expected to develop projections of future uses of robots and the impact those uses will have on society. Societal projects must use data and projected data as evidence as well as expert testimony to develop future projections related to robots.

Some sample topics are listed below as technical and societal projects:

Robot art and performance. How will robots be used to perform and generate art in the future? Societal project: Use research from the philosophy of art to justify and expound why or why a robot cannot be an artist. Strong philosophical justification for one's argument will be needed. Interview local or national artists to gain the perspective of a broader audience. Technical project: develop a robot that dances. The robot's dance cannot be a static, predetermined dance but must take into consideration aspects of the music being played. Musical characteristics such as rhythm, timbre, etc should influence the dance.

Criminal uses of robotics and AI. How will criminals use robots and AI in the future. Societal project: evaluate how these systems might be used by criminal enterprises, for a given future period project the percent of crime utilizing robots and AI, what crimes are most likely be utilized robots and AI, which are least likely, who is most likely to be impacted? Technical project: develop a multi-agent simulation and program an agent to act as a criminal within the simulation. Evaluate the types of crimes that the simulated robot performs and, more importantly, the use of motives (rather than rule based programming) to induce criminal activity by the agent.

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.
Several different methods of student evaluation will be used. Assessments will focus on effective written, verbal, and visual communication. Students will write critical analyses of weekly reading materials (25%), participate in class discussions (25%), develop group position statements (25%), and complete a research project (25%).

Critical Analysis papers: Weekly, ongoing assignment. I will remind of the requirement for the first few classes. After that you will not be reminded. These papers are due before class and should be submitted via Canvas. No late assignments will be accepted. Not submitting an assignment on time results in a zero for that assignment. Your lowest two assignment scores will be dropped.

This policy is in place in order to be fair to everyone and to prevent subjective late excuses. Critical analysis papers follow the format provided in the critical analysis pdf. They should be approximately 1 page length, at least 10 pt font. Please do not confuse a critical analysis with a book report. Do not just describe what the paper is about. Please refer to the critical analysis pdf for more
Classes will center on robot society themes, such as the impact of robots on employment. Most classes will begin with an instructor lead topical presentation of evidence and viewpoints. Student participation will be measured using clickers and in class. The students will then be presented with leading questions for in class discussion. Clickers may be used to record student participation.

The research project is an individual project in which students must take one single course topic and examine the topic in depth from a variety of different stakeholder viewpoints. They must consider how the topic will impact society in the next 5, 15, and 30 years, explain the likely positive and negative outcomes associated with the topic, examine how the topic will impact different groups in society, present evidence to support their view points, and cite relevant sources of evidence.

The student learning experience will also be evaluated. Student feedback surveys will be the primary means for evaluating the student learning experience. I intend to create and employ specialized mid-course and end of course surveys to determine if the students found the robot ethics related topics of interest and the methods of delivery engaging. In addition, I intend to work closely with Scheyer College and the Leonard Center to determine if better methods of evaluating the student experience are appropriate.

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. There are no specific prerequisites for this course. This course is not a specific prerequisite for other courses. The course will open to all engineering students. The primary rationale for a 400 level is that students must be mature to in order to deeply consider important topics such as human robot sexual relationships.

This course is related to:
Phil 107 Introduction to Philosophy of Technology
Phil 233 Ethics and the Design of Technology
Phil 407 Technology and Human Values
STS 200S Critical Issues in Science, Technology, and Society
IST 402 Emerging Issues and Technologie Science, Technology, and Society,

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 meant to be a General Education inter-domain course. The course will contribute to the Engineering major as an elective by introducing students to the societal level impacts that technology, such as drones, can have. It will teach these students to think critically about how to critically evaluate arguments about technology, introduce them to different frameworks for applied ethics, and examine professional codes of conduct. This course will also contribute to the Philosophy major as an elective by introducing students and exploring a particularly type of technology—robotics—and its potential ramifications on society. We will look at how technology and people tend to merge, both physically and psychologically, with continued interaction. We will also examine how people become attached to machines.

A description of any special facilities:
No special facilities will be required.

Frequency of Offering and Enrollment:
Annually.

Alignment with General Education Objectives

- EFFECTIVE COMMUNICATION – the ability to exchange information and ideas in oral, written, and visual form in ways that allow for informed and persuasive discourse that builds trust and respect among those engaged in that exchange, and helps create environments where creative ideas and problem-solving flourish.

- KEY LITERACIES – the ability to identify, interpret, create, communicate and compute using materials in a variety of media and contexts. Literacy acquired in multiple areas, such as textual, quantitative, information/technology, health, intercultural, historical, aesthetic, linguistic (world languages), and scientific, enables individuals to achieve their goals, to develop their knowledge and potential, to lead healthy and productive lives, and to participate fully in their community and wider society.

- CRITICAL AND ANALYTICAL THINKING – the habit of mind characterized by comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating a conclusion. It is the intellectually disciplined process of conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.

- INTEGRATIVE THINKING – the ability to synthesize knowledge across multiple domains, modes of inquiry, historical periods, and perspectives, as well as the ability to identify linkages between existing knowledge and new information. Individuals who engage in integrative thinking are able to transfer knowledge within and beyond their current contexts.

- CREATIVE THINKING – the capacity to synthesize existing ideas, images, or expertise in original ways and the experience of performing, making, thinking, or acting in an imaginative way that may be characterized by innovation, divergent thinking, and intellectual risk taking.

- GLOBAL LEARNING – the intellectually disciplined abilities to analyze similarities and differences among cultures; evaluate natural, physical, social, cultural, historical, and economic legacies and hierarchies; and engage as
community members and leaders who will continue to deal with the intricacies of an ever-changing world. Individuals should acquire the ability to analyze power; identify and critique interdependent global, regional, and local cultures and systems; and evaluate the implications for people’s lives.

**SOCIAL RESPONSIBILITY AND ETHICAL REASONING** – the ability to assess one’s own values within the social context of problems, recognize ethical issues in a variety of settings, describe how different perspectives might be applied to ethical dilemmas, and consider the ramifications of alternative actions. Individuals should acquire the self-knowledge and leadership skills needed to play a role in creating and maintaining healthy, civil, safe, and thriving communities.

What component(s) of the course will help students achieve the General Education Learning Objectives covered in the course? Provide evidence that students in the course have adequate opportunities to achieve the identified learning objectives.

This course will require weekly writing in the form of critical analyses and daily discussions of robots in society topics. Students will also present group policy statements and their own independent research project on a topic of interest to the student and related to the course.

This course will focus on student synthesis of engineering related robotics problems and their broad impact on society. For example, students will be asked to consider the ethical/philosophical problem call the Trolley Problem in which a person must decide whether to alter the course of a runaway trolley trading off the deaths of different numbers and types of people. For autonomous cars managing the Trolley Problem becomes a real life reality. Students will be required to analyze problems from a variety of perspectives, historical periods and cultural views. In some cases, quantitative methods have been applied to questions such as this and will be considered.

As part of the course, students will be asked to generate a group position statement and presentation related to autonomous policing. The purpose of the activity is for the students to deeply consider the issues surrounding the use of autonomous robots and their impact on social behavior and one’s community. Overall, a large portion of the course will be devoted to examining the impact of robots on social behavior and the community.

**How will students be assessed to determine their attainment of the Learning Objective(s) of General Education covered in this course? This assessment must be included as a portion of the student’s overall performance in this course.**

Objective 1: Discuss and reflect on how robots will impact a number of society level issues including economics, safety, and privacy.

Objective 1: Course activity and purpose: Class discussion of topics and examination of trade-offs for different courses of action. Class discussions present students will difficult ethical situations and require them to consider unique viewpoints.

Objective 1: Assessment: Discussion participation, discussion of class topics and attendance. Scored using participation rubric.

Objective 2: Critically read and argue a position verbally in and in writing related to the class topics.

Objective 2: Course activity and purpose: Students are asked to critically analyze weekly reading on topics such as the impact of automation on unemployment. They must present an argument and evidence for or against that argument.


Objective 3: Identify common rhetorical fallacies.

Objective 3: Course Activity and Purpose: Students are asked to identify common rhetorical fallacies during class and in on a quiz.

Objective 3: Assessment: Quiz: 10 question in class quiz testing ability to identify common fallacies. Scored using quiz rubric.

Objective 4: Make connections between the scientific development of a technology and the social, ethical, and philosophical implications of that technology.

Objective 4: Course Activity and Purpose: Group activity in which students must examine a selected topic and develop a policy related to the topic. They must then present their policy recommendation in class and defend it.

Objective 4: Assessment: Group Position Paper, 5-8 page policy position statement and presentation examining the topic of autonomous policing. Scored using position paper rubric.

**General Education Domain Criteria**

**General Education Designation:** Inter-Domain

**GN Criteria**

- Explain the methods of inquiry in the natural science fields and describe how the contributions of these fields complement inquiry in other areas
- Construct evidence-based explanations of natural phenomena
- Demonstrate informed understandings of scientific claims and their applications
- Evaluate the quality of the data, methods, and inferences used to generate scientific knowledge
- Identify societal or philosophical implications of discoveries in the natural sciences, as well as their potential to address contemporary problems

What components of the course will help students achieve the domain criteria selected above?

The proposed course is an approximately even mix between natural science topics and social and behavioral science topics. With respect to the natural sciences, portions of the course focus on the computational methods and techniques, an their limitations, for creating artificially intelligent robots. For example, the topic on Machine Ethics (week 3) examines the methods proposed to create autonomous robotic systems that behave ethically. Robots as Intelligent Beings explores the subjects like the Turing Test and the Chinese Room test which are proposed algorithmic methods for determining if an autonomous system is intelligent. The topic on Privacy (week 7) looks at methods for age and gender detection and their use to assign specific privacy rules. Practically every topic has a substantial natural science component focused on the connection between intelligence, society, and computational/algorithmic development.
1) Demonstrate informed understanding: Several assessments are specifically focused on the ability of students to demonstrate informed understandings of scientific claims and applications. The best example is the week 8 topic in which students must develop a technology policy for the governance and regulation of automated policing robots. For this assessment, students must present data related to face recognition false positive rates, failure modes, and the likely result of these failure modes in terms of false imprisonment. Students must also investigate the mean time to failure for different types potential robot police officers and understand how these failure rates impact policing and the policed.

2) Evaluate the quality of data, methods, and inferences: The course specifically looks at (in week 1) techniques for argumentation and the methods by which data can be construed to generate fallacies and engage cognitive biases. This criteria is supported both with readings, lectures and course discussions. More generally, throughout the course students will be presented with data and asked to examine how the development of robotic and automation related technology has influenced the data. For example, considering the increase in the use of drones for targeted killings and the role of the technology for this purpose.

3) Identify societal or philosophical implications: The course will focus on human-robot interaction and intelligent technology development as a major driver of upcoming large scale change. We will directly address the societal and philosophical implications of robotic technology development using readings, course lectures, and research projects. For example, in week 5 we examine the impact that robotic technology and automation has had and is going to have on employment, unemployment, real-wages, macro-economics measure such as GDP, and inflation or deflation. We will examine in detail how progress in the development of automation has already begun to impact these measures and how future progress exacerbate these changes.

Overall, this course his a significant and well-defined natural sciences focus that will allow students to better understand the limitations of a technology and how the scientific assumptions that underpin that technology relate to its use and misuse.

GS Criteria

- Explain the various methods of inquiry used in the social and behavioral sciences and describe how the contributions of these fields complement inquiry in other areas
- Identify and explain major foundational theories and bodies of work in a particular area of social and behavioral sciences
- Describe the ways in which many different factors may interact to influence behaviors and/or institutions in historical or contemporary settings
- Explain how social and behavioral science researchers use concepts, theoretical models and data to better understand and address world problems
- Recognize social, cultural, political and/or ethical implications of work in the social and behavioral sciences

What components of the course will help students achieve the domain criteria selected above?

The proposed course is an approximately even mix between natural science topics and social and behavioral science topics (see below). With respect to the social and behavioral sciences, significant aspects of the course focus on the how the development of robots, in particular, will influence human behavior, values, attitudes and institutions. With respect to the three GS student learning criteria selected above the course will help students in the following manner:

1) Describe the ways in which many different factors may interact to influence behaviors and/or institutions in historical or contemporary settings. This criteria is examined not only through several of the courses topics (military robots, robots and entertainment, for example) but also captured in the class discussions on these topics as well as through the group position statement creation on presentation.

2) Explain how social and behavioral science researchers use concepts, theoretical models and data to better understand and address world problems. This criteria is also addressed throughout the course. For instance, the topic “Robots as Sexual Objects” will examine the concept of anthropomorphism, the topic of automated law examines fairness and equity with respect to the use of technology (for example to determine recidivism). In class discussion and the critical analysis papers related to the readings are the primary means of assessment of this criteria.

3) Recognize social, cultural, political and/or ethical implications of work in the social and behavioral sciences. This criteria is captured in nearly every aspect of the course. Specific components of the course that help students achieve the domain criteria are, for example, the week 4 topic titled “Societal and Cultural Variations in Robot Acceptance and Usage” and the associated critical analysis that they must perform on the related reading by Bartle and Turkle. This topic examines the influence that culture has on the acceptability of robots within a society both in general and with respect to particular applications.

Overall, this course his a significant and well-defined social sciences focus that will allow students to better understand robots and automation will impact the behavior and values of those in society.

Integrative Studies

Explain how the intellectual frameworks And methodologies of the two Knowledge Domains will be explicitly addressed in the course and practiced by the students.

Robots and automation will impact many areas of future human society ranging from artistic expression to warfare. The variety of topics examined and discussed demands, at a minimum, an ability to think critically about a range of topics and to present one’s position related to these topics to a diverse audience. Natural Sciences are the basis for creating robots and automation. As a discipline, engineers focus on the creation of a system that meets specific predefined specifications. The Social and Behavioral Sciences contribute in two ways. First, by suggesting methods related to how people interact with machines (anthropomorphism for example) and secondly, by allowing for a broad examination of how the technology impacts society as a whole.

These two viewpoints play off and complement one another. The engineering viewpoint challenges students to look for a specification that will meet some defined criteria whereas the social sciences viewpoint challenges them to look beyond simple, definable criteria. In general, the course does not focus on specific frameworks and methodologies from the two knowledge domains but rather examines the knowledge domains holistically. We do look at ethical frameworks. These frameworks are used to evaluate both the engineering and societal knowledge domains through specific problems, such as the Trolley Problem.

Students will be asked to critically analyze papers from a variety of different fields, discuss topics in class, develop an in depth research paper on a topic of their choice, and generate a group policy paper and presentation related to the topic of autonomous policing.

Demonstrate that each Of the two domains will receive approximately equal attention, providing evidence from course topics, assignments, or other course components, and that students will integrate material from both domains.

The two domains are tightly and inexorably integrated. For example (as can be seen in the example lecture provided), the topic of
how automation impacts economics explores both the types of machines created and the ease of their impact on the labor markets. The reading materials are also taken from mixed venues which explore the nexus of these to domains, not delving too deeply in to the engineering details or into the sociological details, but rather examining the how, why, and when of robot's impact on society.

The course is guided by the following key course objectives:
1) Discuss how robots will impact a number of society level issues including economics, safety, and privacy;
2) Make connections between the scientific development of a technology and the social, ethical, and philosophical implications of that technology;
3) Reflect and explain how technology and robots will or is impacting their role in society.

All three objectives are addressed using theories, frameworks, and research methods from both the social and natural sciences. Although all course topics weave together both natural science and social science approaches and concerns, some topics emphasize one approach more than the other, as outlined here:

Week 1: Techniques of Rhetoric and Logical Argumentation; Fallacies 75% GN / 25% GS
Week 2: Ethical Foundations. Applied Ethics 25% GN / 75% GS
Week 3: RoboEthics and Machine Ethics 75% GN / 25% GS
Week 4: Societal and Cultural Variations in Robot Acceptance and Usage 25% GN / 75% GS
Week 5: Robots, Automation, and Economics 50% GN / 50% GS
Week 6: Military Robots 50% GN / 50% GS
Week 7: Robots and Privacy 50% GN / 50% GS
Week 8: Group Position: Automated Policing 50% GN / 50% GS
Week 9: Robots as sexual objects 50% GN / 50% GS
Week 10: Education and Healthcare 50% GN / 50% GS
Week 11: Robot Enhancement 50% GN / 50% GS
Week 12: Robots as Intelligent, Volitional Beings 50% GN / 50% GS
Week 13: Robot Entertainment and Robots in the Media 25% GN / 75% GS
Week 14: Robots, Automation, and Economics 50% GN / 50% GS
Week 15: Project Presentations
Week 16: Project Presentations

Briefly explain the staffing plan. Given that each Inter-Domain course is approved for two Knowledge Domains, it will be taught by an instructor (or instructional team) with appropriate expertise in both domains.

The instructor for the course will be Alan Wagner. My background and research combine theories from social psychology and behavior economics to create robots that model and interact with people. I have degrees in Psychology (BA) and Computer Science (MS, PhD). I am also a co-fund hire of the Rock Ethics Institute who's focus is on the ethical ramifications of robots on society, and area in which I have several publications.

Describe the assessments that will be used to determine students' ability to apply integrative thinking.

Critical analysis: These weekly writing assessments require students to evaluate and critique readings (25% of class grade). Group policy paper and presentation: This assessment requires students to research, develop, present and argue for a policy related to robot policing (25% of class grade). Students will choose a specific topic, such as the use of robot to kill armed perpetrators, and research the topic. Their research will force them to look at other and related instances of similar incidents and consider both the arguments for and against the current policy (if one exists). They will then develop their own policy and rationale and must be prepared to answer and argue for there policy. To receive a high grade on these assignments, students must demonstrate that they recognize and draw from both computational sciences and human/social processes in explaining complex human-robot technology.

Class participation: Understanding and critical examination of the topic will be evaluated through daily class participation.

Campuses That Have Offered ( ) Over The Past 4 Years

<table>
<thead>
<tr>
<th>semester</th>
<th>AB</th>
<th>AL</th>
<th>BK</th>
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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: EDUARDO MENDIETA Department: Philosophy
Position: Consultation Campus: UNIVERSITY PARK CAMPUS
Title: PROFESSOR OF PHILOSOPHY
Recipient Name: THEODORE TOADVINE
Department: Philosophy
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: ASSOC PROF PHIL/DIR REI

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

Recipient Name: KEEFE MANNING
Department: Biomedical Engineering
Position: Consultation
Campus: UNIVERSITY PARK CAMPUS
Title: PROF BIOE & SURGERY

Initiator Comments: Keefe,
I have added an honors project which requires students to probe deeply into a topic of their choice. It wasn't clear where the text for the honors description should be added so I put it in the Course Objectives section. The text is also listed below:
>>>>>>>>>>>>>>>>>
Honors Course:
This course is also offered as an honors course. For the honors component of the course the student will choose a project focused either on technical aspects of human-robot interaction or on the societal ramifications of these systems. If the student chooses a technical honors project they will be expected to develop and demonstrate hardware or software related to the use, communication, and/or interaction of robots with people. For technical projects, the students must have the skills needed to perform the work. This course will not be able to train students to
develop software or hardware. If the student chooses a societal implications honors project they will be expected to develop projections of future uses of robots and the impact those uses will have on society. Societal projects must use data and projected data as evidence as well as expert testimony to develop future projections related to robots.

Some sample topics are listed below as technical and societal projects:

--Robot art and performance. How will robots be used to perform and generate art in the future? Societal project: Use research from the philosophy of art to justify and expound why or why a robot cannot be an artist. Strong philosophical justification for one's argument will be needed. Interview local or national artists to gain the perspective of a broader audience. Technical project: develop a robot that dances. The robot's dance cannot be a static, predetermined dance but must take into consideration aspects of the music being played. Musical characteristics such as rhythm, timbre, etc should influence the dance.

--Criminal uses of robotics and AI. How will criminals use robots and AI in the future. Societal project: evaluate how these systems might be used by criminal enterprises, for a given future period project the percent of crime utilizing robots and AI, what crimes are most likely to be utilize robots and AI, which are least likely, who is most likely to be impacted? Technical project: develop a multi-agent simulation and program an agent to act as a criminal within the simulation. Evaluate the types of crimes that the simulated robot performs and, more importantly, the use of motives (rather than rule based programming) to induce criminal activity by the agent.

(5) Request sent: 4/16/2018 at 10:59 AM
Last sent: 4/23/2018 at 7:30 AM
Concur: Yes
Comments: Reviewed On: 4/24/2018 at 11:24 AM

Head of Department

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

SCCA Representative

Recipient Name: ROBERT MELTON
Department: (Not Available)
Position: SCCA Representative
Campus: UNIVERSITY PARK CAMPUS
Title: 
Concur: [Not Yet Reviewed]
Comments: [Not Yet Reviewed]
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<tr>
<td></td>
<td>PETER BUTLER</td>
<td>(Not Available)</td>
<td>Dean of the College</td>
<td>UNIVERSITY PARK CAMPUS</td>
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Faculty Senate Review

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

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

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

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

Department: (Not Available)
Campus: UNIVERSITY PARK CAMPUS

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

Curricular Information
Blue Sheet Item #:
Review Date:

SCRID Numbers

(ENGR 467):

UPLOADED DOCUMENTS:
Context Type: Supporting Documents
File Description: Assignments and Rubrics
File Name: AssignmentsAndRubrics.pdf
Context Type: Supporting Documents
File Description: Reading List
File Name: CourseReadingList.pdf
Context Type: Supporting Documents
File Description: LOA
File Name: LOA-GenEdIntegrativeStudies.pdf
Context Type: Supporting Documents
File Description: Sample Lecture
File Name: L11.pdf
Context Type: Syllabus
File Description: Syllabus
File Name: Syllabus.pdf

Proposal ID: 5051 created on 9/14/2018 12:02 PM
Uploaded documents follow:
Critical Analysis Papers

For this course you will be asked to write several critical analysis papers that more deeply examine the topics covered in class. For these assignments will you do the following: first identify and explain the author’s argument and two, create your own argument related to the author’s argument. In order to do well on these assignments it is important that you avoid writing a “book report” that simply summarizes the author’s point, provides your own personal likes or dislikes regarding the paper and/or provides a shallow, thinly supported argument related to the topic. The highest grades will be reserved for those papers that demonstrate significant consideration of the topic as well as evidence to support one’s argument.

Structuring your Analysis

Your paper should begin with a short summary of the work and then dive in to the argument. It is important to be concise. Writing an outline (and following it) may help to keep you focused on your argument and avoid irrelevant descriptions. Below is a sample:

I. Introduction
   a. Brief statement identifying the paper or topic.
   b. Present your argument about the work
   c. Preview your argument – what are the steps you will take to prove your argument

II. Short summary of the work
   a. Present only what needs to be known to understand your argument

III. Your argument
   a. Your argument may involve a number of sub-arguments – mini-theses you prove to prove your larger argument true. This should be the bulk of the paper – Your professor/TA wants to read your argument about the work, not a summary.
      i. Present evidence to support your sub-arguments
      ii. Identifying how his examples do not meet the example of civilizations
      iii. Argue that civilization is so broad and non-specific that it is not useful

IV. Conclusion
   a. Briefly reflect on how you have proven your argument.
   b. Note the importance of your argument
   c. Note potential avenues for additional research or analysis

Reminders
• You need to cite where your information comes from, using either parenthetical citation or footnotes/endnotes.

1 Adopted from Writing Critical Analysis Papers Political Science/LSJ/JSIS Writing Center University of Washington; Adopted from J.L. Beyer, “Critically Analyzing an Academic Article or Book”
2 Adopted from https://sociology.byu.edu/.../326%20Grading%20Rubric%20for%20Critical%20Analy.doc
## Critical Analysis Rubric

<table>
<thead>
<tr>
<th>Category</th>
<th>Exceeds Standard</th>
<th>Meets Standard</th>
<th>Nearly Meets Standard</th>
<th>Does Not Meet Standard</th>
<th>No Evidence</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure of Argument</strong></td>
<td>Clear and concise, well developed. The central argument governs the development and organization of the paper.</td>
<td>Establishes strong sense of purpose, either explicitly or implicitly. Most supporting ideas help develop the central argument.</td>
<td>Purpose or central argument is established initially, but inconsistently attended to. Paper shows some unity of purpose, though some material may not be well aligned.</td>
<td>Paper drifts substantially from initial purpose or central argument.</td>
<td>Fails to establish purpose for writing. No clear point, or purpose; no central argument to the paper. Thesis is a summary of source text.</td>
<td></td>
</tr>
<tr>
<td><strong>Analysis</strong></td>
<td>Summarizes key points or issues in the source text and then critically analyzes or synthesizes those ideas with the student’s own, thoroughly articulated ideas.</td>
<td>Writing clearly demonstrates that the student read and understood the text fully; however, the critique is underdeveloped, one-sided, or biased.</td>
<td>Shows a basic understanding and ability to engage the substance of the text. Goes beyond repetition or summary of the text.</td>
<td>Repeats or summarizes source text without analyzing or critiquing. Shows only spotty understanding of issues, very limited analysis</td>
<td>Does not connect well to the source text. Lacks basic understanding of the issue or assignment, little or no analysis.</td>
<td></td>
</tr>
<tr>
<td><strong>Evidence</strong></td>
<td>Thoughtful use of well-chosen evidence from source text, demonstrating a profound understanding of the text and its arguments.</td>
<td>Mostly good use of source text, showing a general understanding of its argument and relevance.</td>
<td>Some use of evidence, not clearly demonstrating relevance of text to argument.</td>
<td>Little support for argument, or misuse of source text (misunderstanding source text, using text in ways that are not relevant to argument).</td>
<td>No support for argument, misuse of source text (misunderstanding source text, using text in ways that are not relevant to argument).</td>
<td></td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Well organized, with a logical structure that develops the ideas one paragraph at the time, with appropriate transitions between segments.</td>
<td>Mostly well-organized with each paragraph containing one idea, each idea related to the thesis, but with some elements vague, or minor links missing.</td>
<td>Shows some organization, most ideas related to thesis, some parts of the argument muddled or contradictory.</td>
<td>Limited evidence of organization, several elements lacking connection to thesis and each other.</td>
<td>Little evidence of organization, many elements lacking connection to thesis and each other.</td>
<td></td>
</tr>
<tr>
<td><strong>Style</strong></td>
<td>Student clearly controls the pace, rhythm, and variety of sentences.</td>
<td>Student uses variation in word choices, sentence lengths, and</td>
<td>Style is competent, though not engaging or inventive.</td>
<td>Requires the reader to backtrack to make sense of the organization.</td>
<td>Lacks control over sentence structure, difficult to follow, does not use</td>
<td></td>
</tr>
</tbody>
</table>

1 Adopted from Writing Critical Analysis Papers Political Science/LSJ/JSIS Writing Center University of Washington; Adopted from J.L. Beyer, “Critically Analyzing an Academic Article or Book”

2 Adopted from https://sociology.byu.edu/.../326%20Grading%20Rubric%20for%20Critical%20Analy.doc
| Sentence style is smooth and efficient. Words are well chosen and phrasing is precise. Sentences move smoothly from one to the next. No mechanical errors and only appropriate use of passive voice. | sentence transitions, but sentences are often wordy and cluttered. Economy in writing has not yet been developed. Student refrains from making typical mechanical errors, but errors arise as complexities in writing increase. Passive voice is used, but not in excess. | Shows reasonable command over phrasing and word choice. Some useful transitions and patterns of reference provide connections in the paper. Some typical mechanical errors and predictable use of passive voice. | Uses awkward, though not necessarily incorrect phrasing. Overly reliant on passive voice. | appropriate transitions. Many mechanical errors (spelling, punctuation, verb tense, capitalization, punctuation, etc.). |
Group Position Development and Presentation

For this assessment you will develop policy paper and present and defend your position to the class. The general topic investigated will be autonomous policing. As a team you will select a single area or issue related to this topic.

Your paper will present an arguable opinion about an issue. Your paper should convince the audience that your opinion is valid and worth listening to. Ideas that you are considering need to be carefully examined in choosing a topic, developing your argument, and organizing your paper. It is very important to ensure that you are addressing all sides of the issue and presenting it in a manner that is easy for your audience to understand. Your job is to take one side of the argument and persuade your audience that you have well-founded knowledge of the topic being presented. It is important to support your argument with evidence to ensure the validity of your claims, as well as to address the counterclaims to show that you are well informed about both sides. Policy papers not only present your opinion with respect to a given issue, but also lay out a plan for proactive advocacy and generally commit you to playing an active role in the issue.

As part of the assessment you will also present the policy to class. Be prepared to explain and defend the policy. Each member of the team will present a portion of the team’s position. You will have 15 minutes to present your team’s position and 5 minutes for questions.

1 Adopted from https://www.cfms.org/files/.../15Position_and_Policy_Paper_Development.doc
2 Adopted from https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf
Format for Policy Paper

Problem History
   A. Background of the problem
   B. Current status

Problem Definition
   C. Statement of the problem
   D. Identification of the stakeholders involved
   E. Impact and importance of the problem, both generally and specifically for the organization for whom the paper is being written

Position Statement
   F. A clear statement, which may be point-form, of the specific positions you are taking on the selected issue. A short rationale may be included for each position if this rationale is not clear in the preceding sections.

Recommendations
   G. Description of policy recommendations
   H. Rationale for recommendations
   I. Options for implementation

Accountability Statement
   J. This statement should identify individuals who will be responsible for this paper and for its advocacy plan.

Advocacy Plan
   K. A concrete, step-by-step plan to be followed in order to implement the recommendations. This includes any steps to be taken (such as, but not limited to: meeting with stakeholders, letter-writing campaigns, direct lobbying of congressional representatives, information and education campaigns, etc...).

   A timeline should be included for each step in the plan.

   Note should be made that the advocacy plan is generally subject to change as the situation changes at the discretion of those responsible for the paper.

References
   L. References (a consistent format must be used)

Suggested Length
   5 pages (max 7), single-spaced

1 Adopted from https://www.cfms.org/files/.../15Position_and_Policy_Paper_Development.doc
2 Adopted from https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf
## Research Paper Rubric

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<th>Nearly Meets Standard</th>
<th>Does Not Meet Standard</th>
<th>No Evidence</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title Page</strong></td>
<td><strong>Title, Your Name, Instructor’s Name, Course Period, Date, Neatly finished-no errors</strong></td>
<td>Evidence of four</td>
<td>Evidence of three</td>
<td>Evidence of two or fewer</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td><strong>Position Statement</strong></td>
<td>Clearly and concisely states the group’s position, which is engaging, and thought provoking</td>
<td>States the group’s position</td>
<td>States the group’s position</td>
<td>Incomplete and/or unfocused.</td>
<td>Absent, no evidence.</td>
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</tr>
<tr>
<td><strong>Policy Recommendations</strong></td>
<td>The group presents extensive novel, thorough recommendations plan.</td>
<td>The group presents reasonably novel and thorough policy recommendations</td>
<td>The group presents somewhat novel and thorough policy recommendations</td>
<td>The group presents minimally novel and thorough policy recommendations</td>
<td>No policy recommendations are presented.</td>
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</tr>
<tr>
<td><strong>Advocacy Plan</strong></td>
<td>The group presents extensive novel, thorough advocacy plan.</td>
<td>The group presents a reasonably novel and thorough advocacy plan</td>
<td>The group presents a somewhat novel and thorough advocacy plan.</td>
<td>The group presents a minimally novel and thorough advocacy plan.</td>
<td>No advocacy plan is presented.</td>
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<tr>
<td><strong>Organization-Structural Development of the Position</strong></td>
<td>All sections present and adequately detailed</td>
<td>Most sections present and adequately detailed</td>
<td>Some sections present and adequately detailed</td>
<td>Several missing sections and little detail</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>No errors in punctuation, capitalization and spelling.</td>
<td>Almost no errors in punctuation, capitalization and spelling.</td>
<td>Many errors in punctuation, capitalization and spelling.</td>
<td>Numerous and distracting errors in punctuation, capitalization and spelling</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Usage</strong></td>
<td>No errors sentence structure and word usage</td>
<td>Almost no errors in sentence structure and word usage</td>
<td>Many errors in sentence structure and word usage.</td>
<td>Numerous and distracting errors in sentence structure and word usage.</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Citation</strong></td>
<td>All cited works, both text and visual, are done in the correct format with no errors.</td>
<td>Some cited works, both text and visual, are done in the correct format. Inconsistencies evident</td>
<td>Few cited works, both text and visual, are done in the correct format.</td>
<td>Absent</td>
<td>Not applicable</td>
<td></td>
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</tbody>
</table>

2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
| Bibliography | Correct format with no errors. Includes more than 7 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet sites) | Correct format with few errors. Includes 5 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet) | Correct format with some errors. Includes 4 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet) | Correct format with many errors. Includes 3 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet sites) | Absent or the only sites are internet sites. |

2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
# Oral Presentation Rubric

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<th>Nearly Meets Standard</th>
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<th>No Evidence</th>
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<td><strong>Language Use and Delivery</strong></td>
<td>- Effectively uses eye contact.</td>
<td>- Maintains eye contact.</td>
<td>- Some eye contact, but not maintained.</td>
<td>- Uses eye contact ineffectively.</td>
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<tr>
<td>The student communicates ideas effectively</td>
<td>- Speaks clearly, effectively and confidently using suitable volume and pace.</td>
<td>- Speaks clearly and uses suitable volume and pace.</td>
<td>- Speaks clearly and unclearly in different portions.</td>
<td>- Fails to speak clearly and audibly and uses unsuitable pace.</td>
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<tr>
<td></td>
<td>- Fully engages the audience.</td>
<td>- Takes steps to engage the audience.</td>
<td>- Occasionally engages audience.</td>
<td>- Does not engage audience.</td>
<td></td>
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<tr>
<td></td>
<td>- Dresses appropriately.</td>
<td>- Dresses appropriately.</td>
<td>- Dresses inappropriately.</td>
<td>- Dresses inappropriately.</td>
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</tr>
<tr>
<td></td>
<td>- Selects rich and varied words for context and uses correct grammar.</td>
<td>- Selects words appropriate for context and uses correct grammar.</td>
<td>- Selects words inappropriate for context; uses incorrect grammar.</td>
<td>- Selects words inappropriate for context; uses incorrect grammar.</td>
<td></td>
</tr>
<tr>
<td><strong>Organization and Preparation</strong></td>
<td>- Introduces the topic clearly and creatively.</td>
<td>- Introduces the topic clearly.</td>
<td>- Introduces the topic. Somewhat maintains focus on the topic.</td>
<td>- Does not clearly introduce the topic. Does not establish or maintain focus on the topic. Uses ineffective transitions that rarely connect points. Ends without a conclusion</td>
<td></td>
</tr>
<tr>
<td>The student exhibits logical organization</td>
<td>- Maintains clear focus on the topic.</td>
<td>- Maintains focus on the topic.</td>
<td>- Includes some transitions to connect key points. Ends with coherent conclusion based on evidence</td>
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<tr>
<td></td>
<td>- Effectively includes smooth transitions to connect key points.</td>
<td>- Include transitions to connect key points.</td>
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<tr>
<td></td>
<td>- Ends with logical, effective and relevant conclusion.</td>
<td>- Ends with a conclusion based on evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>- Clearly defines the topic or thesis and its significance.</td>
<td>- Clearly defines the topic or thesis.</td>
<td>- Defines the topic or thesis.</td>
<td>- Does not clearly define the topic or thesis.</td>
<td></td>
</tr>
<tr>
<td>The student explains the process and findings of the project and the resulting learning</td>
<td>- Supports the thesis and key findings with an analysis of relevant and accurate evidence</td>
<td>- Supports the thesis and key findings with evidence.</td>
<td>- Supports the thesis with evidence.</td>
<td>- Does not support the thesis with evidence.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Provides evidence of extensive and valid research with multiple and varied sources.</td>
<td>- Present evidence of valid research with multiple sources.</td>
<td>- Presents evidence of research with sources.</td>
<td>- Presents little or no evidence of valid research.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Combines existing ideas to form new insights</td>
<td>- Combines existing ideas</td>
<td>- Shows little evidence of the combination of ideas.</td>
<td></td>
</tr>
</tbody>
</table>

2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
| Questions and Answers | - Combines and evaluates existing ideas to form new insights. | Demonstrates extensive knowledge of the topic by responding confidently, precisely and appropriately to all audience questions and feedback | Demonstrates knowledge of the topic by responding accurately and appropriately to questions and feedback | Demonstrates some knowledge of the topic by responding accurately and appropriately to questions and feedback | Demonstrates incomplete knowledge of the topic by responding inaccurately and inappropriately to questions and feedback |

2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
# Participation Rubric

<table>
<thead>
<tr>
<th>Category</th>
<th>Exceeds Standard</th>
<th>Meets Standard</th>
<th>Does Not Meet Standard</th>
<th>No Evidence</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attendance</strong></td>
<td>Missed 2 or fewer classes</td>
<td>Missed 2 to 4 classes</td>
<td>Missed 4 to 6 classes</td>
<td>Missed more than 6 classes</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency of class participation</strong></td>
<td>Initiates contributions more than once in each recitation.</td>
<td>Initiates contribution once in each recitation.</td>
<td>Initiates contribution at least in half of the recitations.</td>
<td>Does not initiate contribution &amp; needs instructor to solicit input.</td>
<td></td>
</tr>
<tr>
<td><strong>Quality of comments</strong></td>
<td>Comments always insightful &amp; constructive; uses appropriate terminology. Comments balanced between general impressions, opinions &amp; specific, thoughtful criticisms or contributions.</td>
<td>Comments mostly insightful &amp; constructive; mostly uses appropriate terminology. Occasionally comments are too general or not relevant to the discussion.</td>
<td>Comments are sometimes constructive, with occasional signs of insight. Student does not use appropriate terminology; comments not always relevant to the discussion.</td>
<td>Comments are uninformative, lacking in appropriate terminology. Heavy reliance on opinion &amp; personal taste, e.g., “I love it”, “I hate it”, “It’s bad” etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Receptiveness and Attentiveness</strong></td>
<td>Student listens attentively when others present materials, perspectives, as indicated by comments that build on others’ remarks, i.e., student hears what others say &amp; contributes to the dialogue. Student is seldom focused on phone or laptop.</td>
<td>Student is mostly attentive when others present ideas, materials, as indicated by comments that reflect &amp; build on others’ remarks. Student is occasionally focused on phone or laptop.</td>
<td>Student is often inattentive and needs reminder of focus of class. Occasionally makes inappropriate comments while others are speaking. Student is often distracted by their phone or laptop.</td>
<td>Does not listen to others; regularly talks or is on phone or laptop while others speak or does not pay attention while others speak; detracts from discussion; sleeps, etc.</td>
<td></td>
</tr>
</tbody>
</table>

1 Adopted from [https://www.cmu.edu/teaching/assessment/examples/cfa/tools/participationrubric-cfa.pdf](https://www.cmu.edu/teaching/assessment/examples/cfa/tools/participationrubric-cfa.pdf)
Sample Fallacy Quiz, Answers, and Rubric

Identify the type of fallacy

1. The suggestion that an argument is true because it has not been shown to be false.
Answer:

2. An attack on the motive or character of the individual providing the argument.
Answer:

3. “Well, it’s pretty obvious that your political party doesn’t know how to be fiscally responsible, so I wouldn’t expect you to, either.”
Answer:

4. A mischaracterization of one’s argument in order to make the refutation easier.
Answer:

5. The argument that because an individual of authority believes something to be true it is therefore true.
Answer:

6. Asserting that if some event A is allowed to occur, then some more consequential event will also occur.
Answer:

7. After Will said that we should put more money into health and education, Warren responded by saying that he was surprised that Will hates our country so much that he wants to leave it defenceless by cutting military spending.
Answer:
8. To defend his position that evolution 'isn't true' Bob says that he knows a scientist who also questions evolution (and presumably isn't a primate).

Answer:

9. Colin Closet asserts that if we allow same-sex couples to marry, then the next thing we know we'll be allowing people to marry their parents, their cars and even monkeys.

Answer:

10. George pointed a finger at Sean and asked him to explain how so many people could believe in leprechauns if they're only a silly old superstition.

Answer:
Answers

1. Appeal to Ignorance
2. Ad hominem
3. Ad hominem
4. Strawman
5. Appeal to Authority
6. Slippery Slope
7. Strawman
8. Appeal to Authority
9. Slippery Slope
10. Bandwagon
Rubric

Grade based on percentage correct. Grade accounts for 5% of participation grade.
Research Paper

The research project for this course is an individual project. Your research project should focus on a topic that we examined in class. You may choose any topic that you like as long it is related to course description.

Research Proposal: Prior to beginning your research paper you must submit a 1-page research proposal. This proposal should state what topic you will be investigating, why the topic is relevant to the course, and list some preliminary sources of information.

Research proposals are worth 5% of the project grade and are graded on a pass/fail basis. You will receive a passing grade if the proposal is complete (has all of the sections described) and turned in on time.

Research Paper: You can choose either an argumentative research paper or an analytic research paper. The argumentative research paper begins with an introduction clearly introducing the topic and presents the reader with a stance they intend to take. This stance is called a thesis statement. An argumentative research paper is meant to be persuasive, which means the topic chosen should be debatable or controversial. For example, it would be difficult for one to successfully argue the following thesis:

- Cigarette smoking poses medical dangers and may lead to cancer for both the smoker and those who experience secondhand smoke. Perhaps 25 years ago this topic would have been debatable; however, today, it is assumed that smoking cigarettes is, indeed, harmful to one's health.

This thesis does not challenge the currently accepted point of view that both firsthand and secondhand cigarette smoke is dangerous. A better thesis would be the following:

- Although it has been proven that cigarette smoking may lead to sundry health problems in the smoker, the social acceptance of smoking in public places demonstrates that many still do not consider secondhand smoke as dangerous to one's health as firsthand smoke.

The second thesis present a point of view are arguably. The writer will support this thesis throughout the paper by means of both primary and secondary sources and research, with the intent to persuade her audience that her particular interpretation of the situation is viable.

The analytical research paper typically begins by asking a question (a research question) on which the writer takes no stance. This type of paper is used to explore and evaluate a research question. For example, perhaps one is interested in the topic of the impact automation and economics. Reviewing the related literature the following question draws their interest:

- How should one interpret unemployment data over the past 30 years with respect to advances in automation and robots?

Their research may lead them to the following conclusion:

- Robots and automation have had little or no measurable impact on unemployment over the past 30 years.

Though this topic may be debatable and controversial, it is not the intent to persuade the audience that the writer’s are right while those of others are wrong. Instead, the goal is to offer a critical

1 Adopted from https://owl.english.purdue.edu/owl/owlprint/658/
2 Adopted from https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf
interpretation of primary and secondary sources throughout the paper--sources that should, ultimately, buttress the writer’s particular analysis of the topic. The following is an example of what the writer’s thesis statement may look like once they have completed their research.

Unemployment is impacted by a number of factors which may hide attempts to tease out the role of robots and automation. Adjusting for these factors it becomes apparent that automation and robots will have led to a slight gradual increase unemployment.

This statement does not negate the readings; instead, it offers a fresh and detailed perspective of the readings that are supported by the writer’s research.

It is typically not until the writer has begun the writing process that his thesis statement begins to take solid form. In fact, the thesis statement in an analytical paper is often more fluid than the thesis in an argumentative paper. Such is one of the benefits of approaching the topic without a predetermined stance.

Structure
Your research paper should be between 8-12 pages long, single-spaced, 12 point font.

Your paper should include an introduction, conclusion, references, and citations. Moreover, your arguments should be based on research that you have conducted. Your research may include literature reviews and synthesis of viewpoints from related fields, conducting of experiments, surveys and opinion polls, interviews with prominent figures, etc. An important aspect of your research paper is that you must generate new knowledge and information related to the topic of your choice. It is not enough to simply survey or review the viewpoints of others. The knowledge or information created will act as evidence for or against your paper’s argument.

Research Presentation: You will have approximately 15 minutes to present your project to the class. You should present the topic being studied, your argument related to the topic, background information, your research, conclusions, and references.
## Research Paper Rubric

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<th>Nearly Meets Standard</th>
<th>Does Not Meet Standard</th>
<th>No Evidence</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td><strong>Title Page</strong></td>
<td>Title, Your Name, Instructor’s Name, Course Period, Date, Neatly finished-no errors</td>
<td>Evidence of four</td>
<td>Evidence of three</td>
<td>Evidence of two or fewer</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td><strong>Thesis Statement</strong></td>
<td>Clearly and concisely states the paper’s purpose in a single sentence, which is engaging, and thought provoking</td>
<td>Clearly states the paper’s purpose in a single sentence.</td>
<td>States the paper’s purpose in a single sentence</td>
<td>Incomplete and/or unfocused.</td>
<td>Absent, no evidence</td>
<td></td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td>The introduction is engaging, states the main topic and previews the structure of the paper.</td>
<td>The introduction states the main topic and previews the structure of the paper.</td>
<td>The introduction states the main topic but does not adequately preview the structure of the paper.</td>
<td>There is no clear introduction or main topic and the structure of the paper is missing.</td>
<td>Absent, no evidence</td>
<td></td>
</tr>
<tr>
<td><strong>Body</strong></td>
<td>Each paragraph has thoughtful supporting detail sentences that develop the main idea.</td>
<td>Each paragraph has sufficient supporting detail sentences that develop the main idea.</td>
<td>Each paragraph lacks supporting detail sentences.</td>
<td>Each paragraph fails to develop the main idea.</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td>The writer presents extensive novel, thorough research on the topic.</td>
<td>The writer presents reasonable novel, thorough research on the topic.</td>
<td>The writer presents some novel, thorough research on the topic.</td>
<td>The writer presents minor novel, thorough research on the topic.</td>
<td>No research presented.</td>
<td></td>
</tr>
<tr>
<td><strong>Organization-Structural Development of the Idea</strong></td>
<td>Writer demonstrates logical and subtle sequencing of ideas through well-developed</td>
<td>Paragraph development present but not perfected.</td>
<td>Logical organization; organization of ideas not fully developed</td>
<td>No evidence of structure or organization.</td>
<td>Not applicable</td>
<td></td>
</tr>
</tbody>
</table>

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2 Adopted from [https://www.cpe.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cpe.cornell.edu/documents/Science%20Rubrics.pdf)
<table>
<thead>
<tr>
<th></th>
<th>paragraphs; transitions are used to enhance organization</th>
<th>The conclusion is engaging and restates the thesis.</th>
<th>The conclusion restates the thesis</th>
<th>Incomplete and/or unfocused</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conclusion</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>No errors in punctuation, capitalization and spelling.</td>
<td>Almost no errors in punctuation, capitalization and spelling.</td>
<td>Many errors in punctuation, capitalization and spelling.</td>
<td>Numerous and distracting errors in punctuation, capitalization and spelling</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Usage</strong></td>
<td>No errors in sentence structure and word usage</td>
<td>Almost no errors in sentence structure and word usage</td>
<td>Many errors in sentence structure and word usage.</td>
<td>Numerous and distracting errors in sentence structure and word usage.</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Citation</strong></td>
<td>All cited works, both text and visual, are done in the correct format with no errors.</td>
<td>Some cited works, both text and visual, are done in the correct format. Inconsistencies evident</td>
<td>Few cited works, both text and visual, are done in the correct format.</td>
<td>Absent</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Bibliography</strong></td>
<td>Correct format with no errors. Includes more than 7 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet)</td>
<td>Correct format with few errors. Includes 5 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet).</td>
<td>Correct format with some errors. Includes 4 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet)</td>
<td>Correct format with many errors. Includes 3 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet)</td>
<td>Absent or the only sites are internet sites.</td>
</tr>
</tbody>
</table>

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2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
# Oral Presentation Rubric

<table>
<thead>
<tr>
<th>Category</th>
<th>Exceeds Standard</th>
<th>Meets Standard</th>
<th>Nearly Meets Standard</th>
<th>Does Not Meet Standard</th>
<th>No Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language Use and Delivery</strong></td>
<td>- Effectively uses eye contact.</td>
<td>- Maintains eye contact.</td>
<td>- Some eye contact, but not maintained.</td>
<td>- Uses eye contact ineffectively.</td>
<td></td>
</tr>
<tr>
<td>The student communicates ideas effectively</td>
<td>- Speaks clearly, effectively and confidently using suitable volume and pace.</td>
<td>- Speaks clearly and uses suitable volume and pace.</td>
<td>- Speaks clearly and unclearly in different portions.</td>
<td>- Fails to speak clearly and audibly and uses unsuitable pace.</td>
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</tr>
<tr>
<td></td>
<td>- Fully engages the audience.</td>
<td>- Takes steps to engage the audience.</td>
<td>- Occasionally engages audience.</td>
<td>- Does not engage audience.</td>
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<tr>
<td></td>
<td>- Dresses appropriately.</td>
<td>- Dresses appropriately.</td>
<td>- Dresses inappropriately.</td>
<td>- Dresses inappropriately.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Selects rich and varied words for context and uses correct grammar.</td>
<td>- Selects words appropriate for context and uses correct grammar.</td>
<td>- Selects words inappropriate for context; uses incorrect grammar.</td>
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</tr>
<tr>
<td><strong>Organization and Preparation</strong></td>
<td>- Introduces the topic clearly and creatively.</td>
<td>Introduces the topic clearly.</td>
<td>Introduces the topic. Somewhat maintains focus on the topic.</td>
<td>Does not clearly introduce the topic.</td>
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</tr>
<tr>
<td>The student exhibits logical organization.</td>
<td>- Maintains focus on the topic.</td>
<td>Maintains focus on the topic.</td>
<td>Includes some transitions to connect key points. Ends with a conclusion based on evidence</td>
<td>Does not establish or maintain focus on the topic.</td>
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<td></td>
<td>- Effectively includes smooth transitions to connect key points.</td>
<td>Include transitions to connect key points.</td>
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<td>Uses ineffective transitions that rarely connect points. Ends without a conclusion</td>
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<td>- Ends with logical, effective and relevant conclusion.</td>
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<td>- Clearly defines the topic or thesis and its significance.</td>
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</tr>
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<td>The student explains the process and findings of the project and the resulting learning</td>
<td>- Supports the thesis and key findings with an analysis of relevant and accurate evidence</td>
<td>- Supports the thesis and key findings with evidence.</td>
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<tr>
<td></td>
<td>- Provides evidence of extensive and valid research with multiple and varied sources.</td>
<td>- Presents evidence of valid research with multiple sources.</td>
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<td></td>
<td></td>
<td>- Combines existing ideas to form new insights</td>
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2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
- Combines and evaluates existing ideas to form new insights.

| Questions and Answers | Demonstrates extensive knowledge of the topic by responding confidently, precisely and appropriately to all audience questions and feedback | Demonstrates knowledge of the topic by responding accurately and appropriately to questions and feedback | Demonstrates some knowledge of the topic by responding accurately and appropriately to questions and feedback | Demonstrates incomplete knowledge of the topic by responding inaccurately and inappropriately to questions and feedback |

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2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
The research project for this course is an individual project. Your research project should focus on a topic that we examined in class. You may choose any topic that you like as long it is related to course description.

**Research Proposal:** Prior to beginning your research paper you must submit a 1-page research proposal. This proposal should state what topic you will be investigating, why the topic is relevant to the course, and list some preliminary sources of information.

Research proposals are worth 5% of the project grade and are graded on a pass/fail basis. You will receive a passing grade if the proposal is complete (has all of the sections described) and turned in on time.

**Research Paper:** You can choose either an argumentative research paper or an analytic research paper. The argumentative research paper begins with an introduction clearly introducing the topic and presents the reader with a stance they intend to take. This stance is called a thesis statement. An argumentative research paper is meant to be persuasive, which means the topic chosen should be debatable or controversial. For example, it would be difficult for one to successfully argue the following thesis:

> Cigarette smoking poses medical dangers and may lead to cancer for both the smoker and those who experience secondhand smoke. Perhaps 25 years ago this topic would have been debatable; however, today, it is assumed that smoking cigarettes is, indeed, harmful to one's health.

This thesis does not challenge the currently accepted point of view that both firsthand and secondhand cigarette smoke is dangerous. A better thesis would be the following:

> Although it has been proven that cigarette smoking may lead to sundry health problems in the smoker, the social acceptance of smoking in public places demonstrates that many still do not consider secondhand smoke as dangerous to one's health as firsthand smoke.

The second thesis present a point of view are arguably. The writer will support this thesis throughout the paper by means of both primary and secondary sources and research, with the intent to persuade her audience that her particular interpretation of the situation is viable.

The analytical research paper typically begins by asking a question (a research question) on which the writer takes no stance. This type of paper is used to explore and evaluate a research question. For example, perhaps one is interested in the topic of the impact automation and economics. Reviewing the related literature the following question draws their interest:

> How should one interpret unemployment data over the past 30 years with respect to advances in automation and robots?

Their research may lead them to the following conclusion:

> Robots and automation have had little or no measurable impact on unemployment over the past 30 years.

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2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
Though this topic may be debatable and controversial, it is not the intent to persuade the audience that the writer’s are right while those of others are wrong. Instead, the goal is to offer a critical interpretation of primary and secondary sources throughout the paper--sources that should, ultimately, buttress the writer’s particular analysis of the topic. The following is an example of what the writer’s thesis statement may look like once they have completed their research.

Unemployment is impacted by a number of factors which may hide attempts to tease out the role of robots and automation. Adjusting for these factors it becomes apparent that automation and robots will have led to a slight gradual increase unemployment.

This statement does not negate the readings; instead, it offers a fresh and detailed perspective of the readings that are supported by the writer’s research.

It is typically not until the writer has begun the writing process that his thesis statement begins to take solid form. In fact, the thesis statement in an analytical paper is often more fluid than the thesis in an argumentative paper. Such is one of the benefits of approaching the topic without a predetermined stance.

Structure
Your research paper should be between 8-12 pages long, single-spaced, 12 point font.

Your paper should include an introduction, conclusion, references, and citations. Moreover, your arguments should be based on research that you have conducted. Your research may include literature reviews and synthesis of viewpoints from related fields, conducting of experiments, surveys and opinion polls, interviews with prominent figures, etc. An important aspect of your research paper is that you must generate new knowledge and information related to the topic of your choice. It is not enough to simply survey or review the viewpoints of others. The knowledge or information created will act as evidence for or against your paper’s argument.

Research Presentation: You will have approximately 15 minutes to present your project to the class. You should present the topic being studied, your argument related to the topic, background information, your research, conclusions, and references.
# Research Paper Rubric

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<td>Title, Your Name, Instructor’s Name, Course Period, Date, Neatly finished-no errors</td>
<td>Evidence of four</td>
<td>Evidence of three</td>
<td>Evidence of two or fewer</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td>Thesis Statement</td>
<td>Clearly and concisely states the paper’s purpose in a single sentence, which is engaging, and thought provoking</td>
<td>Clearly states the paper’s purpose in a single sentence.</td>
<td>States the paper’s purpose in a single sentence</td>
<td>Incomplete and/or unfocused.</td>
<td>Absent, no evidence</td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>The introduction is engaging, states the main topic and previews the structure of the paper.</td>
<td>The introduction states the main topic and previews the structure of the paper.</td>
<td>The introduction states the main topic but does not adequately preview the structure of the paper.</td>
<td>There is no clear introduction or main topic and the structure of the paper is missing.</td>
<td>Absent, no evidence</td>
<td></td>
</tr>
<tr>
<td>Body</td>
<td>Each paragraph has thoughtful supporting detail sentences that develop the main idea.</td>
<td>Each paragraph has sufficient supporting detail sentences that develop the main idea.</td>
<td>Each paragraph lacks supporting detail sentences.</td>
<td>Each paragraph fails to develop the main idea.</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>The writer presents extensive novel, thorough research on the topic.</td>
<td>The writer presents reasonable novel, thorough research on the topic.</td>
<td>The writer presents some novel, thorough research on the topic.</td>
<td>The writer presents minor novel, thorough research on the topic.</td>
<td>No research presented.</td>
<td></td>
</tr>
<tr>
<td>Organization-Structural Development of the Idea</td>
<td>Writer demonstrates logical and subtle sequencing of ideas through well-developed.</td>
<td>Paragraph development present but not perfected.</td>
<td>Logical organization; organization of ideas not fully developed</td>
<td>No evidence of structure or organization.</td>
<td>Not applicable</td>
<td></td>
</tr>
</tbody>
</table>

1 Adopted from [https://owl.english.purdue.edu/owl/owlprint/658/](https://owl.english.purdue.edu/owl/owlprint/658/)
2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
<table>
<thead>
<tr>
<th></th>
<th>paragraphs; transitions are used to enhance organization</th>
<th>The conclusion is engaging and restates the thesis.</th>
<th>The conclusion restates the thesis</th>
<th>Incomplete and/or unfocused</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conclusion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>No errors in punctuation, capitalization and spelling.</td>
<td>Almost no errors in punctuation, capitalization and spelling.</td>
<td>Many errors in punctuation, capitalization and spelling.</td>
<td>Numerous and distracting errors in punctuation, capitalization and spelling</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Usage</strong></td>
<td>No errors sentence structure and word usage</td>
<td>Almost no errors in sentence structure and word usage</td>
<td>Many errors in sentence structure and word usage.</td>
<td>Numerous and distracting errors in sentence structure and word usage.</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Citation</strong></td>
<td>All cited works, both text and visual, are done in the correct format with no errors.</td>
<td>Some cited works, both text and visual, are done in the correct format. Inconsistencies evident</td>
<td>Few cited works, both text and visual, are done in the correct format.</td>
<td>Absent</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Bibliography</strong></td>
<td>Correct format with no errors. Includes more than 7 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet)</td>
<td>Correct format with few errors. Includes 5 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet).</td>
<td>Correct format with some errors. Includes 4 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet).</td>
<td>Correct format with many errors. Includes 3 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet)</td>
<td>Absent or the only sites are internet sites.</td>
</tr>
</tbody>
</table>

1 Adopted from [https://owl.english.purdue.edu/owl/owlprint/658/](https://owl.english.purdue.edu/owl/owlprint/658/)
2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
## Oral Presentation Rubric

<table>
<thead>
<tr>
<th>Category</th>
<th>Exceeds Standard</th>
<th>Meets Standard</th>
<th>Nearly Meets Standard</th>
<th>Does Not Meet Standard</th>
<th>No Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Use and Delivery</td>
<td>- Effectively uses eye contact.</td>
<td>- Maintains eye contact.</td>
<td>- Some eye contact, but not maintained.</td>
<td>- Uses eye contact ineffectively.</td>
<td></td>
</tr>
<tr>
<td>The student communicates</td>
<td>- Speaks clearly, effectively and confidently using suitable volume and pace.</td>
<td>- Speaks clearly and uses suitable volume and pace.</td>
<td>- Speaks clearly and unclearly in different portions.</td>
<td>- Fails to speak clearly and audibly and uses unsuitable pace.</td>
<td></td>
</tr>
<tr>
<td>ideas effectively</td>
<td>- Fully engages the audience.</td>
<td>- Takes steps to engage the audience.</td>
<td>- Occasionally engages audience.</td>
<td>- Does not engage audience.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Dresses appropriately.</td>
<td>- Dresses appropriately.</td>
<td>- Dresses inappropriately.</td>
<td>- Dresses inappropriately.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Selects rich and varied words for context and uses correct grammar.</td>
<td>- Selects words appropriate for context and uses correct grammar.</td>
<td>- Selects words inappropriate for context; uses incorrect grammar.</td>
<td>- Selects words inappropriate for context; uses incorrect grammar.</td>
<td></td>
</tr>
<tr>
<td>Organization and Preparation</td>
<td>- Introduces the topic clearly and creatively.</td>
<td>Introduces the topic clearly.</td>
<td>Introduces the topic. Somewhat maintains focus on the topic.</td>
<td>Does not clearly introduce the topic. Does not establish or maintain focus on the topic.</td>
<td></td>
</tr>
<tr>
<td>The student exhibits logical</td>
<td>- Maintains clear focus on the topic.</td>
<td>Maintains focus on the topic.</td>
<td>Includes some transitions to connect key points. Ends with a conclusion based on evidence</td>
<td>Uses ineffective transitions that rarely connect points. Ends without a conclusion.</td>
<td></td>
</tr>
<tr>
<td>organization.</td>
<td>- Effectively includes smooth transitions to connect key points.</td>
<td>Include transitions to connect key points.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Ends with logical, effective and relevant conclusion.</td>
<td>Ends with coherent conclusion based on evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>- Clearly defines the topic or thesis and its significance.</td>
<td>- Clearly defines the topic or thesis.</td>
<td>- Defines the topic or thesis.</td>
<td>- Does not clearly define the topic or thesis.</td>
<td></td>
</tr>
<tr>
<td>The student explains the</td>
<td>- Supports the thesis and key findings with an analysis of relevant and accurate evidence</td>
<td>- Supports the thesis and key findings with evidence.</td>
<td>- Supports the thesis with evidence.</td>
<td>- Does not support the thesis with evidence.</td>
<td></td>
</tr>
<tr>
<td>process and findings of the</td>
<td>- Provides evidence of extensive and valid research with multiple and varied sources.</td>
<td>- Presents evidence of valid research with multiple sources.</td>
<td>- Presents evidence of research with sources.</td>
<td>- Presents little or no evidence of valid research.</td>
<td></td>
</tr>
<tr>
<td>project and the resulting</td>
<td>- Provides evidence of complex problem solving and learning stretch.</td>
<td>- Provides evidence of problem solving and learning stretch.</td>
<td>- Provides evidence of problem solving and learning stretch.</td>
<td>- Shows little evidence of problem solving and learning stretch.</td>
<td></td>
</tr>
<tr>
<td>learning</td>
<td></td>
<td>- Combines existing ideas to form new insights</td>
<td>- Combines existing ideas</td>
<td>- Shows little evidence of the combination of ideas.</td>
<td></td>
</tr>
</tbody>
</table>

1 Adopted from [https://owl.english.purdue.edu/owl/owlprint/658/](https://owl.english.purdue.edu/owl/owlprint/658/)
2 Adopted from [https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cte.cornell.edu/documents/Science%20Rubrics.pdf)
- Combines and evaluates existing ideas to form new insights.

| Questions and Answers | Demonstrates extensive knowledge of the topic by responding confidently, precisely and appropriately to all audience questions and feedback | Demonstrates knowledge of the topic by responding accurately and appropriately to questions and feedback | Demonstrates some knowledge of the topic by responding accurately and appropriately to questions and feedback | Demonstrates incomplete knowledge of the topic by responding inaccurately and inappropriately to questions and feedback |

1 Adopted from [https://owl.english.purdue.edu/owl/owlprint/658/](https://owl.english.purdue.edu/owl/owlprint/658/)
2 Adopted from [https://www.cie.cornell.edu/documents/Science%20Rubrics.pdf](https://www.cie.cornell.edu/documents/Science%20Rubrics.pdf)
Robots and Their Role in Society
Course Reading List

Books
The following textbook is used in this course:

- Robot Futures, Illah Nourbakhsh

The following papers and articles are used in the course:

- McKinsey Global Institute, A Future that works: Automation, Employment, and Productivity, Executive Summary
- Lawrence Mischel and Josh Bivens (2017), The zombie robot argument lurches on, Economic Policy Institute
• Issac Asimov (1941), *Reason*, In: The Golden Years, 318-338.
• Sidney Perkowitz, Digital People (2004), Chapter 4.
• Laurel Reik and Don Howard (2014), A Code of Ethics for the Human-Robot Interaction Profession, *In We Robot 2014*.
• [https://www.wired.com/2012/08/next-gen-prosthetics-and-sports/](https://www.wired.com/2012/08/next-gen-prosthetics-and-sports/)

Additional non required reading

• Moral Machines, Wendell Wallach and Collin Allen
• Digital People, Sidney Perkowitz
Course name: Robots and their Role in Society
Course code: AERSP/PHIL 467
Term: Open
Faculty name(s): Alan Wagner
Campus: University Park
Number students started course/ completed course: (complete when course completed)

Instructions: Complete sections A-E by Fall 2017. Complete sections F-J after your course is completed.

A. Course materials checklist

<table>
<thead>
<tr>
<th>Item</th>
<th>Included?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syllabus</td>
<td>X</td>
</tr>
<tr>
<td>Course materials list (readings, etc.)</td>
<td>X</td>
</tr>
<tr>
<td>Lecture notes</td>
<td>X</td>
</tr>
<tr>
<td>In-class course activity descriptions</td>
<td>X (in slides)</td>
</tr>
<tr>
<td>Assignment prompts including scoring schemes (e.g. rubrics)</td>
<td>X</td>
</tr>
<tr>
<td>Quiz, exam questions</td>
<td>X</td>
</tr>
</tbody>
</table>

B. Curriculum rationale:

Main purpose:
What is significant topic, issue, or product to be approached in interdisciplinary fashion?

This course explores and critically analyzes the growing influence and impact of robots and automation on society.

Reason for interdisciplinary approach:
Why is an interdisciplinary approach valuable or necessary for this issue(s) or topic?

Robots and automation will impact a variety of areas of future human society ranging from artistic expression to warfare. The variety of topics examined and discussed demands, at a minimum, an ability to think critically about a range of topics and to present one’s position related to these topics to a diverse audience.

Integrative objects for student work:
What is aim of taking integrative approach? What are students expected to produce?

The aim of taking an integrative approach is to combine elements of engineering (robots as engineered technologies) with social psychology and sociology (their impact on society). Students are expected to be able to develop positions on the positive and negative future impacts of these technologies and to articulate their view with others.

Interdisciplinary tasks:
What sort of interdisciplinary tasks will students need to make to produce the integrative objects?
Students will be asked to critically analyze papers from a variety of different fields, discuss topics in class, develop an in depth research paper on a topic of their choice, and generate a group policy paper and presentation related to the topic of autonomous policing.

**Disciplines to be integrated:**
- Why is it important for interdisciplinary work on this issue?
- What substantial contribution does each discipline make?
- How does each present a clearly distinct perspective, mode of knowing and inquiry?
- What would be missing if this discipline were not represented?

*Natural Sciences are the basis for creating robots and automation. As a discipline, engineers focus on the creation of a system that meets specific predefined specifications. The Social and Behavioral Sciences contribute in two ways. First, by suggesting methods related to how people interact with machines (anthropomorphism for example) and secondly, by allowing for a broad examination of how the technology impacts society as a whole.*

These two viewpoints play off and complement one another. The engineering viewpoint challenges students to look for a specification that will meet some defined criteria whereas the social sciences viewpoint challenges them to look beyond simple, definable criteria.

**Course structure:**
- Does the syllabus serve as a map of, or orientation, to the course? Do tools, readings, message for each week reinforce each other and take students on a developmental path toward integrative thinking?

Yes. Yes.

**C. Integrative Studies Courses must address TWO Knowledge Domains. In the table below, mark the domains addressed in your course:**

<table>
<thead>
<tr>
<th>Knowledge Domain</th>
<th>Mark X for two domains:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA</td>
<td></td>
</tr>
<tr>
<td>GH</td>
<td></td>
</tr>
<tr>
<td>GHW</td>
<td></td>
</tr>
<tr>
<td>GN</td>
<td>X</td>
</tr>
<tr>
<td>GS</td>
<td>X</td>
</tr>
</tbody>
</table>

**D. List course learning objectives. Mark the Gen Ed Knowledge Domain and Key Learning Objectives addressed by each course objective (at least 3 out of 5 objectives for each Domain must be addressed; at least 2 out of 7 objectives for each Key objective including Integrative Thinking Key objective). See appendix for list of Knowledge Domain and Key Learning Objectives at end of document. (BY FALL 2017)**

<table>
<thead>
<tr>
<th>COURSE LEARNING OBJECTIVE</th>
<th>Gen Ed Knowledge Domain Objective Addressed</th>
<th>Gen Ed Key Learning Objective Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: 1. Students will be able to use methods of literary analysis to examine science fiction novel and produce an essay.</td>
<td>GH2, GH3</td>
<td>K1, K2, K3</td>
</tr>
<tr>
<td>Example: 2. Students will be able to discuss use of science concepts in science fiction novel with peers.</td>
<td>GN1</td>
<td>K1, K2</td>
</tr>
<tr>
<td>Example: 3. Students will be able to analyze use of science concepts as a literary device in early 20th century</td>
<td>GH1, GN1</td>
<td>K1, K2, K3, K4</td>
</tr>
<tr>
<td>Activity</td>
<td>Relevant Courses</td>
<td>Relevant Knowledge Levels</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Discuss and reflect on how robots will impact a number of society level issues including economics, safety, and privacy.</td>
<td>GN5, GS3</td>
<td>K1, K3</td>
</tr>
<tr>
<td>Critically read and argue a position verbally in and in writing related to the class topics.</td>
<td>GN3, GS4</td>
<td>K1, K2, K3</td>
</tr>
<tr>
<td>Identify common rhetorical fallacies.</td>
<td>GN4</td>
<td>K1</td>
</tr>
<tr>
<td>Make connections between the scientific development of a technology and the social, ethical, and philosophical implications of that technology.</td>
<td>GN5, GS5</td>
<td>K1, K3, K5, K7</td>
</tr>
</tbody>
</table>
E. For each course objective listed in D, list in-class course activities to develop each course objective. Also note how you will assess each course objective. Attach course activity descriptions, assignment prompts and any related assessment documents (e.g. rubrics, exam questions).

<table>
<thead>
<tr>
<th>COURSE LEARNING OBJECTIVE</th>
<th>Course activity and purpose</th>
<th>Course assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: 1. Students will be able to use methods of literary analysis to review science fiction novel and produce an essay.</td>
<td>Class discussion of Moby Dick in order to learn about process of literary analysis from instructor and peers</td>
<td>Assessment 1: 500 word essay uses literary analysis method. Essay scored using rubric.</td>
</tr>
<tr>
<td>Example: 3. Students will be able to analyze use of science concepts as a literary device in early 20th century science fiction novels and present analysis in oral presentation to class and lead class discussion.</td>
<td>Collaborative in-class team project to develop ideas for novel analysis for presentation to class. Team must also develop questions for class discussion.</td>
<td>Assessment 2: Team analyzes science fiction novel and create presentation and discussion questions. Assessed using rubric.</td>
</tr>
<tr>
<td>Discuss and reflect on how robots will impact a number of society level issues including economics, safety, and privacy.</td>
<td>Class discussion of topics and examination of tradeoffs for different courses of action. Class discussions present students will difficult ethical situations and require them to consider unique viewpoints.</td>
<td>Discussion participation: Discussion of class topics and attendance. Scored using participation rubric.</td>
</tr>
<tr>
<td>Critically read and argue a position verbally in and in writing related to the class topics.</td>
<td>Students are asked to critically analyze weekly reading on topics such as the impact of automation on unemployment. They must present an argument and evidence for or against that argument.</td>
<td>Critical Analysis: 1-2 page essay examining weekly reading assignment. Scored using critical analysis rubric.</td>
</tr>
<tr>
<td>Identify common rhetorical fallacies.</td>
<td>Students are asked to identify common rhetorical fallacies during class and in on a quiz.</td>
<td>Quiz: 10 question in class quiz testing ability to identify common fallacies. Scored using quiz rubric.</td>
</tr>
<tr>
<td>Make connections between the scientific development of a technology and the social, ethical, and philosophical implications of that technology.</td>
<td>Group activity in which students must examine a selected topic and develop a policy related to the topic. They must then present their policy recommendation in class and defend it.</td>
<td>Group Position Paper: 5-8 page policy position statement and presentation examining the topic of autonomous policing. Scored using position paper rubric.</td>
</tr>
</tbody>
</table>
F. For each course assessment listed in E, note how students performed.

<table>
<thead>
<tr>
<th>Student Assessment</th>
<th>Student Performance</th>
</tr>
</thead>
</table>
| Assessment 1: 500 word essay uses literary analysis method. Essay scored using rubric. | Students scored as follows for each rubric element (5 point scale):  
  a- Use literary analysis conventions: 80% scored 4 or above  
  b- Develop argument: 70% scored 3 or above  
  c- Grammar |

G. Did students have expected prior knowledge and skills to commence study in your course? If not, how did you address lack of expected knowledge/skills?

H. Discuss student reaction to course activities with particular attention to grasp of each Knowledge Domain’s modes of inquiry, and integrative thinking ability development. Did student reaction to course activities meet your expectations? If not, will you improve any course activities in the next course offering?

I. Discuss student performance on assessments with particular attention to grasp of each Knowledge Domain’s modes of inquiry, and integrative thinking ability development. Did student performance for each assessment meet your expectations? If students did not meet your performance expectations, what will change in the next course offering to improve student performance?

J. Reflect as Knowledge Domain expert(s) on teaching an interdisciplinary course. Did you teach the course alone or as a faculty team? What did you learn about interdisciplinary course teaching? Were you able to sufficiently grasp modes of inquiry in each Knowledge Domain in order to lead integrative course activities and assess student integrative thinking? What do you plan to improve as a teacher to ensure course success the next time you teach the course?
### Appendix: General Education Objectives: Knowledge Domain, Key and Integrative Thinking (with number codes)

#### Knowledge Domain

<table>
<thead>
<tr>
<th>Bloom’s taxonomy level</th>
<th>Knowledge Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RECOMMENDED</strong></td>
<td><strong>GA</strong></td>
</tr>
<tr>
<td><strong>EXPLAIN</strong> GA1.</td>
<td>Explain the methods of inquiry in arts fields and describe how the contributions of these fields complement inquiry in other areas</td>
</tr>
<tr>
<td><strong>DEFINE, COMPREHEND</strong> GA2.</td>
<td>Demonstrate an expanded knowledge and comprehension of the role that the arts play in various aspects of human endeavor</td>
</tr>
<tr>
<td><strong>CREATE</strong> GA3.</td>
<td>Demonstrate competence in the creation of works of art and design</td>
</tr>
<tr>
<td><strong>ANALYZE, CRITICAL THINK</strong> GA4.</td>
<td>Demonstrate competence in analysis, critical thinking and interpretive reasoning through the exploration of creative works</td>
</tr>
<tr>
<td><strong>IDENTIFY, EXPLAIN</strong> GA5.</td>
<td>Identify and explain the aesthetic, historic, social, and cultural significance of important works of art and critically assess creative works, their own or others’, through evaluative processes of analysis and interpretation</td>
</tr>
<tr>
<td><strong>GH</strong></td>
<td></td>
</tr>
<tr>
<td><strong>EXPLAIN</strong> GH1.</td>
<td>Explain the methods of inquiry in humanities fields and describe how the contributions of these fields complement inquiry in other areas</td>
</tr>
<tr>
<td><strong>CRITICAL THINK</strong> GH2.</td>
<td>Demonstrate competence in critical thinking about topics and texts in the humanities through clear and well-reasoned responses</td>
</tr>
<tr>
<td><strong>CRITICAL THINK, EVALUATE</strong> GH3.</td>
<td>Critically evaluate texts in the humanities– whether verbal, visual, or digital– and identify and explain moral or ethical dimensions within the disciplines of the humanities</td>
</tr>
<tr>
<td><strong>DEFINE</strong> GH4.</td>
<td>Demonstrate knowledge of major cultural currents, issues, and developments through time, including evidence of exposure to unfamiliar material that challenges their curiosity and stretches their intellectual range</td>
</tr>
<tr>
<td><strong>DEFINE</strong> GH5.</td>
<td>Become familiar with groups, individuals, ideas, or events that have influenced the experiences and values of different communities</td>
</tr>
<tr>
<td><strong>GHW</strong></td>
<td></td>
</tr>
<tr>
<td><strong>EXPLAIN</strong> GHW1.</td>
<td>Explain the methods of inquiry in Health and Wellness fields and describe how the contributions of these fields complement inquiry in other areas</td>
</tr>
<tr>
<td><strong>DESCRIBE</strong> GHW2.</td>
<td>Describe multiple perceptions and dimensions of health and wellness (emotional, spiritual, environmental, physical, social, intellectual, and occupational)</td>
</tr>
<tr>
<td><strong>IDENTIFY, EXPLAIN</strong> GHW3.</td>
<td>Identify and explain ways individuals and/or communities can achieve and maintain health and wellness</td>
</tr>
<tr>
<td><strong>DESCRIBE, EXPLAIN</strong> GHW4.</td>
<td>Describe health-related risk factors and explain changes in knowledge, attitudes, behaviors, activities or skills that have the potential of improving health and wellness</td>
</tr>
<tr>
<td><strong>DISSEMINATE KNOWLEDGE, DEMONSTRATE BEHAVIOR</strong> GHW5.</td>
<td>Disseminate knowledge about health and wellness and demonstrate behavioral practices needed to engage in healthy living across the life span.</td>
</tr>
<tr>
<td><strong>GN</strong></td>
<td></td>
</tr>
<tr>
<td><strong>EXPLAIN, DESCRIBE</strong> GN1.</td>
<td>Explain the methods of inquiry in the natural science fields and describe how the contributions of these fields complement inquiry in other areas</td>
</tr>
<tr>
<td><strong>EXPLAIN</strong> GN2.</td>
<td>Construct evidence-based explanations of natural phenomena</td>
</tr>
<tr>
<td><strong>COMPREHEND</strong> GN3.</td>
<td>Demonstrate informed understandings of scientific claims and their applications</td>
</tr>
<tr>
<td><strong>EVALUATE</strong> GN4.</td>
<td>Evaluate the quality of the data, methods, and inferences used to generate scientific knowledge</td>
</tr>
<tr>
<td><strong>IDENTIFY</strong> GN5.</td>
<td>Identify societal or philosophical implications of discoveries in the natural sciences, as well as their potential to address contemporary problems</td>
</tr>
<tr>
<td>GS</td>
<td>GS1. Explain the various methods of inquiry used in the social and behavioral sciences and describe how the contributions of these fields complement inquiry in other areas</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>IDENTIFY, EXPLAIN</td>
<td>GS2. Identify and explain major foundational theories and bodies of work in a particular area of social and behavioral sciences</td>
</tr>
<tr>
<td>DESCRIBE</td>
<td>GS3. Describe the ways in which many different factors may interact to influence behaviors and/or institutions in historical or contemporary settings</td>
</tr>
<tr>
<td>EXPLAIN</td>
<td>GS4. Explain how social and behavioral science researchers use concepts, theoretical models and data to better understand and address world problems</td>
</tr>
<tr>
<td>RECOGNIZE</td>
<td>GS5. Recognize social, cultural, political and/or ethical implications of work in the social and behavioral sciences.</td>
</tr>
</tbody>
</table>

**Key Objectives**

| K1. EFFECTIVE COMMUNICATION – the ability to exchange information and ideas in oral, written, and visual form in ways that allow for informed and persuasive discourse that builds trust and respect among those engaged in that exchange, and helps create environments where creative ideas and problem-solving flourish. |
| K2. KEY LITERACIES – the ability to identify, interpret, create, communicate and compute using materials in a variety of media and contexts. Literacy acquired in multiple areas, such as textual, quantitative, information/technology, health, intercultural, historical, aesthetic, linguistic (world languages), and scientific, enables individuals to achieve their goals, to develop their knowledge and potential, to lead healthy and productive lives, and to participate fully in their community and wider society. |
| K3. CRITICAL AND ANALYTICAL THINKING – the habit of mind characterized by comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating a conclusion. It is the intellectually disciplined process of conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. |
| K5. CREATIVE THINKING – the capacity to synthesize existing ideas, images, or expertise in original ways and the experience of performing, making, thinking, or acting in an imaginative way that may be characterized by innovation, divergent thinking, and intellectual risk taking. |
| K6. GLOBAL LEARNING – the intellectually disciplined abilities to analyze similarities and differences among cultures; evaluate natural, physical, social, cultural, historical, and economic legacies and hierarchies; and engage as community members and leaders who will continue to deal with the intricacies of an ever-changing world. Individuals should acquire the ability to analyze power; identify and critique interdependent global, regional, and local cultures and systems; and evaluate the implications for people’s lives. |
| K7. SOCIAL RESPONSIBILITY AND ETHICAL REASONING – the ability to assess one’s own values within the social context of problems, recognize ethical issues in a variety of settings, describe how different perspectives might be applied to ethical dilemmas, and consider the ramifications of alternative actions. Individuals should acquire the self-knowledge and leadership skills needed to play a role in creating and maintaining healthy, civil, safe, and thriving communities. |
Integrative Thinking Objectives

K4. INTEGRATIVE THINKING – the ability to synthesize knowledge across multiple domains, modes of inquiry, historical periods, and perspectives, as well as the ability to identify linkages between existing knowledge and new information. Individuals who engage in integrative thinking are able to transfer knowledge within and beyond their current contexts.

<table>
<thead>
<tr>
<th>Disciplinary grounding</th>
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</thead>
<tbody>
<tr>
<td>IT1. Define/recognize/apply disciplinary theories, findings, examples, methods, validation criteria, genres, communication forms</td>
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</table>

<table>
<thead>
<tr>
<th>Advancement through integration</th>
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<tbody>
<tr>
<td>IT2. Use integrative structures such as conceptual frameworks, graphic representations, models, metaphors, explanations, solutions that result in more complex, effective, empirically grounded or comprehensive accounts or products than would have been possible under single disciplinary framework.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Critical awareness</th>
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<tbody>
<tr>
<td>IT3. Frame problems or solutions in ways that show reflection on choices, opportunities, compromises by taking interdisciplinary approach</td>
</tr>
<tr>
<td>IT4. Exhibit awareness of of disciplinary contributions, how disciplines are integrated, limitations of integration</td>
</tr>
<tr>
<td>IT5. Recognize personal and disciplinary bias and the role such bias may play in framing of issues, events, ideas or works as well as the development of ideas or solutions (optional).</td>
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</table>
Robots and their Role in Society

Military Robots

Prof. Alan R Wagner
Aerospace Department /
Rock Ethics Institute
Robots in use by Militaries

More than 40 countries have robots in their arsenal
Robots in use by Militaries

The idea of using robots for war is not new. Improvements in technology are now making it possible.
Roles of Military Robots

- Demining
- Warfighter
- Command and control
- Reconnaissance
- Intelligence
- Rescue
- Supply/resupply
- Support
- Defense
Military Robot Ethical Issues

- Autonomous versus remote controlled
- Combat versus non-combat
- Dynamic versus static environment
- Social versus non-social
Robots in use by Militaries

What are some of the advantages of using robots in combat?
Robots in use by Militaries

What are some of the advantages of using robots in combat?

• Saves human lives
• Saves civilian lives
• Superior performance
  • More ethical?
  • More accurate targeting?
  • Greater lethality?
  • Less prone to lapses
Robots in use by Militaries

What are some of the disadvantages of using robots in combat?
Robots in use by Militaries

What are some of the disadvantages of using robots in combat?

- Cheapens the human toll of war
- Does have a cost
- Mistakes/misunderstandings could increase civilian deaths
- Lack of human fallabilty, judgment may equal no sporting chance
  - “With hands folded” by Jack Williamson
Meet the Robots

https://www.youtube.com/watch?v=mZF-qXpEz8U
Meet the Robots

https://www.youtube.com/watch?v=chPanW0QWhA

https://www.youtube.com/watch?v=_luhn7TLfWU

https://www.youtube.com/watch?v=M8YjvHYbZ9w

https://www.youtube.com/watch?v=rVlhMGQgDkY

https://www.youtube.com/watch?v=-7xvqQeoA8c

https://www.youtube.com/watch?v=tf7IEVTDjng
Atlas versus Terminator

Atlas Robot
Moral Hazard of Military Robots

**Moral Hazard**: people take more risks when someone else bears the burden

- Mortgage originators find and create loans but do not cover their losses. Motive to create bad loans.

Greater risks tend to result in larger, more devastating loss later
Moral Hazard of Military Robots

Starting a war costs little

Increased use of robots for targeted killings

- Lack of risks makes decision easier, more easily justified
- Little opposition to use of drones
- May lead to larger more costly wars
Campaign to Stop Killer Robots

Should we be creating these types of robots?
- Have we thought out the consequences of doing so?
- Pandora’s Box?

Is abandoning military robotics practical?

Is it ethical?
Impact of Robots on Warfighters

Drone pilots can suffer PTSD

- 17% clinically depressed; 4% full blown PTSD (Pentagon, 2011)

Are not considered for combat awards

Work 12 hours observing, killing, then go home to family

- Psychological schism?
Impact of Military Robots on Civilians

Targeted killings do result in civilian causalities

- Civilians with/near the target
- Wrong target
- Double tap strikes
Impact of Military Robots on Civilians

Civilians suffer PTSD

- Never know when they are being surveilled
- Never know when a bomb is going to explode

Double-tap strikes

- What are the ramifications? Ethical ramifications?
Impact of Military Robots on Civilians

It’s important to put these numbers in context

- Prior wars were much worse

<table>
<thead>
<tr>
<th>Target</th>
<th>Estimated deaths</th>
<th>Date</th>
<th>Perpetrator</th>
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</thead>
<tbody>
<tr>
<td>Warsaw, Poland</td>
<td>25,800</td>
<td>Sep 1939</td>
<td>Germany</td>
</tr>
<tr>
<td>Britain <em>(of which London)</em></td>
<td>40,000 <em>(20,000)</em></td>
<td>Sep 1940-May 1941</td>
<td>Germany</td>
</tr>
<tr>
<td>Dresden, Germany</td>
<td>18,000</td>
<td>Feb 13th-15th 1945</td>
<td>Britain &amp; US</td>
</tr>
<tr>
<td>Japan* <em>(of which Tokyo†)</em></td>
<td>300,000 <em>(100,000†)</em></td>
<td>Nov 1944-Aug 1945</td>
<td>United States</td>
</tr>
<tr>
<td>Hiroshima, Japan</td>
<td>140,000</td>
<td>Aug 6th 1945</td>
<td>United States</td>
</tr>
<tr>
<td>Nagasaki, Japan</td>
<td>74,000</td>
<td>Aug 9th 1945</td>
<td>United States</td>
</tr>
</tbody>
</table>

*Excludes atomic bombs †March 9th-10th 1945

Source: The Economist
Slippery Slope of Military Robots

Less justification
- War powers act
- Declaration of war

Acts not limited to military countries
- Drug dealers
- Libia, Yemen

Not limited to foreign fighters
- Anwar al-Awlaki, US citizen

Born New Mexico
B.S. in Civil Engineering
Colorado State University
Summary

The use of military robots are already changing warfare

It’s not clear this new type of warfare will play out
• What happens when two technologically sophisticated countries go to war?

It’s not clear how this type of war will effect civilian life
• Drone strikes by drug dealers?
• By terrorists?
Questions?
Robots and Their Role in Society
Syllabus

Course Abbreviation and Number: ENGR 467
Credits: 3.0
Prerequisites/Co-requisites/Concurrent Requirements/Recommended Preparation: None
Course Attributes/Designations: GenEd

General Education Learning Objectives: K1-Effective Communication, K2-Critical and Analytical Thinking, K5-Creative Thinking, K7-Social Responsibility and Ethical Reasoning

Course Description: This course explores and critically analyzes the growing influence and impact of robots and automation on society. The course is not technical in its treatment of robots and robotics, rather the focus is on critically investigating how the development of robotic technologies have impacted society in the past, present, and future. The course will not require programming or the development of an implemented project. Rather students will be required to write and orally defend a research paper on a selected topic. Participation is critical for this course. Students will be expected to actively participate and attend class, keep up with reading assignments, and complete written analysis of the discussed topics.

This course does not focus on the technical methods for developing or programming robots. The overarching area of treatment in this course will be on how the development of such technologies will impact and influence society and people, organizations, and institutions. Much of the basis for this course is in recent events. The purpose of the course will be to train engineers to think critically about the impact of their professional work and their ethical responsibilities as a professional. The students will be asked to read, write, critically analyze, and evaluate (both in written and verbally) current, previous, and upcoming ethics related dilemmas and problems posed by the advent of intelligent robots. Some of these issues are unique to robotics; others arise in the context of computing in general as well as in other technologies; still others are new manifestations of more general ethical, political and constitutional law issues.

Learning Outcomes: By the end of this course students will be able to:
- Discuss and reflect on how robots will impact a number of society level issues including economics, safety, and privacy.
- Critically read and argue a position verbally in and in writing related to the class topics.
- Identify common rhetorical fallacies.
- Make connections between the scientific development of a technology and the social, ethical, and philosophical implications of that technology.

Textbook: In additional to several publicly available papers, the following textbooks will be used in this course:
- Robot Futures, Illah Nourbakhsh
Additional non-required reading

- Moral Machines, Wendell Wallach and Collin Allen
- Digital People, Sidney Perkowitz
- Wired for War, P.W. Singer

**Course Structure:** Class periods will be spent discussing the topics described below. We will spend 1-2 weeks on each topic. Participation is critical for this course. Students will be expected to actively participate and attend class, keep up with reading assignments, and complete written analysis of the discussed topics.

Class begins promptly at XXX. It is important that you arrive on time. At the beginning of class I will pose information about the topic of discussion. We will then spend the rest of the course period exploring the topic through discussion and analysis.

Students are asked to be respectful with respect to the use of phones during class.

**Assessments:** Assessments will focus on effective written, verbal, and visual communication. Students will write critical analyses of weekly reading materials (25%), participate in class discussions (25%), develop group position statements (25%), and complete a research project (25%).

**Critical Analysis papers:** Weekly, ongoing assignment. I will remind of the requirement for the first few classes. After that you will not be reminded. These papers are due before class and should be submitted via Canvas. No late assignments will be accepted. Not submitting an assignment on time results in a zero for that assignment. Your lowest two assignment scores will be dropped. This policy is in place in order to be fair to everyone and to prevent subjective late excuses. Critical analysis papers follow the format provided in the critical analysis pdf. They should be approximately 1 page length, at least 10 pt font. Please do not confuse a critical analysis with a book report. Do not just describe what the paper is about. Please refer to the critical analysis pdf for more details.

**Group position policy paper and presentation:** pick and present a position as a team. Groups will pick different aspects and/or positions related to autonomous policing. Provide a policy outline describing the procedures for how this technology should interface with society. Be sure to cite relevant research. Present your policy recommendation to the class and defend it. Refer to the pdf for more details.

**Research paper:** Individual project examining in detail a robots in society topic. Present the topic's current status, the history of the topic, predict how the topic will impact society, present the topic from the perspective of different stakeholders. Be sure to include references and citations.

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<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>Daily</td>
<td>25</td>
</tr>
<tr>
<td>Critical analyses</td>
<td>Weekly</td>
<td>25</td>
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</table>
**Academic Integrity:** Faculty Senate Rule 49-20 states, in part, "Academic integrity is the pursuit of scholarly activity free from fraud and deception and is an educational objective of this institution."

Academic integrity is important for students both professionally and personally. Students violate the ideals of ethical conduct when they feel behind, confused or if the directions are unclear. Please speak either to the Prof. or the TA if this is the case. In order to promote academic integrity, students will be asked to sign a statement indicating that the work they submit is there own.

**Preliminary Schedule***

<table>
<thead>
<tr>
<th>Classes</th>
<th>Topic(s)</th>
<th>Readings</th>
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<tbody>
<tr>
<td>Week 1</td>
<td><strong>Techniques of Rhetoric and Logical Argumentation; Fallacies</strong>&lt;br&gt;Arguments as claims supported by reasons, evidence, authority, and the anticipation and rebuttal of objections.</td>
<td>Robot Futures (book)</td>
</tr>
<tr>
<td>Week 2</td>
<td><strong>Ethical Foundations. Applied Ethics</strong>&lt;br&gt;Assessing and balancing the benefits and costs of alternatives to stakeholders, virtue ethics.</td>
<td>Robot Futures (book)</td>
</tr>
<tr>
<td>Week 3</td>
<td><strong>RoboEthics and Machine Ethics</strong>: Ethical issues unique to robots</td>
<td>Robot Futures (Book)&lt;br&gt;Veruggio &amp; Operto paper</td>
</tr>
<tr>
<td>Week 4</td>
<td><strong>Societal and Cultural Variations in Robot Acceptance and Usage</strong></td>
<td>Bartneck&lt;br&gt;Turkle</td>
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<tr>
<td>Week 5</td>
<td><strong>Robots, Automation, and Economics</strong></td>
<td>McKinsey Study&lt;br&gt;Mischel &amp; Bivens</td>
</tr>
<tr>
<td>Week 6</td>
<td><strong>Military Robots</strong>&lt;br&gt;Military drones, targeted killings, robots as ethical soldiers, legality of military robots.</td>
<td>Cummings&lt;br&gt;Etzioni &amp; Etzioni</td>
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<tr>
<td>Week 7</td>
<td><strong>Robots and Privacy</strong>&lt;br&gt;Personal information, its disclosure and misuse.&lt;br&gt;Surveillance and changing interpretations of the Fourth Amendment.</td>
<td>Calo&lt;br&gt;McNeal</td>
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<tr>
<td>Week 8</td>
<td><strong>Group Position: Automated Policing</strong></td>
<td>Scheutz &amp; Arnold&lt;br&gt;Sharkey</td>
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<tr>
<td>Week 9</td>
<td><strong>Robots as sexual objects.</strong> The power of anthropomorphism, attachment, robot relationships, robot marriage.</td>
<td>Mubin&lt;br&gt;Beasley</td>
</tr>
<tr>
<td>Week 10</td>
<td><strong>Education and Healthcare.</strong> Robots in the classroom, use with older adults, psychological care, quality of care</td>
<td>next-gen-prosthetics-and-sports&lt;br&gt;the_future_of_human_augmentation</td>
</tr>
<tr>
<td>Week 11</td>
<td><strong>Robot Enhancement.</strong> Enhancement versus restorations, cyborgs, enhancements in athletics, automated referees.</td>
<td>Asimov’s Reason</td>
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<tr>
<td>Week 12</td>
<td><strong>Robots as Intelligent, Volitional Beings.</strong> Turing test, relations to philosophy of art, robot rights, robots as slaves.</td>
<td><a href="http://www.europarl.europa.eu">http://www.europarl.europa.eu</a></td>
</tr>
</tbody>
</table>
**Week 13**

**Robot Entertainment and Robots in the Media.** Robot pets, deep learning art, cultural depicts of robots in the media, utopias, dystopias.  

**Chapter 2 from Digital People**

**Week 14**

**Automated Law and Justice & Professional Responsibility.** Automated lawyer, automated judges, robots and crime. Professions and being professional, whistleblowing, moral hazard.  

[Riek](http://abovethelaw.com/2016/09/biglaw-automation-whose-job-goes-first/)  

**Week 15**  

**Research project presentation**  

None  

**Week 16**  

**Research project presentation**  

None

* We may stray from these topics over the course of the semester

**Class Cancellation:** If class is cancelled for any topics to be covered will be covered on the next day of class. Any dues assignments will also be due the next day of class.

**Services for Students with Disabilities:** Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Office for Disability Services (ODS) Web site provides contact information for every Penn State campus: [http://equity.psu.edu/ods/dcl](http://equity.psu.edu/ods/dcl). For further information, please visit the Office for Disability Services Web site: [http://equity.psu.edu/ods](http://equity.psu.edu/ods).

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: [http://equity.psu.edu/ods/guidelines](http://equity.psu.edu/ods/guidelines). If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible.
<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday Topic</th>
<th>Thursday Topic</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction.</td>
<td>Techniques of Rhetoric and Logical Argumentation</td>
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<td></td>
<td>Class topics:</td>
<td>Class topics:</td>
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<tr>
<td></td>
<td>• Review syllabus and assessments.</td>
<td>• Fallacies</td>
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<td></td>
<td>• Arguments as claims supported by reasons.</td>
<td>• Types of argument concerning the social consequences of robotics and the aptness of robotics-related policies.</td>
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<td></td>
<td>• Evidence, authority, and the anticipation and rebuttal of objections.</td>
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<tr>
<td></td>
<td>• Respectful and civil dialog</td>
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<tr>
<td>2</td>
<td>Ethical Foundations</td>
<td>Applied Ethics</td>
<td>Robot Futures (book)</td>
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<td></td>
<td>Class topics:</td>
<td>Class topics:</td>
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<tr>
<td></td>
<td>• Ethics background</td>
<td>• Moral Psychology</td>
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<td></td>
<td>• Review of utilitarianism</td>
<td>• Asimov's Laws.</td>
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<td></td>
<td>• Review of Kantian ethics</td>
<td>• Decision ethics</td>
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<td></td>
<td>• Review of virtue ethics</td>
<td>• Professional ethics</td>
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<td></td>
<td>• Assessing and balancing the costs and benefits of alternatives.</td>
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<td>3</td>
<td>Overview of RoboEthics</td>
<td>Overview of Machine Ethics</td>
<td>Robot Futures (book)</td>
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<tr>
<td></td>
<td>Class topics:</td>
<td>Class topics:</td>
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<tr>
<td></td>
<td>• Overview of robots/robotics</td>
<td>• Different approaches to Machine Ethics</td>
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<td></td>
<td>• Review of RoboEthics topics</td>
<td>• Implicitly ethical robots versus explicitly ethical robots Review of RoboEthics topics</td>
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<td></td>
<td>• Major results</td>
<td>• The challenges of creating an ethical robot</td>
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<td></td>
<td>• Means of experimentation</td>
<td>• Asmirov's stories</td>
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<td>• Trolley Problem</td>
<td>• Examples from SciFi</td>
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<td>4</td>
<td>Societal and Cultural Variations in Robot Acceptance and Usage</td>
<td>Societal and Cultural Variations in Robot Acceptance and Usage</td>
<td>Robot Futures (book)</td>
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<td>Class topics:</td>
<td>Class topics:</td>
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<tr>
<td></td>
<td>• Views related to gender</td>
<td>• Asia versus Europe versus United States</td>
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<td>• Views related to age</td>
<td>• Japan and animism</td>
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<td></td>
<td>• Socio-economic status as robot acceptance</td>
<td>• Acceptance related to purpose, role</td>
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<tr>
<td>5</td>
<td>Robots, Automation, and Economics</td>
<td>Robots, Automation, and Economics</td>
<td>McKinsey Study</td>
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<td>Class topics:</td>
<td>Class topics:</td>
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<tr>
<td></td>
<td>• Economic impact of robots</td>
<td>• Robots and income disparity</td>
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<td>6</td>
<td><strong>Robots and warfare</strong>&lt;br&gt;Class topics:</td>
<td><strong>Robots and warfare</strong>&lt;br&gt;Class topics:</td>
<td>Mischel and Bivens</td>
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<tr>
<td>Measuring the impact</td>
<td>Robots and unemployment</td>
<td>Impact of intelligent robots</td>
<td>Teleoperation and workforce multiplication</td>
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<td>Type of jobs impacted</td>
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<td>Compare to traditional automation</td>
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<td>Robots and unemployment</td>
<td>Impact of intelligent robots</td>
<td>Teleoperation and workforce multiplication</td>
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<td>7</td>
<td><strong>Robots that help: Search and Rescue</strong>&lt;br&gt;Class topics:</td>
<td><strong>Robots and Privacy</strong>&lt;br&gt;Class topics:</td>
<td>Calo</td>
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<tr>
<td>Robots save humans</td>
<td>Surveillance</td>
<td></td>
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<tr>
<td>Lying to prevent fear, panic</td>
<td>Fourth Amendment interpretations</td>
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<td>Overtrust of robots</td>
<td>Orwellian examples</td>
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<td>Triage decision making</td>
<td>Policing</td>
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<td>Robotic imprisonment</td>
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<td>8</td>
<td><strong>Group Position: Automated Policing</strong></td>
<td><strong>Group Position: Automated Policing</strong></td>
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<td>9</td>
<td><strong>Robots as sexual objects</strong>&lt;br&gt;Class topics:</td>
<td><strong>Robots as sexual objects</strong>&lt;br&gt;Class topics:</td>
<td>Scheutz &amp; Arnold</td>
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<tr>
<td>The power of anthropomorphism</td>
<td>Robot relationships</td>
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<td>Attachment to robots</td>
<td>Real Doll phenomenon</td>
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<td>Attitudes about robot sex</td>
<td>Robot marriage</td>
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<tr>
<td>Matching personality traits</td>
<td>Mechanistic dehumanization</td>
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</tr>
<tr>
<td>10</td>
<td><strong>Robots and Education</strong>&lt;br&gt;Class topics:</td>
<td><strong>Robots that help: Healthcare robots</strong>&lt;br&gt;Class topics:</td>
<td>Mubin</td>
</tr>
<tr>
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<td>---</td>
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</tr>
<tr>
<td>Robots in the classroom</td>
<td>Robots in healthcare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth mindset</td>
<td>Nudging and pushing patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robot abuse by children</td>
<td>Robot psychiatrist</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Quality of care</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><strong>Becoming Robotic: Robot-human enhancement, faster, stronger, better</strong>&lt;br&gt;Class topics:</td>
<td><strong>Becoming Robotic: Robot-human enhancement in Athletics</strong>&lt;br&gt;Class topics:</td>
<td></td>
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<tr>
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<td>---</td>
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<tr>
<td>Enhancement versus restorations</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Class</td>
<td>Class topics</td>
<td>Class topics</td>
<td>Class topics</td>
</tr>
<tr>
<td>-------</td>
<td>--------------</td>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>12</td>
<td>Robots as intelligent, volitional beings</td>
<td>Robots as intelligent, volitional beings</td>
<td>Should a robot have rights</td>
</tr>
<tr>
<td></td>
<td>• Turning test and subsequent measures.</td>
<td>• Should a robot have rights</td>
<td>• Different rights models and their application to robots.</td>
</tr>
<tr>
<td></td>
<td>• When is a robot ‘truly’ intelligent</td>
<td>• Factors that influence rights considerations: agency, intentionality, culpability</td>
<td>• Robots as slaves.</td>
</tr>
<tr>
<td></td>
<td>• Robot IQ test</td>
<td>• Different rights models and their application to robots.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Relations to philosophy of Art</td>
<td>• Robots as slaves.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Robot Entertainment</td>
<td>Robots in the Media</td>
<td>Class topics:</td>
</tr>
<tr>
<td></td>
<td>Class topics:</td>
<td>Class topics:</td>
<td>• Cultural depictions in the media</td>
</tr>
<tr>
<td></td>
<td>• Manipulation of the individual through affect in consumer robotics</td>
<td>• Cultural depictions in the media</td>
<td>• Spark of life</td>
</tr>
<tr>
<td></td>
<td>• Robot pets</td>
<td>• Cultural depictions in the media</td>
<td>• Utopias</td>
</tr>
<tr>
<td></td>
<td>• Deep learning art</td>
<td>• Cultural depictions in the media</td>
<td>• Dystopias</td>
</tr>
<tr>
<td></td>
<td>• Drone performances</td>
<td>• Cultural depictions in the media</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Automated Law, Justice, Judges</td>
<td>Professional Responsibility</td>
<td>Class topics:</td>
</tr>
<tr>
<td></td>
<td>Class topics:</td>
<td>Class topics:</td>
<td>• Professions and being professional</td>
</tr>
<tr>
<td></td>
<td>• Automated lawyers</td>
<td>• Professions and being professional</td>
<td>• Whistleblowing</td>
</tr>
<tr>
<td></td>
<td>• Enhanced lawyers and jury selection</td>
<td>• Professional codes of conduct</td>
<td>• Professional codes of conduct</td>
</tr>
<tr>
<td></td>
<td>• Automated judges, protection from or recipe for bias</td>
<td>• Social responsibility</td>
<td>• Social responsibility</td>
</tr>
<tr>
<td></td>
<td>• Automated governance</td>
<td>• Moral Hazard</td>
<td>• Moral Hazard</td>
</tr>
<tr>
<td></td>
<td>• Robots and Crime</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Research project presentation</td>
<td>Research project presentation</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Research project presentation</td>
<td>Research project presentation</td>
<td></td>
</tr>
</tbody>
</table>
Graduate Studies and Research Committee Report
Prepared for EFC Meeting: September 18, 2018

Graduate Faculty Nominations -- Non-Tenure (Informational Only):  
Approved (unanimous):
- None for review

Course Proposals:  
Approved (unanimous):
- (EE 578) Introduction to Radar Systems, Add

Program or Certificate Proposals:  
Approved (unanimous):
- Additive Manufacturing Engineering (AMD) – Change Proposal – Updates and Addition of MS Thesis Option
- Industrial Engineering (IE) – Change Proposal to Remove MS Options and Update the Graduate Degree Program

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>
</thead>
</table>
| Industrial Engineering - Proposal to Remove MS Options and Update the Graduate Degree Program | Program Change       | 1. Degree options as part of the Industrial Engineering MS program have been removed. These coursework specialization options have become obsolete; some of the required courses in the options are no longer taught. No impact on enrollment is expected for this change.  
2. An integrated description of the newly approved MEng Industrial Engineering degree has been added. The primary delivery mode for this new degree will be on-line. This is expected to boost graduate enrollment by 30%. These expected increases in enrollment will be sustainable with existing department faculty and instructional resources.  
3. Small editorial changes have been made to keep the program descriptions current with Penn State and IE Department policies. |       |
| Additive Manufacturing Engineering (AMD) – Change Proposal – Updates and Addition of MS Thesis Option | Program Change       | • Change 1: Removing department restrictions for program electives The MSAMD and MEngAMD options are 30-credit degree programs, which includes the successful completion of eight credits of elective courses. Currently students in the program are limited to taking “400/500-level courses in the following designations: EDSGN, ESC, IE, MATSE, or ME”. In order to expand the available options for elective offerings to AMD students, we propose removing the required elective designation and replace it with maintaining “a list of approved elective course offerings relevant to AMD in the program office”. Each semester the approved elective course offerings list will be reviewed by the AMD Program Director and distributed to AMD students. If a student wishes to enroll in an elective course that is not on the list of approved offerings, then they can submit a request for an elective course review by the AMD Program Director who will determine whether the course is a relevant elective for the AMD program.  
• Change 2: Add and cross-list AMD 590 colloquium Currently, AMD students are required to complete one credit of colloquium in either of the following departmental designations: EDSGN, ESC, IE, MATSE, or ME. Currently, all of the online MEngAMD students complete colloquium by enrolling in ME 590 because it is the only colloquium that offers an online section. Since ME 590 is also a requirement for students in the online MSME program, enrollments can be large and enrollment is limited to students in the MSME program. We |       |
propose to add AMD 590 as a new course, cross-listing it with ME 590 so that the AMD Program Office will be able to more accurately account for AMD student enrollments when generating reports and conducting degree audits.

- Change 3: Add AMD 596 as an option for independent study. Currently, all MSAMD and MEngAMD students are required to complete a culminating experience resulting in a final paper. Students have the option to complete their culminating experience at their place of employment (online students) or through an industrial internship (resident students). As part of the degree requirements, students enroll in either of the following departmental designations for individual studies: EDSGN 596, ESC 596, IE 596, MATSE 596, or ME 596, making it hard to keep track of AMD students when they pursue this option. The program proposes removing the specific department designations and replacing them with a new individual study course, AMD 596, to fulfill the culminating experience. Enrolling all students in AMD 596 will allow the AMD Program Office a more efficient process for accurately registering students with the appropriate faculty adviser and improve program reporting.

- Change 4: Add thesis option for resident MSAMD students. Finally, the program proposes the addition of a thesis option for the resident MSAMD students’ culminating experience. As the program continues to grow, we anticipate that a thesis option 2 will make our program more competitive and encourage AMD faculty to provide Graduate Research Assistantships for resident graduate students. Initially the program target was geared towards the existing engineering workforce; however, as interest in additive manufacturing and design expands, we aim to encompass those students coming directly from an engineering undergraduate program, who may not have extensive work experience and would seek a MSAMD thesis option degree program to make themselves a competitive candidate in the workforce. Students pursuing this option (instead of the paper) will write and defend a thesis at an oral examination based upon original research in the field. The thesis will be submitted following the procedures specified by the Graduate School and the students will register for at least six credits of thesis research (AMD 600).

(EE 578) Introduction to Radar Systems

Course Add

The course will study the fundamental principles of a radar system. The students will be able to acquire key theoretical concepts that will help them develop critical thinking so they can engage in the synthesis of current knowledge of radar systems and able to use that knowledge to develop creative research in producing new radar systems.

Committee Response to Proposer: What I DO suggest is that the first paragraph of the response be put into the proposal in the section “Relationship/Linkage of Course to Other Courses” as it “provides a rationale for the level of instruction.” (But without the capitalization of IS.)

Proposer made this change.
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Office of the Dean of the Graduate School, 211 Kern Building, University Park. For more information about the process, see the Overview of the Graduate Council Curricular Review Process.

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

College/School: College of Engineering
Department or Instructional Area: Department of Industrial and Manufacturing Engineering

New Graduate Program, Option, or Minor: Add

Designation of new graduate program:
Classification of Instructional Programs (CIF) Code:
Designation of new graduate option:
Designation of new graduate minor:

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

Existing Graduate Program Option, or Minor: X Change Drop

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

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

Brief description of the change (if not noted above): 1. Dropping MS Degree Options 2. Making Minor/Editorial MS Degree changes 3. Adding Approved MEng Degree Documentation

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

Submitted by Graduate Program Head
Janis P. Terpenny
Printed name
Signature
Date: 8/31/18

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

Printed name
Signature
Date:

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

Printed name
Signature
Date:
PROPOSAL TO REMOVE MS OPTIONS AND UPDATE THE
GRADUATE DEGREE PROGRAM
INDUSTRIAL ENGINEERING

DEPARTMENT SUBMITTING THE PROPOSAL:
DEPARTMENT OF INDUSTRIAL AND MANUFACTURING
ENGINEERING

CONTACT INFORMATION: JANIS TERPENNY, HEAD
Email: jpt5311@psu.edu
Telephone: 814-865-7601

ADDITIONAL CONTACT: ROBERT C. VOIGT
PROFESSOR
Email: rcv2@psu.edu
Telephone: 814-863-7290

COLLEGE AFFILIATION:
COLLEGE OF ENGINEERING
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Justification Statement</td>
<td>3</td>
</tr>
<tr>
<td>B. Proposed Graduate Programs Bulletin Listing</td>
<td>4</td>
</tr>
<tr>
<td>C. Consultations</td>
<td>9</td>
</tr>
</tbody>
</table>
Proposal to Remove MS Options and Update the Graduate Degree Program in Industrial Engineering

A. Justification Statement

1. Degree options as part of the Industrial Engineering MS program have been removed. These coursework specialization options have become obsolete; some of the required courses in the options are no longer taught. No impact on enrollment is expected for this change.

2. An integrated description of the newly approved MEng Industrial Engineering degree has been added. The primary delivery mode for this new degree will be on-line. This is expected to boost graduate enrollment by 30%. These expected increases in enrollment will be sustainable with existing department faculty and instructional resources.

3. Small editorial changes have been made to keep the program descriptions current with Penn State and IE Department policies.
B. Proposed Graduate Programs Bulletin Listing

Industrial Engineering (I E)

Program Home Page (Opens New Window)

JANIS P. TERPENNY, Peter and Angela Dal Pezzo Chair and Department Head, Harold and Inge Marcus Department of Industrial and Manufacturing Engineering
310 Leonhard Building
814-865-7601

Degrees Conferred:

M.S., M. Eng., Ph.D.

The Graduate Faculty

Graduate study and research are conducted in manufacturing process, information engineering, operations research, management science, production engineering, process design, systems engineering, human factors, ergonomics, quality engineering, service systems and robotics, data analytics.

Admission Requirements

Scores from the Graduate Record Examination (GRE) are required for admission. To be admitted into the program, an applicant must have received a baccalaureate degree from a regionally accredited institution. Graduates in engineering, physical sciences, and mathematics who present with a 3.00 grade-point average will be considered for admission.

All international applicants must submit scores for the TOEFL (Test of English as a Foreign Language) or the IELTS (International English Language Testing System), with the exceptions noted below. The minimum acceptable score for the TOEFL is 550 for the paper-based test, 213 for the computer-based test, or a total score of 80 with a 19 on the speaking section for the Internet-based test (iBT). The minimum composite score for the IELTS is 6.5.

In addition to academic admissibility, Penn State requires that all applicants whose native language is not English provide proof of English language proficiency. The following are ways in which the language proficiency requirement can be satisfied:

A minimum TOEFL score of 80 on the Internet-based TOEFL, or 550 on the paper exam;
A minimum IELTS score of 6.5 on the academic test;

International applicants who have received a baccalaureate or Master’s degree from a college, university, or institution in any of the following countries are exempt from the TOEFL requirement: Australia, Belize, British Caribbean and British West Indies, Canada (except Quebec), England, Guyana, Republic of Ireland, Liberia, New Zealand, Northern Ireland, Scotland, the United States, or Wales.
Degree Requirements

Three degrees are offered: Master of Science (M.S.) with thesis and non-thesis tracks, Master of Engineering in Industrial Engineering (M.Eng.IE) and the Doctor of Philosophy (Ph.D.).

The M.S. degree program is intended for students to gain advanced knowledge for research, analysis, and design in industrial engineering. The M.S. degree is offered with thesis or research paper tracks, both requiring 32 credits. The M.S. degree with thesis track requires 24 credits of coursework and two credits of IE 590 (Colloquium). Out of the 24 credits of coursework, at least 15 must be IE courses, and at least 12 must be at the 500 level. Of the 12 credits at the 500 level, at least nine must be IE courses. A thesis is required, for which six credits of IE 600 or IE 610 must be taken. The M.S. degree with non-thesis track requires 27 credits of coursework, two credits of IE 590 (Colloquium). Out of the 27 credits of coursework, at least 18 must be IE courses, and at least 18 must be at the 500 level. Of the 18 credits at the 500 level, at least fifteen must be IE courses. A scholarly paper is required for the MS degree with non-thesis track for which three credits of IE 596/600 must be taken. For both tracks, a core curriculum is required that is composed of IE 505 (Linear Programming) (3 credits) and IE 511 (Experimental Design in Engineering) (3 credits), which all the students must satisfy. The M.S. thesis must demonstrate comprehensive and in-depth knowledge of a topic in industrial engineering, and it should be suitable for submission for publication in a refereed journal as approved by the committee. The M.S. paper should demonstrate the ability of the student to integrate and apply concepts and techniques learnt in the courses to solve an engineering problem.

The students seeking the Master of Science degree in Industrial Engineering with non-thesis track are expected to start their degree in the Fall semester of every year and complete their degree including all the required coursework and three credits of research resulting in a paper and graduate by the end of summer following the second semester. Students who cannot complete their research paper by this summer can graduate after the summer. The plan of study is as follows:

- **Fall semester:** Twelve credits of coursework, one credit of colloquium and one credit of research (IE 596).
- **Spring semester:** Twelve credits of coursework, one credit of colloquium and one credit of research (IE 596).
- **Summer semester:** Three credits of coursework and one credit of research (IE 596).

For the M.S. degree, area options are available in Human Factors/Ergonomics Engineering, Manufacturing Engineering and Quality Engineering. M.S. dual-title degree program in Industrial Engineering and Operations Research is also offered.

The M.Eng.IE program emphasizes the scientific study of systems and processes, and the effective organization of people, products and services. The degree requirements consist of 30 credits of coursework including a required three credit capstone design course (IE 894) in lieu of a thesis or paper. Of the remaining coursework (27 credits), the following course restrictions apply:

- at least 15 credits must be courses at the 500 level or 800 level
- At least 18 credits must be Industrial Engineering Department (IE) courses
- at least 12 credits must be IE courses at the 500 level or 800 level
- at least 9 credits must be IE courses at the 500 level

The Ph.D. program emphasizes scholarly research and prepares students for research and development careers in industry, government, and academia. Students are admitted to candidacy after passing a written examination. The Ph.D. is awarded upon completion of a program of advanced study that includes a minimum period of residence, passing the English proficiency and comprehensive examinations, completing a satisfactory dissertation, and passing the final oral examination.
The degree requirements consist of 45 credits of course work and four I E 590 (Colloquium) credits. Of the 45 credits of required course work, 36 must be prefixed I E, and at least 30 must be at the 500 level. Nine credits must be from outside the Department and must include a six-credit sequence, with at least three credits at the 500 level.

A Ph.D. dual-title degree program in Industrial Engineering and Operations Research is also available.

Continuous registration is required for all graduate students until the paper, thesis, or dissertation is approved.

**Master of Science (M.S.) Degree with thesis and non-thesis tracks—Human Factors/Ergonomics Engineering Option**

To receive the M.S. degree in Industrial Engineering with thesis track and with an Option in Human Factors/Ergonomics Engineering, a student must complete at least 32 credits beyond the bachelor’s degree: 24 credits of course work, 2 credit of colloquium, and 6 credits of research leading to a thesis, as required for the M.S. degree in Industrial Engineering with thesis track. To receive the M.S. degree in Industrial Engineering with non-thesis track and with an Option in Human Factors/Ergonomics Engineering, a student must complete at least 32 credits beyond the bachelor’s degree: 27 credits of course work, 2 credit of colloquium, and 3 credits of research leading to a scholarly paper, as required for the M.S. degree in Industrial Engineering with non-thesis track.

The course credits for the Option in Human Factors/Ergonomics Engineering must include the following:

All the following three courses: (9 credits)
- I E 549 Design Decision Making
- I E 553 Engineering of Human Work
- I E 558 Engineering of Cognitive Work

**Master of Science (M.S.) Degree with thesis and non-thesis tracks—Manufacturing Engineering Option**

To receive the M.S. degree in Industrial Engineering with thesis track and with an Option in Human Factors/Ergonomics Engineering, a student must complete at least 32 credits beyond the bachelor’s degree: 24 credits of course work, 2 credit of colloquium, and 6 credits of research leading to a thesis, as required for the M.S. degree in Industrial Engineering with thesis track. To receive the M.S. degree in Industrial Engineering with non-thesis track and with an Option in Human Factors/Ergonomics Engineering, a student must complete at least 32 credits beyond the bachelor’s degree: 27 credits of course work, 2 credit of colloquium, and 3 credits of research leading to a scholarly paper, as required for the M.S. degree in Industrial Engineering with non-thesis track.

The course credits for the Option in Manufacturing Engineering must include the following:

All the following three courses: (9 credits)
- I E 528 Metal Cutting Theory
- I E 550 Manufacturing Systems
- I E 563 Computer-Aided Design for Manufacturing
Master of Science (M.S.) Degree with thesis and non-thesis tracks—Quality Engineering Option

To receive the M.S. degree in Industrial Engineering with thesis track and with an Option in Human Factors/Ergonomics Engineering, a student must complete at least 32 credits beyond the bachelor’s degree: 24 credits of coursework, 2 credit of colloquium, and 6 credits of research leading to a thesis, as required for the M.S. degree in Industrial Engineering with thesis track. To receive the M.S. degree in Industrial Engineering with non-thesis track and with an Option in Human Factors/Ergonomics Engineering, a student must complete at least 32 credits beyond the bachelor’s degree: 27 credits of coursework, 2 credit of colloquium, and 3 credits of research leading to a scholarly paper, as required for the M.S. degree in Industrial Engineering with non-thesis track.

The course credits for the Option in Quality Engineering must include the following:

All the following three courses (9 credits)
IE 555 Statistical Process Monitoring and Analysis
IE 566 Quality Control
IE 583 Response Surface Methodology and Process Optimization

Other Relevant Information

Students in this program may elect the dual-title degree program in Operations Research for the Ph.D. and M.S. degrees.

Student Aid

In addition to the fellowships, traineeships, graduate assistantships, and other forms of financial aid described in the STUDENT AID section of the Graduate Bulletin, the following award typically has been available to graduate students in this program:

HAROLD & INGE MARCUS GRADUATE FELLOWSHIPS—Consideration for these fellowships shall be given to all students exhibiting academic excellence who have been admitted to Penn State as candidates for a graduate degree in the Department of Industrial and Manufacturing Engineering, College of Engineering.

BENJAMIN W. NIEBEL MANUFACTURING FELLOWSHIP
Consideration for this fellowship shall be given to all students exhibiting academic excellence who have been admitted to Penn State as candidates for a graduate degree in the Department of Industrial and Manufacturing Engineering, College of Engineering.

Courses

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

Last Revised by the Department: Spring Semester 2015 Fall Semester 2018

Blue Sheet Item #: 43-06

Review Date: 04/14/2015

UCA Revision #: 7/30/07

Faculty linked: 6/20/14
C. Consultations
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Office of the Dean of the Graduate School, 211 Kern Building, University Park. For more information about the process, see the Overview of the Graduate Council Curricular Review Process.

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

College/School: College of Engineering
Department or Instructional Area: Mechanical and Nuclear Engineering

New Graduate Program, Option, or Minor: Add

Designation of new graduate program:
Classification of Instructional Programs (CIP) Code:
Designation of new graduate option:
Designation of new graduate minor:

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

Existing Graduate Program Option, or Minor: Change Drop

Current designation of graduate program: Additive Manufacturing and Design
Current designation of graduate option:
Current designation of graduate minor:

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

Brief description of the change (if not noted above): Degree requirement updates and addition of MS thesis option

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

Submitted by Graduate Program Head
Timothy W. Simpson
Printed name
Signature
Date: 3/14/18

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

Printed name
Signature
Date:

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

Printed name
Signature
Date:
Graduate Council Joint Curricular Committee
Graduate Program Change Proposal
April 23, 2018

Proposal Type: Change

Program Name: Additive Manufacturing and Design

Degree(s) Offered: M.S. and M.Eng.

Location Offered: University Park and World Campus

Delivery: Residential and Online

Proposed Effective Semester: Fall 2018

Proposer/Program Head: Dr. Timothy Simpson, Director of Additive Manufacturing & Design
Email: tws8@psu.edu
Phone: 814-863-7136

Department Head: Dr. Karen Thole, Mechanical and Nuclear Engineering
Email: kthole@psu.edu
Phone: 814-865-2519

Staff Contact: Jaclyn Stimely, Program Coordinator of Additive Manufacturing & Design
Email: juc52@psu.edu
Phone: 814-863-8069
Table of Contents

I. Justification for Proposed Changes .................................................................1

II. Overview of Proposed Changes ......................................................................2

III. Current Bulletin Listing with Tracked Changes ...........................................3

IV. Appendices .....................................................................................................7

   A. Appendix A: CRCS Change Course Proposal for AMD 590 ....................7
   B. Appendix B: CRCS Add Course Proposal for AMD 596 ........................12
   C. Appendix C: CRCS Add Course Proposal for AMD 600 ......................17
   D. Appendix D: Consultation ........................................................................22
I. Justification for Proposed Changes

The Additive Manufacturing and Design (AMD) graduate program began in Fall semester 2017 offering a Master’s of Science in AMD (MSAMD) for in-resident students or a Master’s of Engineering in AMD (MEngAMD) for online students. The AMD program is an inter-departmental degree program in the College of Engineering with inclusion of the Material Science and Engineering Department in the College of Earth and Mineral Science.

Change 1: Removing department restrictions for program electives

The MSAMD and MEngAMD options are 30-credit degree programs, which includes the successful completion of eight credits of elective courses. Currently students in the program are limited to taking “400/500-level courses in the following designations: EDSGN, ESC, IE, MATSE, or ME”. In order to expand the available options for elective offerings to AMD students, we propose removing the required elective designation and replace it with maintaining “a list of approved elective course offerings relevant to AMD in the program office”. Each semester the approved elective course offerings list will be reviewed by the AMD Program Director and distributed to AMD students. If a student wishes to enroll in an elective course that is not on the list of approved offerings, then they can submit a request for an elective course review by the AMD Program Director who will determine whether the course is a relevant elective for the AMD program.

Change 2: Add and cross-list AMD 590 colloquium

Currently, AMD students are required to complete one credit of colloquium in either of the following departmental designations: EDSGN, ESC, IE, MATSE, or ME. Currently, all of the online MEngAMD students complete colloquium by enrolling in ME 590 because it is the only colloquium that offers an online section. Since ME 590 is also a requirement for students in the online MSME program, enrollments can be large and enrollment is limited to students in the MSME program. We propose to add AMD 590 as a new course, cross-listing it with ME 590 so that the AMD Program Office will be able to more accurately account for AMD student enrollments when generating reports and conducting degree audits.

Change 3: Add AMD 596 as an option for independent study

Currently, all MSAMD and MEngAMD students are required to complete a culminating experience resulting in a final paper. Students have the option to complete their culminating experience at their place of employment (online students) or through an industrial internship (resident students). As part of the degree requirements, students enroll in either of the following departmental designations for individual studies: EDSGN 596, ESC 596, IE 596, MATSE 596, or ME 596, making it hard to keep track of AMD students when they pursue this option. The program proposes removing the specific department designations and replacing them with a new individual study course, AMD 596, to fulfill the culminating experience. Enrolling all students in AMD 596 will allow the AMD Program Office a more efficient process for accurately registering students with the appropriate faculty adviser and improve program reporting.

Change 4: Add thesis option for resident MSAMD students

Finally, the program proposes the addition of a thesis option for the resident MSAMD students’ culminating experience. As the program continues to grow, we anticipate that a thesis option
will make our program more competitive and encourage AMD faculty to provide Graduate Research Assistantships for resident graduate students. Initially the program target was geared towards the existing engineering workforce; however, as interest in additive manufacturing and design expands, we aim to encompass those students coming directly from an engineering undergraduate program, who may not have extensive work experience and would seek a MSAMD thesis option degree program to make themselves a competitive candidate in the workforce. Students pursuing this option (instead of the paper) will write and defend a thesis at an oral examination based upon original research in the field. The thesis will be submitted following the procedures specified by the Graduate School and the students will register for at least six credits of thesis research (AMD 600).

II. Overview of Proposed Changes

<table>
<thead>
<tr>
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<td><strong>Electives (8c)</strong></td>
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<td>EDSGN 590 or ESC 514 or IE 590 or MATSE 590 or ME 590</td>
<td>AMD 590</td>
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<tr>
<td><strong>Culminating Experience</strong></td>
<td>Paper</td>
<td>Paper or Thesis</td>
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Current Requirements | Proposed Changes | MEngAMD | MSAMD |
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<td>MSAMD</td>
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<tr>
<td>Culminating Experience</td>
<td>Paper</td>
<td>Paper or Thesis</td>
<td></td>
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</table>
III. Current Bulletin Listing with Tracked Changes

University Bulletin
Graduate Degree Programs

Additive Manufacturing and Design

KAREN A. THOLE, *Head of the Department of Mechanical and Nuclear Engineering*
137 Reber Building
814-865-2519

Degree Conferred:
- **M.S. M.S.** in Additive Manufacturing and Design (resident)
- **M.Eng.** in Additive Manufacturing and Design (online)

**The Graduate Faculty**

The Program
The overall goal of the Master’s of Science in Additive Manufacturing and Design and Master’s of Engineering in Additive Manufacturing and Design are to educate students and working engineers to become technically outstanding experts in additive manufacturing. Specifically, the objectives include:

1. Apply foundational knowledge, critical thinking, problem solving, and creativity in the uses of additive manufacturing and associated design tools and methods.
2. Grow as leaders in manufacturing while maintaining the highest ethical standards in applying additive manufacturing to industry-relevant problems and design challenges.
3. Strive for the advancement of the state-of-art in additive manufacturing and design.
4. Develop innovative solutions through new design paradigms in their respective industries.

**Admission Requirements**
Admission requirements listed here are in addition to requirements stated in the **GENERAL INFORMATION** section of the Graduate Bulletin. Applicants apply for admission to the program via the [Graduate School application for admission](#). The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. Consult the English Proficiency section of the [Graduate Bulletin Application and Admission Procedures page](#) for more information.

To maintain a high quality program, it is important that our students are of a caliber to succeed. As such, the admission requirements for the students enrolling in the MSAMD and MEngAMD degree program will be based on: academic records, GRE scores, applicable work experience, their personal
statement of interests in additive manufacturing design, and three letters of recommendation from a
previous professor or supervisor who can attest to the applicant’s academic potential. Applicants will
be expected to have a Bachelor of Science or four-year Associates degree from an accredited institution
in engineering, 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.

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

- A minimum of 30 credits at the 400, 500, or 800 level is required. For the M.S., at least 18
  credits must be in 500-level courses. For the M.Eng., at least 18 credits must be at the 500 or
  800 level, with a minimum of 6 credits at the 500 level.

- Completion of 5 required courses that total 19 credits with a grade point average of 3.00 or
  higher. The 5 required courses are EDSGN 562 (4 credits), E SC 545 (4 credits), IE 527 (4 credits),
  MatSE 567 (4 credits), and ME 566 (3 credits).

- A minimum of at least 8 credits of electives in 400 and/or 500 level courses. A listing of
  approved courses is maintained by the program, offered with the following designations:
  EDSGN, E SC, IE, MATSE, or ME. Note that AMD 596, EDSGN 596, E SC 596, IE 596, MATSE 596,
  and ME 596 cannot be used to fulfill this requirement.

- Completion of 3 credits in one of the following offerings to complete the culminating project:
  EDSGN 596, E SC 596, IE 596, MATSE 596, or ME 596. MSAMD students will be required to
  complete one (1) credit in each of three (3) semesters while MEngAMD students can complete
  a three (3) credit course in one (1) semester.

- A scholarly paper or thesis must be completed to meet the specific requirement of the
  culminating experience. The thesis paper or thesis will demonstrate depth of knowledge to his/her
  adviser, a second reader, and the Director of the AMD Graduate Program, Associate
  Department Head of Graduate Studies in one of the five aforementioned Departments.

- All students must successfully complete one credit of colloquium preferably in their first two
  semesters in the program. The one-credit colloquium does not count toward the 30 graduate
  course credits in Requirement 1 above. The following courses are offered to meet this
  requirement: AMD 590, EDSGN 590, ESC 514, IE 590, or MATSE 590, and ME 590.

- All students will be required to complete SARI (Scholarship and Research Integrity) training.

The M.S. degree is designed to be completed in 3 semesters, or one calendar year (fall, spring, and
summer). A research adviser will be assigned to students in their first semester. Students who need
more time to complete the final paper will be allowed to complete the paper, and have it reviewed and
approved after the third semester has ended. Students are not required to remain in residence while
they complete the final paper. However, extensions granted to students in this program must comply with the Graduate Council policy on deferred grades.

**CULMINATING EXPERIENCE - MS PAPER and MEng PAPER**

A faculty adviser will be assigned to students in their first semester. Candidates must write a culminating project paper on a topic mutually agreed upon with the adviser. Students will be encouraged to utilize an industry internship (resident students) or current employer (online students) to identify a relevant or practical problem of importance that additive manufacturing and appropriate design methods could address. The quality of the required paper is such that it must be suitable for publication in a professional journal or proceedings at a national or international conference, which generally requires a peer-review process. The M.S. paper option degree is designed to be completed in 3 semesters, or one calendar year (fall, spring, and summer). A research adviser will be assigned to students in their first semester. Students who need more time to complete the final paper will be allowed to complete the paper, and have it reviewed and approved after the third semester has ended. Students are not required to remain in residence while they complete the final paper. However, extensions granted to students in this program must comply with the Graduate Council policy on deferred grades.

An oral presentation is at the discretion of the faculty adviser. Candidates must register for three (3) credits of individual study (AMD 596) to produce the final paper. MSAMD students will be required to complete one (1) credit in each of the three (3) semesters while MEngAMD students can complete a three (3) credit course in one (1) semester.

**CULMINATING EXPERIENCE – MS THESIS**

A research adviser will be assigned to MSAMD students in their first semester. For the thesis option, candidates must write and defend, at an oral examination, a thesis based upon original research in the field. Candidates must submit a thesis following the procedures specified by the Graduate School. Candidates will register for a minimum of six (6) credits of thesis research (AMD 600).

**Student Aid**

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

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section of the World Campus website for more information.

**Courses**

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

#### COURSE SUBMISSION AND CONSULTATION FORM

**Principal Faculty Member(s) Proposing Course**

<table>
<thead>
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<th>Name</th>
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<th>Department</th>
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<td>tws8</td>
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**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:

- [x] in residence
- [ ] off-site
- [ ] 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 | FE | GA | GV | HB | HN | HY | LV | MA | NK | PC | SH | 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**
- **Rejected**
- **Waiting Review**
- **User Action Required**

- **Pending Action(s)**
- **Moved to Rejected Status**
- **Approved**
- **(#) - Review Order Sequence Number**

Head of Department

**Recipient Name:** Karen Ann Thole  
**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:** Karen Ann Thole  
**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:** 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

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

Recipient Name: JOY ROBERTSON  
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
(ME 590):
(AMD 590):
Proposal ID: 6389 created on 3/22/2018 11:19 AM
Graduate Council Subcommittee On New And Revised Programs and Courses

COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

<table>
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<tr>
<th>Name</th>
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<td>TIMOTHY SIMPSON</td>
<td>tws8</td>
<td>Engineering (EN)</td>
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</table>

Academic Home: Engineering (EN)

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

Course Designation

(AMD 596) Individual Studies

Justification of Course Number:

Additive Manufacturing and Design Individual Study course credit for students to complete culminating experience project and paper.

Course Information

Cross-Listed Courses:

Prerequisites:

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Individual Studies

This course will be delivered:

[ ] in residence

[ ] off-site

[ ] online

Bulletin Listing

Minimum Credits: 1

Maximum Credits: 9

Repeatable: YES

Maximum Total Credits: 9

Department with Curricular Responsibility: Mechanical Engineering (UPEN_ME)

Effective Semester: SU1 2018

Travel Component: NO

Campuses That Have Offered () Over The Past 4 Years

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</table>

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:

Creative projects, including non-thesis research, which are supervised on an individual basis and which fall outside the scope of
formal courses.

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:

CIP Code: 149999

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

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

College Administrator Review

Recipient Name: Graduate Studies and Research Program and EFC
Position: College Administrator Review
Department: (Not Available)
Campus: (Not Available)
Title:
Request sent: 3/22/2018 at 7:42 AM
Concur: Yes
Comments: This proposal was reviewed by GS&R and approved at the 3/20/18 EFC meeting
Reviewed On: 3/22/2018 at 7:42 AM

Respond To Comments

Head of Department

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

Request sent: 3/22/2018 at 7:43 AM
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: 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]
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<td>UNIVERSITY PARK CAMPUS</td>
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<td>JOY ROBERTSON</td>
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<td>Final Confirmation</td>
<td>UNIVERSITY PARK CAMPUS</td>
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<td>Title:</td>
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<td>KADI CORTER</td>
<td>(Not Available)</td>
<td>Final Confirmation</td>
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SCRID Numbers

(AMD 596):
Proposal ID: 6373 created on 3/22/2018 11:21 AM
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>
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<th>College</th>
<th>Department</th>
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<tr>
<td>TIMOTHY SIMPSON</td>
<td>tws8</td>
<td>Engineering (EN)</td>
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Academic Home: Engineering (EN)

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

Course Designation

(AMD 600) Thesis Research

Justification of Course Number:
Additive Manufacturing and Design Research Credit

Course Information

Cross-Listed Courses:

Prerequisites:

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Thesis Research

This course will be delivered:

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

Bulletin Listing

Minimum Credits: 1
Maximum Credits: 6
Repeatable: YES
Maximum Total Credits: 6
Department with Curricular Responsibility: Mechanical Engineering (UPEN_ME)
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:

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:

Thesis research.
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

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

College Administrator Review

Recipient Name: Graduate Studies and Research Program and EFC
Department: (Not Available)
Position: College Administrator Review
Campus: (Not Available)
Title:
(1) **Request sent:** 3/22/2018 at 7:40 AM

Concur: Yes
Comments: This proposal was reviewed by GS&R and approved at the 3/20/18 EFC meeting
Reviewed On: 3/22/2018 at 7:40 AM

**Respond To Comments**

---

**Head of Department**

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

---

**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

---

**Dean of the College**

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

---

**Review on Behalf of the Dean of the Graduate School**

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

Title:

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

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

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

### Final Confirmation

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

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

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

**Concur:** [Not Yet Reviewed]  
**Comments:** [Not Yet Reviewed]  
**Reviewed On:** [Not Yet Reviewed]
SCRID Numbers

(AMD 600):
Proposal ID: 6376 created on 3/22/2018 11:20 AM
Appendix D

Consultation summary followed by full consultation documentation.

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<tr>
<th>Name</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>Sven Bilén</td>
<td>Head of SEDTAPP and Professor</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
<tr>
<td>Cathy Holsing</td>
<td>Director, College of Engineering Office for Digital Learning</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
<tr>
<td>Sonya Leitzell</td>
<td>Director of Academic Affairs, Program Planning and Management for World Campus</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
<tr>
<td>Karen Pollack</td>
<td>Assistant Vice Provost for Online Undergraduate and Blended Programs for World Campus</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
<tr>
<td>Susan Sinnott</td>
<td>Department Head Professor, Materials Science and Engineering and Chemistry</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
<tr>
<td>Janis Terpenney</td>
<td>Peter and Angela Dal Pezzo Department Head of IME and Professor</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
<tr>
<td>Karen Thole</td>
<td>Department Head of MNE and Distinguished Professor</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
<tr>
<td>Judith Todd</td>
<td>Department Head of ESM, P.B. Breneman Chair, and Professor of Engineering Science and Mechanics</td>
<td>4/5/18</td>
<td>Favorable</td>
</tr>
</tbody>
</table>
Jaclyn and Tim,

In general, I approve of these. However, I am not sure why we don’t use the AMD 594 for paper research option. I would suggest we also add AMD 596, too, but that does not seem appropriate for the work that leads to the paper or culminating experience.

Sven

Sven G. Bilén, Ph.D., P.E.
Head, School of Engineering Design, Technology, and Professional Programs

From: Jaclyn Stimely
Sent: Monday, April 16, 2018 2:34 PM
To: Janis P. Terpenny <jpt5311@engr.psu.edu>; Judith Todd <JTodd@engr.psu.edu>; kiw1@psu.edu; Sven Bilen <SBilen@engr.psu.edu>; Cathy Holsing <cjh145@engr.psu.edu>; Sonya Leitzell <sns103@psu.edu>
Cc: Timothy Simpson <tws8@engr.psu.edu>
Subject: REMINDER: Request for Consultation: AMD Program Change Proposal

This is a reminder to please review the attached change proposal for the AMD Graduate Program by Thursday, April 19th. Please reply if you are in favor or not of the following proposed changes:

1. Removal of department restriction language for program electives
2. Addition and cross-listing of AMD 590 (colloquium) with ME 590
3. Addition of AMD 596
4. Addition of MS thesis option

Thank you,
Jaclyn

From: Jaclyn Stimely
Sent: Thursday, April 5, 2018 11:45 AM
Subject: Request for Consultation: AMD Program Change Proposal

All,
The AMD Graduate Program is submitting a change proposal. The proposal was submitted to Lori Long, College
Administrator, on March 22, 2018 for review. Lori is requesting that we obtain consultation with all Department Heads, CoE Digital Learning, and World Campus.

Please review the attached proposal and reply to this email by Thursday, April 19, 2018 stating if you are favorable or not of the proposed changes.

Thank you,
Jaclyn

Jaclyn Stimely
Program Coordinator, Additive Manufacturing & Design Graduate Program
The Pennsylvania State University
College of Engineering
314A Leonhard Building
University Park, PA 16802
Phone: 814-863-8069

From: Cathy Holsing
Sent: Friday, April 20, 2018 4:14 PM
To: Jaclyn Stimely
Subject: Re: Please reply: AMD Program Change Proposal

Hi Jaclyn

My apologies if I was holding up the process. I thought I had replied to this earlier. I concur with these changes.

Cathy
All autocorrects sent by my iPhone

On Apr 20, 2018, at 12:54 PM, Jaclyn Stimely <juc52@engr.psu.edu> wrote:
Hi Cathy,
Can you please review the attached change proposal for the AMD Graduate Program and reply if you concur?
Thank you,
Jaclyn

From: Jaclyn Stimely
Sent: Monday, April 16, 2018 2:34 PM
Subject: REMINDER: Request for Consultation: AMD Program Change Proposal

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Jaclyn

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Thank you,
Jaclyn

Jaclyn Stimely
Program Coordinator, Additive Manufacturing & Design Graduate Program
The Pennsylvania State University
College of Engineering
314A Leonhard Building
University Park, PA 16802
Phone: 814-863-8069

From: Sonya Leitzell <sns103@psu.edu>
Sent: Tuesday, April 17, 2018 9:30 AM
To: Jaclyn Stimely
Cc: Karen Pollack
Subject: Re: REMINDER: Request for Consultation: AMD Program Change Proposal

Hi Jaclyn,

The World Campus supports the AMD program change proposal.

Best,
Sonya
On Apr 16, 2018, at 2:34 PM, Jaclyn Stimely <juc52@engr.psu.edu> wrote:

This is a reminder to please review the attached change proposal for the AMD Graduate Program by Thursday, April 19th. Please reply if you are in favor or not of the following proposed changes:

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2. Addition and cross-listing of AMD 590 (colloquium) with ME 590
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4. Addition of MS thesis option

Thank you,
Jaclyn

From: Jaclyn Stimely
Sent: Thursday, April 5, 2018 11:45 AM
Subject: Request for Consultation: AMD Program Change Proposal

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Thank you,
Jaclyn

Jaclyn Stimely
Program Coordinator, Additive Manufacturing & Design Graduate Program
The Pennsylvania State University
College of Engineering
314A Leonhard Building
University Park, PA 16802
Phone: 814-863-8069
Hi Jaclyn,

The World Campus supports the AMD program change proposal.

Best,
Sonya

__________________________
Sonya Leitzell, M.Ed.
Director of Academic Affairs
Program Planning and Management
Penn State World Campus

On Apr 16, 2018, at 2:34 PM, Jaclyn Stimely <juc52@engr.psu.edu> wrote:

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2. Addition and cross-listing of AMD 590 (colloquium) with ME 590
3. Addition of AMD 596
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Thank you,
Jaclyn

From: Jaclyn Stimely
Sent: Thursday, April 5, 2018 11:45 AM
Subject: Request for Consultation: AMD Program Change Proposal

All,

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Please review the attached proposal and reply to this email by Thursday, April 19, 2018 stating if you are favorable or not of the proposed changes.
Dear Jaclyn,
I am fine with the proposed changes.
Susan

Susan B. Sinnott, PhD
Head and Professor, Department of Materials Science & Engineering
Professor, Department of Chemistry
Editor in Chief, *Computational Materials Science*
The Pennsylvania State University

All,
The AMD Graduate Program is submitting a change proposal. The proposal was submitted to Lori Long, College Administrator, on March 22, 2018 for review. Lori is requesting that we obtain consultation with all Department Heads, CoE Digital Learning, and World Campus.

Please review the attached proposal and reply to this email by Thursday, April 19, 2018 stating if you are favorable or not of the proposed changes.

Thank you,
Jaclyn

Jaclyn Stimely
Program Coordinator, Additive Manufacturing & Design Graduate Program
The Pennsylvania State University
Yes, I support the changes. Thanks - Janis

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

Hi Janis,
Can you please review the attached change proposal for the AMD Graduate Program and reply if you concur? Thank you,

Jaclyn

This is a reminder to please review the attached change proposal for the AMD Graduate Program by Thursday, April 19th. Please reply if you are in favor or not of the following proposed changes:

1. Removal of department restriction language for program electives
2. Addition and cross-listing of AMD 590 (colloquium) with ME 590
3. Addition of AMD 596
4. Addition of MS thesis option

Thank you,

Jaclyn
All,
The AMD Graduate Program is submitting a change proposal. The proposal was submitted to Lori Long, College Administrator, on March 22, 2018 for review. Lori is requesting that we obtain consultation with all Department Heads, CoE Digital Learning, and World Campus.

Please review the attached proposal and reply to this email by Thursday, April 19, 2018 stating if you are favorable or not of the proposed changes.

Thank you,
Jaclyn

Jaclyn Stimely
Program Coordinator, Additive Manufacturing & Design Graduate Program
The Pennsylvania State University
College of Engineering
314A Leonhard Building
University Park, PA 16802
Phone: 814-863-8069

From: Karen Thole
Sent: Thursday, April 5, 2018 12:49 PM
To: Jaclyn Stimely
Subject: RE: Request for Consultation: AMD Program Change Proposal

Jaclyn,
Thank you and I approve!
Karen

From: Jaclyn Stimely
Sent: Thursday, April 5, 2018 12:48 PM
To: Karen Thole <kthole@engr.psu.edu>
Subject: RE: Request for Consultation: AMD Program Change Proposal

Karen,
The following items were changed:

1. Removal of department restriction language for program electives
2. Addition and cross-listing of AMD 590 (colloquium) with ME 590
3. Addition of AMD 596
4. Addition of MS thesis option

Please let me know if you have any additional questions.
Thank you,
Jaclyn

From: Karen Thole
Sent: Thursday, April 5, 2018 12:43 PM
To: Jaclyn Stimely <juc52@engr.psu.edu>
Subject: RE: Request for Consultation: AMD Program Change Proposal

Jaclyn,
What was changed? The specifics would be helpful.
Karen

From: Jaclyn Stimely
Sent: Thursday, April 5, 2018 11:45 AM
To: Karen Thole <kthole@engr.psu.edu>; Janis P. Terpenny <jpt5311@engr.psu.edu>; Judith Todd <JTodd@engr.psu.edu>; kiw1@psu.edu; Susan Sinnott <sbs5563@psu.edu>; Sven Bilen <SBilen@engr.psu.edu>; Cathy Holsing <cjh145@engr.psu.edu>
Cc: Timothy Simpson <tws8@engr.psu.edu>
Subject: Request for Consultation: AMD Program Change Proposal

All,
The AMD Graduate Program is submitting a change proposal. The proposal was submitted to Lori Long, College Administrator, on March 22, 2018 for review. Lori is requesting that we obtain consultation with all Department Heads, CoE Digital Learning, and World Campus.

Please review the attached proposal and reply to this email by Thursday, April 19, 2018 stating if you are favorable or not of the proposed changes.

Thank you,
Jaclyn

From: Judith Todd
Sent: Friday, April 20, 2018 1:59 PM
To: Jaclyn Stimely
Subject: RE: Please reply: AMD Program Change Proposal

Jaclyn,

Sorry for the delay, I was traveling. I support the changes.

Judy

Professor Judith A. Todd, Department Head
P. B. Breneman Chair and Professor of Engineering Science and Mechanics
Department of Engineering Science and Mechanics
The Pennsylvania State University
Hi Judy,
Can you please review the attached change proposal for the AMD Graduate Program and reply if you concur? Thank you,
Jaclyn

This is a reminder to please review the attached change proposal for the AMD Graduate Program by Thursday, April 19th. Please reply if you are in favor or not of the following proposed changes:

1. Removal of department restriction language for program electives
2. Addition and cross-listing of AMD 590 (colloquium) with ME 590
3. Addition of AMD 596
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Thank you,
Jaclyn

All,
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Please review the attached proposal and reply to this email by Thursday, April 19, 2018 stating if you are favorable or not of the proposed changes.

Thank you,
Jaclyn
Jaclyn Stimely
Program Coordinator, Additive Manufacturing & Design Graduate Program
The Pennsylvania State University
College of Engineering
314A Leonhard Building
University Park, PA 16802
Phone: 814-863-8069
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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<tr>
<td>Ram Mohan Narayanan</td>
<td>rmn12</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Julio Urbina</td>
<td>jvu1</td>
<td>Engineering (EN)</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Academic Home: Engineering (EN)

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

Course Designation

(EE 578) Introduction to Radar Systems

Justification of Course Number:

TBD

The course will study the fundamental principles of a radar system. The students will be able to acquire key theoretical concepts that will help them develop critical thinking so they can engage in the synthesis of current knowledge of radar systems and able to use that knowledge to develop creative research in producing new radar systems.

Course Information

Cross-Listed Courses:

Prerequisites:

EE 430 ; AND ( EE 432; EE 438; EE 439 ) AND ( EE 453; EE 460 )

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: IRADAR RADAR SYSTEMS

This course will be delivered:

[X] in residence

[ ] off-site

[ ] online

Bulletin Listing

Minimum Credits: 3
Maximum Credits: 3
Repeatable: NO

Department with Curricular Responsibility: Electrical Engineering (UPEN_EE)

Effective Semester: Upon Approval

Travel Component: NO

Campuses That Have Offered () Over The Past 4 Years

Course Outline

A brief outline or overview of the course content:
Radar range equation, radar systems and subsystems, detection in noise, clutter phenomena, pulse compression, radar tracking, synthetic aperture radar, radar polarimetry, target recognition, electronic counter-measure techniques, laser radar.
The course will begin with the theory of radar systems. It will continue with target detection in noise, clutter phenomena, pulse compression, radar tracking, radar signal processing, electronic counter-measure techniques, and laser radar. At the end of an intensive semester, the students will have a clear understanding of how radars work and the radar processing techniques for measuring a variety of targets. They will have an understanding and appreciation of the complexity and construction of radars and how it can detect distant objects and how it can infer physical properties of far away target. They will have an appreciation for what kind of research they could potentially carry out in remote sensing using radars.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
1. General introduction to radar (1 week)
2. Radar system architectures (1.5 weeks)
3. Radar subsystem design techniques (1.5 weeks)
4. Detection and clutter (2 weeks)
5. Advanced radar techniques, e.g., radar polarimetry, radar target models, phased array radar (2 weeks)
6. High resolution radar techniques, e.g., pulse compression and Synthetic Aperture Radar (1.5 weeks)
7. Radar tracking (1.5 weeks)
8. Target recognition and Electronic Counter-Measure techniques (2 weeks)
9. Remote sensing radar and laser radar (1 week)
10. Tests (1 week, 2 in-class exams.)

Course Description:
This course provides a general understanding of radar systems. In particular, it investigates the theory of radar systems and subsystems, and continues with the analysis of the radar equation, target detection in noise, and clutter phenomena. It includes radar techniques to enhance high range resolution of targets such as pulse compression. It also considers radar tracking, synthetic aperture radar, radar polarimetry, target recognition, scattering process, radar signal processing, electronic counter-measure techniques, and laser radar. Building on these concepts, students will understand the usage and applications of various types of radar system designs. Students will understand propagation, multi-path, and clutter phenomena and their effects on radar system performance. Students will recognize, identify, and apply proper radar techniques and apply these techniques to a variety of remote sensing radar applications.

This course fulfills the requirements of Electrical Engineering Graduate Program.

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

- Name: Julio Urbina (jvu1)
  Title:
  Phone:
  Address:
  Campus: UP
  City:
  Fax:

- Name: Ram Mohan Narayanan (rmn12)
  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 objective of this course is to introduce graduate students to the intricacies of various types of radar system architectures and their applications. The course will emphasize practical problems associated with radar system design, and will include a group-oriented radar systems project.

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 educational objectives of the course will be assessed as follows:
• Homework 15%
• Midterm Exam 1 25%
• Midterm Exam 2 25%
• Final Project 35%

The concepts introduced in each lecture will be assessed on a weekly basis with assignments. The course will employ MATLAB in selected assignments. MATLAB will help students to solve and visualize the complex math in this course and to explore applications more in depth. The two midterm exams will measure student’s understanding in radar concepts while the final project measure the overall mastering of the course. The final project is patterned as the response will cover all components of radar.
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 main purpose of the course is to teach the principles of modern radars. The course will provide the foundations of radar theory, which are needed in other courses in the department, such as EE 579 Microwave Radar Remote Sensing and other potential new advanced radar techniques courses.

- This course is designed for M.S and Ph.D. students in Electrical Engineering Graduate Program to prepare them for radar research.
- This course will serve as a prerequisite for EE 579 Microwave Radar Remote Sensing and other potential new advanced radar techniques courses.
- This course builds on content covered in EE 430 and EE 432 or EE 438 or EE 439.

The course is focused on teaching advanced concepts in radar with a view to prepare students for research in academia, industry, and government. The course will be taught using advanced level textbooks augmented by research papers in archival technical journals. The course will most certainly emphasize research preparation.

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 serve as an elective course for students in the MS and PhD Electrical Engineering programs.

This course addresses the needs of increasing numbers of students interested in radar systems. There is also a national and international need for students to know how radar systems as these instruments are use for Homeland Security, Military, etc. It will also serve to create a pipeline of students to support research conducted in this area by many Electrical Engineering Faculty.

A description of any special facilities:
The course requires a computer and projector in the classroom.

Frequency of Offering and Enrollment:
The course will be taught every other year during the spring semester. The expected enrollment is about 20 students.

Curricular Information
Blue Sheet Item #:
Review Date:

**SCRID Numbers**
(EE 578):
Proposal ID: 6193 created on 9/14/2018 3:58 PM

**Review History (not subject to comparison)**
This section represents all consultation history that has occurred on this proposal

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Consultation

Recipient Name: AB Shafaye
Department: Science, Engineering And Technology
Position: Consultation
Campus: PENN STATE HARRISBURG,
The CAPITAL COLLEGE
Title: EE/EET Programs Chair
We have no problems with the proposed course. That said, here are our comments:

- All prerequisite courses listed are electromagnetic based. The subject (radar) has intense systems/signal processing aspects (detection, noise, pulse compression, system architectures, ...) that are also mentioned in the course topic, but are not addressed in the listed prerequisites. Our suggestion is to add EE 460 and EE 453 (or equivalent) to the prerequisite list. Also, in the prerequisite list, do you want students to have either EE 430 or EE 432, or both ("EE430; EE432")? Of course, one way to avoid adding more prerequisites would be to cover the primary prerequisite fundamentals at the beginning of the proposed course.

Initiator Comments: The intent is to allow EE 430 OR EE 432 as a prerequisite. We also added EE 453 OR EE 460 as a 2nd prerequisite requirement.

Initiator Comments: Course proposer just responded with a further clarification regarding prerequisites. The correct prerequisites are: EE 430 AND (EE 432 or EE 438 or EE 439) AND (EE 453 or EE 460).

Initiator Comments: I would highly recommend some actual, hands-on lab experience as part of project rather than just a paper and presentation.
The course contains a design project component in response to an "RFP" from one of our sponsors, so there is a detailed design and analysis of a radar system. If time permits, we could have a hands-on component where the students (in groups) build a rudimentary radar system and test its performance in the field.

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**Request sent:** 5/16/2018 at 8:07 PM  
**Last sent:** 5/28/2018 at 7:30 AM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 5/29/2018 at 2:30 AM

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![Verified]
**Recipient Name:** RAM NARAYANAN  
**Department:** Electrical Engineering  
**Position:** Consultation  
**Campus:** UNIVERSITY PARK CAMPUS  
**Title:** PROFESSOR AND GRADUATE COMMITTEE CHAIR, ELECT ENGR

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**Request sent:** 6/1/2018 at 1:38 PM  
**Concur:** Yes  
**Comments:**  
**Reviewed On:** 6/1/2018 at 1:40 PM

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**Request sent:** 6/1/2018 at 1:45 PM  
**Concur:** Yes  
**Comments:** The EE Department Graduate Committee has approved the course with a vote of 9-0-1.  
Ram Narayanan  
Chair of the EE Department Graduate Committee  
**Reviewed On:** 6/1/2018 at 1:48 PM

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**Recipient Name:** GS&R Committee  
**Department:** (Not Available)  
**Position:** College Administrator Review  
**Campus:** (Not Available)  
**Title:**

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**Request sent:** 9/7/2018 at 10:00 AM  
**Concur:** Yes  
**Comments:** At the request of the GS&R committee, the following feedback is being presented to the proposer for optional input before the proposal moves forward to EFC, if you will be providing a response, please address by 9/12/18: There is some possibility that the way the final project is described, as defending a design in the professional workforce, will lead the GCJCC to question whether this should be an 800-level course, focused on application in professional practice, rather than on preparation for research.  
**Reviewed On:** 9/7/2018 at 10:00 AM

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![Verified]
**Recipient Name:** Ram Narayanan  
**Department:** (Not Available)  
**Position:** College Administrator Review  
**Campus:** (Not Available)  
**Title:**

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**Request sent:** 9/14/2018 at 2:59 PM  
**Concur:** Yes
The course IS focused on teaching advanced concepts in radar with a view to prepare students for research in academia, industry, and government. The course will be taught using advanced level textbooks augmented by research papers in archival technical journals. Therefore, let there be no doubt that the course will emphasize research preparation.

Since a full understanding of radar requires a system level appreciation of how all components come together, there is indeed research preparation in working on a group project which covers all aspects. However, the course is NOT designed to focus on professional practice. If any professional practice component comes through, it is simply a by-product.

If the committee wishes, we can replace the words:

“The final project is patterned as the response to a mock Request For Proposal (RFP). Students have to write a professional report, make a professional suit-and-tie presentation, and defend their designs. This will provide students with real world experience before entering the workforce.”

with the words"The final project will cover all components of radar system to achieve an assigned goal. Students have to write a report, make a presentation, and defend their designs.”

Reviewed On: 9/14/2018 at 2:59 PM

Response to proposer from GS&R Committee:
The substitution language is optional. What I DO suggest is that the first paragraph of the response be put into the proposal in the section "Relationship/Linkage of Course to Other Courses" as it "provides a rationale for the level of instruction." (But without the capitalization of IS.)

If you elect to make this change, please do so ASAP, and before the proposal is advanced for required signatories.

Reviewed On: 9/14/2018 at 3:03 PM
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