Memo

To: Randy Smith, Vice Provost for Academic Programs, Office of Academic Affairs

From: Rosie Quinzon-Bonello, Assistant Dean for Curriculum and Assessment

Date: February 26, 2019

Re: Program Change Proposal: Bachelor of Science in Electrical and Computer Engineering (BSECE)

Attached is a curriculum change proposal submitted by the Department of Electrical and Computer Engineering.

The College of Engineering Committee of Academic Affairs unanimously approved the proposal on February 15, 2019. If you have additional questions or require additional information, please feel free to contact me.

Yours sincerely,

Rosie Quinzon-Bonello
Dear Vice Provost Smith:

The faculty of the Department of Electrical and Computer Engineering have proposed to change the ECE core courses required for the Bachelor of Science in Electrical and Computer Engineering degree programs (Electrical Engineering program of study and Computer Engineering program of study), effective for students starting at The Ohio State University in Autumn of 2019. In brief, we would eliminate our 1-credit Engineering Ethics and Professionalism course, ECE 3080, and instead require ECE students to choose PHILOS 1332 as the course that will also satisfy the College of Engineering’s ethics requirement. We also take this opportunity to reduce the minimum hours of math and basic science requirement by 2 credit hours, from 32 to 30, to align with recent changes in ABET requirements. The number of credits to degree remains the same, at 128. This second change affects only transfer students.

The proposal, the current and proposed curriculum sheets, and a letter from the chair of The Department of Philosophy is included, showing that they agree to the change.

The ECE faculty approved the proposed changes by a vote of 32 in favor and 0 opposed in an email vote.

We are requesting approval of the proposed changes by the Council on Academic Affairs.

Sincerely,

Hesham El Gamal
Department Chair
Electrical and Computer Engineering

cc: B.L. Anderson, Associate Chair
    G.J. Valco, Undergraduate Studies Committee Chair
Program change proposal: Bachelor of Science in Electrical and Computer Engineering (BSECE)
November 13, 2018

Executive Summary
This program change request has two parts:

1. We propose to eliminate our current requirement for ECE 3080 Ethics and Professionalism (1 credit hour), and instead require all ECE students to take PHILOS 1332 Ethics in the Professions: Introduction to Engineering Ethics as the general education course that also satisfies the College of Engineering’s ethics general education requirement. The change is proposed for both the Electrical Engineering Program of Study (EES) and Computer Engineering Program of Study (CES).
2. We propose to reduce the minimum college-level Math and Basic Sciences requirement by 2 credit hours.

Contact:
Betty Lise Anderson, Associate Chair, Electrical and Computer Engineering
Anderson.67@osu.edu

1. Ethics requirement
Motivation/Rationale
The Department of Electrical and Computer Engineers strongly believes that all students should study ethics and professionalism. For many years we have offered and required ECE 3080, a one-credit course, on these subjects. Our students, however, like all other engineering students, must take a certain number of General Education (GE) courses, one of which must fulfil an ethics requirement. Some, but not all, of our students take PHILOS 1332 (3 credits) to satisfy this requirement. There is some overlap between PHILOS 1332 and ECE 3080. By requiring all of our students to “choose” PHILOS 1332 as the GE course that satisfies their ethics requirement, we can eliminate that overlap and still ensure all of our students see this material. If this program change is approved, they will actually all see it in more depth.

The Department of Philosophy had agreed to open more sections of PHILOS 1332 to accommodate our students. Further, PHILOS 1332 is offered every semester including summers, whereas we have only able to offer ECE 3080 once a year. Thus, a second benefit of this proposed change is much more scheduling flexibility for our students.

Effective Date
This change will be effective for ECE students who start at OSU Autumn 2019.
Reassignment of Credit Hours
The proposed change results in 1 fewer required credit hour. We propose to keep the number of credit hours to degree the same (128 credit hours), and allow 1 additional credit hour in the “Directed Electives” category. Directed Electives generally include: courses required for entry into other engineering majors; required and technical elective courses in other engineering majors; pre-med courses; business or entrepreneurship courses; math, statistics, physics and chemistry courses at higher level than required in the ECE core; and other physical science or biological science courses.
   For EES students, the number of Directed Electives increases from 12 to 13
   For CES students, the number of Directed Electives increases from 8 to 9

Transition Plan
For ECE students who have started at OSU before Autumn 2019:
   • If they have taken PHILOS 1332, we will waive the requirement for 3080. These students must still meet the requirement of 128 credit hours for the degree, but may use any college credit course numbered 1100 or higher for that credit hour.
   • For students who have already completed their Engineering GE ethics requirement but did not elect PHILOS 1332, there are three choices:
      o We will offer ECE 3080 in both Autumn 2018 and Spring 2019. Students will be advised to take 3080 while it is still available
      o Students can take PHILOS 1332 in addition to their previous GE ethics course, and get 3080 waived
      o The Department of Philosophy will offer a 1-credit version of PHILOS 1332 in autumn 2019 and autumn 2020 for students caught in the transition.

For students who transfer into ECE or ECE-PRE
   • If a student takes PHILOS 1337 or 1338, or NAVALSC 4210 then that course may be substituted for PHILOS 1332 by petition.
   • If a student takes any of the College of Engineering ethics GE courses other than PHILOS 1332, 1337 or 1338, or NAVALSC 4210 prior to transferring into ECE-PRE or ECENG-BS then the student must still take PHILOS 1332.
      o If PHILOS 1332 and the other ethics course already taken by the student double-count in the same GE category (e.g. Culture and Ideas) then the student may petition for PHILOS 1332 to count for Directed Elective credit.
      o If the student has already taken another course that completes the same GE requirement that PHILOS 1332 double-counts in (e.g. Culture and Ideas) then the student may petition for PHILOS 1332 to count for Directed Elective credit.
      o These remedies are only available if the student took that other course before transferring into ECE-PRE or ECENG-BS and before taking PHILOS 1332.

2. Reduce Math and Basic Sciences Requirement by 2 credit hours
ABET, Inc. is the accrediting body for the undergraduate programs offered by the ECE department. Up until now ABET has required that engineering students have one year of college level math and basic science appropriate to the discipline. That amounts to 32 credit
hours for the current 128 credit hour ECE programs. The core requirements satisfy this for both programs of study. However it sometimes happens, most often with transfer students, that a student will have credit for all required math or basic science courses but be short on total hours of math and basic science. In such cases the student has been required to take additional math or basic science courses to meet the 32 credit hour minimum.

While the previous ABET Math and Basic Sciences requirement amounted to 32 credit-hours for our programs, it could be fewer credit hours for programs with fewer hours to degree. Effective with the 2019-2020 accreditation review cycle ABET has standardized the Math and Basic Sciences requirement at a minimum of 30 credit hours for all programs.

We therefore propose that for all ECE students graduating autumn 2019 or later the minimum math and basic science requirement be 30 credit hours. The core requirements are not changing, thus in effect this change means that fewer transfer students will be required to take additional math or basic science courses to meet the new 30 credit hour minimum.

**Attachments**
Attachment 1: Current BSECE Advising Sheet, Electrical Engineering Program of Study
Attachment 2: Proposed BSECE Advising Sheet, Electrical Engineering Program of Study
Attachment 3: Current BSECE Advising Sheet, Computer Engineering Program of Study
Attachment 4: Proposed BSECE Advising Sheet, Computer Engineering Program of Study
## Suggested Curriculum

This should be used as a **guide** only. Semester offerings are subject to change.

<table>
<thead>
<tr>
<th>Year</th>
<th>Autumn</th>
<th>Spring</th>
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<tbody>
<tr>
<td>1</td>
<td>ENGR 1100 (Engineering Survey) 1 hr</td>
<td>ENGR 1182 (Fundamentals of Engr 2) 2 hr</td>
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<td>ENGR 1181 (Fundamentals of Engr 1) 2 hr</td>
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<td>PHYSICS 1250 (Mechanics, Thermal, Waves) 5 hr</td>
<td>CSE 1222 (Intro Prog in C/C++) 3 hr</td>
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<td>General Education 3 hr</td>
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<td>MATH 2568 (Linear Algebra) 3 hr</td>
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<td>General Education 3 hr</td>
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<td>ECE 3027 (Electronics Laboratory) 1 hr</td>
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<td>ECE 3030 (Semiconductor Elec Devices) 3 hr</td>
<td>ECE 3040 (Sustainable Energy &amp; Power Sys I) 3 hr</td>
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<td>General Education 3 hr</td>
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<td>General Education 3 hr</td>
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<td>ISE 2040 (Engineering Economics) 2 hr</td>
<td>ECE 4900 (Capstone Design II) 3 hr</td>
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<td>Technical or Directed Electives 12 hr</td>
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</table>

**Total Hours to complete the degree program = 128**

ECE 3010, 3020, 3030, 3040, and 3050 may be swapped between semesters in year three to facilitate taking later technical electives in the student’s domains of interest, as prerequisites permit.
Technical and Directed Electives (28 hours)

At least 16 hours of the Electives must be ECE Technical Electives.

- Must take a concentration of 6 hours in one of the domains below.
- Must take at least 3 hours in each of two other domains below.
- Must include at least one 5000 level ECE Technical Elective.
- At least one ECE Technical Elective course must be a lab. (Courses with a lab component are underlined in the domain lists.)

**Communication and Signal Processing Domain:** ECE 4194.02, 5000, 5007, 5101, 5200, 5206, 5207, 5400

**Computer and Digital Systems Domain:** ECE 3561, 3567, 5194.08, 5362, 5460, 5462, 5463, 5465

**Control Systems Domain:** ECE 3551, 3557, 5194.11, 5550, 5551, 5553, 5554, 5557, 5759

**RF and Analog Electronic Circuits Domain:** ECE 4021, 5020, 5021, 5022, 5027, 5120, 5194.12, 5227

**Electromagnetics, Microwaves and Electro-optics Domain:** ECE 5010, 5011, 5012, 5013, 5017, 5510

**Sustainable Energy and Power Systems Domain:** ECE 3047, 5025, 5041, 5042, 5043, 5047, 5127

**Solid State Electronics and Photonics Domain:** ECE 5031, 5033, 5037, 5131, 5132, 5194.07, 5194.09, 5194.10, 5194.14, 5237, 5530, 5832, 5833

Up to 12 hours of the Electives may be Directed Electives from the ECE approved list. Directed Electives generally include: courses required for entry into other engineering majors; required and technical elective courses in other engineering majors; pre-med courses; business or entrepreneurship courses; math, statistics, physics and chemistry courses at higher level than required in the ECE core; and other physical science or biological science courses. For physical science or biological science courses a maximum of 7 hours numbered below 2000 may be counted as Directed Electives. ([ece.osu.edu/currentstudents/undergrad/forms](http://ece.osu.edu/currentstudents/undergrad/forms))

General Education Requirement

**Writing and Communication**

- English 1110.xx  3 hr
- Second Writing Course  3 hr

**Social Science**

*Must choose each course from a distinct subgroup of this category.*

- 3 hr
- 3 hr

**Literature**

- 3 hr

**Visual and Performing Arts**

- 3 hr

**Historical Study**

- 3 hr

**Second Historical Study or Cultures and Ideas**

- 3 hr

**Social Diversity in the U.S. or Global Diversity**

*Some courses may overlap with another GE category. See course list.*

- 0 / 3 hr

**Ethics**

*Some courses may overlap with another GE category. See course list.*

- 0 / 3 hr

Optional: Foreign Language

**Foreign Language 1103 Course:** credit (including EM) for a foreign language sequence through 1103, or credit for a foreign language course with a prerequisite of 1103, can be used to satisfy the Cultures & Ideas Gen Ed category.

**Foreign Language Minor Courses:** completion of a foreign language minor permits a student to overlap up to 6 credit hours between the Gen Ed and minor. A curricular petition must be submitted to the student’s program, which will forward it to the college for review. The courses must meet the spirit of the Gen Ed category for which overlap is requested.

See the list of approved general education courses for additional details: ([www.advising.engineering.osu.edu](http://www.advising.engineering.osu.edu))
B.S. Electrical & Computer Engineering  
2019-2020 Academic Year 
Electrical Engineering

Student Information 
Name: ___________________________ OSU Email: ___________________________

Suggested Curriculum 
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**Total Hours to complete the degree program = 128**

ECE 3010, 3020, 3030, 3040, and 3050 may be swapped between semesters in year three to facilitate taking later technical electives in the student’s domains of interest, as prerequisites permit.
Technical and Directed Electives (29 hours)
At least 16 hours of the Electives must be ECE Technical Electives.
- Must take a concentration of 6 hours in one of the domains below.
- Must take at least 3 hours in each of two other domains below.
- Must include at least one 5000 level ECE Technical Elective.
- At least one ECE Technical Elective course must be a lab. (Courses with a lab component are underlined in the domain lists.)

Communication and Signal Processing Domain:  ECE 4194.02, 5000, 5007, 5101, 5200, 5206, 5207, 5400
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General Education Requirement

Writing and Communication
- English 1110.xx 3 hr
- Second Writing Course 3 hr

Social Science
Must choose each course from a distinct subgroup of this category.
- 3 hr
- 3 hr

Literature
- 3 hr

Visual and Performing Arts
- 3 hr

Historical Study
- 3 hr

Cultures and Ideas
- PHILOS 1332 3 hr

Social Diversity in the U.S. or Global Diversity
Some courses may overlap with another GE category. See course list.
- 0 / 3 hr

Ethics
Double counts with
- Culture and Ideas PHILOS 1332 0 hr

Optional: Foreign Language

Foreign Language 1103 Course: credit (including EM) for a foreign language sequence through 1103, or credit for a foreign language course with a prerequisite of 1103, can be used to satisfy the Cultures & Ideas Gen Ed category.

Foreign Language Minor Courses: completion of a foreign language minor permits a student to overlap up to 6 credit hours between the Gen Ed and minor. A curricular petition must be submitted to the student’s program, which will forward it to the college for review. The courses must meet the spirit of the Gen Ed category for which overlap is requested.

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<td>CSE 2221 (Software 1: Components)</td>
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<td>ECE 3020 (Intro to Electronics)</td>
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<td>ECE 3567 (Microcontroller Lab)</td>
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<td></td>
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**Total Hours to complete the degree program = 128**
Technical and Directed Electives (17 hours)

- At least 9 hours of the Technical Electives must be ECE or CSE courses from these lists:
  - ECE 3050, 4021, 5551, 5020, 5101, 5194.08, 5200, 5206, 5460, 5462, 5463, 5465, 5554
  - CSE 3241, 3461, 5242, 5361, 5441
  - One of ECE 4194.02 or CSE 5523

- Must include at least one 5000 level ECE or CSE Technical Elective.

- Up to 8 hours of the Electives may be Directed Electives from the ECE approved list. Directed Electives generally include: courses required for entry into other engineering majors; required and technical elective courses in other engineering majors; pre-med courses; business or entrepreneurship courses; math, statistics, physics and chemistry courses at higher level than required in the ECE core; and other physical science or biological science courses. For physical science or biological science courses a maximum of 7 hours numbered below 2000 may be counted as Directed Electives. (ece.osu.edu/currentstudents/undergrad/forms)

General Education Requirement

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<tr>
<td>Second Writing Course</td>
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Social Science

Must choose each course from a distinct subgroup of this category.

- 3 hr

Literature

- 3 hr

Visual and Performing Arts

- 3 hr

Historical Study

- 3 hr

Second Historical Study or Cultures and Ideas

- 3 hr

Social Diversity in the U.S. or Global Diversity

Some courses may overlap with another GE category. See course list.

- 0 / 3 hr

Ethics

Some courses may overlap with another GE category. See course list.

- 0 / 3 hr

Optional: Foreign Language

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Suggested Curriculum

This should be used as a guide only. Semester offerings are subject to change.

<table>
<thead>
<tr>
<th>Year</th>
<th>Autumn</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>__ ENGR 1100 (Engineering Survey) .................. 1 hr</td>
<td>__ ENGR 1182 (Fundamentals of Engr 2) ............ 2 hr</td>
</tr>
<tr>
<td></td>
<td>__ ENGR 1181 (Fundamentals of Engr I) .............. 2 hr</td>
<td>__ Math 1172 (Engineering Math A) ................. 5 hr</td>
</tr>
<tr>
<td></td>
<td>__ MATH 1151 (Calculus I) .......................... 5 hr</td>
<td>__ CHEM 1250 (Chemistry for Engineers) ............ 4 hr</td>
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<tr>
<td></td>
<td>__ PHYSICS 1250 (Mechanics, Thermal, Waves) ...... 5 hr</td>
<td>__ CSE 1222 (Intro Prog in C/C++) .................. 3 hr</td>
</tr>
<tr>
<td></td>
<td>__ General Education .................................... 3 hr</td>
<td>__ General Education ................................... 3 hr</td>
</tr>
<tr>
<td>2</td>
<td>__ PHYSICS 1251 (E&amp;M, Optics, Modern Phys) ....... 5 hr</td>
<td>__ CSE 2321 (Foundations 1: Discrete Structures) ... 3 hr</td>
</tr>
<tr>
<td></td>
<td>__ MATH 2568 (Linear Algebra) ....................... 3 hr</td>
<td>__ ECE 2050 (Intro Discrete Time Sig &amp; Sysms) .... 3 hr</td>
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<tr>
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<td>__ ECE 2060 (Intro Digital Logic) .................... 3 hr</td>
<td>__ ECE 2020 (Intro Analog Systems &amp; Circuits) .... 3 hr</td>
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<tr>
<td></td>
<td>__ CSE 2221 (Software 1: Components) ............... 4 hr</td>
<td>__ ECE 2560 (Intro Microcontroller-Based Systems) .. 2 hr</td>
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<tr>
<td></td>
<td>__ General Education .................................... 3 hr</td>
<td>__ CSE 2231 (Software 2: Development &amp; Design) .... 4 hr</td>
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<tr>
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<td></td>
<td>__ CSE 2451 (Advanced C Programming) .............. 2 hr</td>
</tr>
<tr>
<td>3</td>
<td>__ ECE 3020 (Intro to Electronics) .................. 3 hr</td>
<td>__ STAT 3470 (Prob &amp; Stats for Engineers) .......... 3 hr</td>
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<tr>
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<td>__ ECE 3561 (Advanced Digital Design) ............... 3 hr</td>
<td>__ ECE 3027 (Electronics Laboratory) ............... 1 hr</td>
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<td>__ ECE 3567 (Microcontroller Lab) .................... 1 hr</td>
<td>__ ECE 5362 (Computer Architecture &amp; Design) ....... 3 hr</td>
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<tr>
<td></td>
<td>__ Math 2415 (Ord &amp; Part Diff Eqns) ............... 3 hr</td>
<td>__ CSE 2431 (Sys2: Intro Operating Systems) ........ 3 hr</td>
</tr>
<tr>
<td></td>
<td>__ PHILOS 1332 .......................................... 3 hr</td>
<td>__ General Education ................................... 3 hr</td>
</tr>
<tr>
<td></td>
<td>__ General Education .................................... 3 hr</td>
<td>__ Technical or Directed Elective .................... 3 hr</td>
</tr>
<tr>
<td>4</td>
<td>__ ISE 2040 (Engineering Economics) ................ 2 hr</td>
<td>__ ECE 4900 (Capstone Design II) .................... 3 hr</td>
</tr>
<tr>
<td></td>
<td>__ ECE 3090 (Technical Writing &amp; Presentations) .. 1 hr</td>
<td>__ General Education ................................... 3 hr</td>
</tr>
<tr>
<td></td>
<td>__ ECE 3900 (Capstone Design I) ................. 1 hr</td>
<td>__ General Education ................................... 3 hr</td>
</tr>
<tr>
<td></td>
<td>__ General Education .................................... 3 hr</td>
<td>__ Technical or Directed Electives .................. 6 hr</td>
</tr>
<tr>
<td></td>
<td>__ Technical or Directed Electives .................. 9 hr</td>
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</tbody>
</table>

Total Hours to complete the degree program = 128
Technical and Directed Electives (18 hours)

- At least 9 hours of the Technical Electives must be ECE or CSE courses from these lists:
  - ECE 3050, 4021, 3551, 5020, 5101, 5194.08, 5200, 5206, 5460, 5462, 5463, 5465, 5554
  - CSE 3241, 3461, 5242, 5361, 5441
  - One of ECE 4194.02 or CSE 5523

- Must include at least one 5000 level ECE or CSE Technical Elective.

- Up to 9 hours of the Electives may be Directed Electives from the ECE approved list. Directed Electives generally include: courses required for entry into other engineering majors; required and technical elective courses in other engineering majors; pre-med courses; business or entrepreneurship courses; math, statistics, physics and chemistry courses at higher level than required in the ECE core; and other physical science or biological science courses. For physical science or biological science courses a maximum of 7 hours numbered below 2000 may be counted as Directed Electives. ([ece.osu.edu/currentstudents/undergrad/forms](http://ece.osu.edu/currentstudents/undergrad/forms))

General Education Requirement

**Writing and Communication**

- **English 1110.xx** 3 hr
- **Second Writing Course** 3 hr

**Social Science**

*Must choose each course from a distinct subgroup of this category.*

- 3 hr
- 3 hr

**Literature**

- 3 hr

**Visual and Performing Arts**

- 3 hr

**Historical Study**

- 3 hr

**Cultures and Ideas**

- PHILOS 1332 3 hr

**Social Diversity in the U.S. or Global Diversity**

*Some courses may overlap with another GE category. See course list.*

- 0 / 3 hr

**Ethics**

*Double counts with Culture and Ideas PHILOS 13320 hr*

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November 26, 2018

Betty Lise Anderson Professor, Associate Chair
Electrical and Computer Engineering
205 Dreese Laboratory | 2015 Neil Avenue Columbus, OH 43210

Dear Professor Anderson,

I write to confirm that the Department of Philosophy will be increasing the number of sections we offer of Philosophy 1332 (Ethics in the Professions: Introduction to Engineering Ethics) in order to accommodate your students. We will also create a 1-credit graduate version of this course, to be offered once a year starting in Spring 2020. We will (subject to approval by our Dean) also twice offer a one-credit version of the course for your undergraduate students during the transition between the requirements, in Spring 2020 and Spring 2021.

Sincerely,

Lisa Downing
Professor and Chair