



Memo

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

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

Date: October 14, 2024

Re: Electrical and Computer Engineering-Computer Engineering Program of Study Curriculum Change Request

On October 10, 2024, the College of Engineering Committee on Academic Affairs unanimously approved a program change proposal submitted by the Department of Electrical and Computer Engineering - Computer Engineering Program of Study to:

- remove Chemistry 1250 (4) *General Chemistry for Engineers* as a requirement
- remove from the prerequisite course list and move to the technical elective (TE) list:
 - CSE 2451 *Advanced Programming in C* (2)
 - CSE 2431 *Systems II: Intro to Operating Systems* (3)
- increase the major TE requirements from nine to twelve credit hours
- revise “course categories” for TEs and replace with “domains”
- implement the requirement to complete at least two courses from one domain
- increase the directed elective requirement from seven to thirteen credit hours

The overall number of credit hours remains the same.

Attached is the proposal.

Yours sincerely,

Rosie Quinzon-Bonello

Program change proposal: Bachelor of Science in Electrical and Computer Engineering (BSECE), Computer Engineering Program of Study (CES)

May 3, 2024

Executive Summary

We propose to increase flexibility and shorten prerequisite chains for the Computer Engineering Program of Study. Key changes include removing chemistry as a requirement, changing two core courses from “required” to “elective,” and creating a set of domains from which students select electives, with the requirement that they take at least two courses in one domain for depth. The total number of hours to degree remains the same. The total number of required courses is reduced by 9 credit hours, and the number of engineering elective hours is increased by 9 credit hours.

Contact:

Betty Lise Anderson, Associate Chair, Electrical and Computer Engineering
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Motivation/Rationale

The Department of Electrical and Computer Engineering (ECE) underwent an external review in 2019, in which it was noted that our computer engineering program had very long prerequisite chains, and recommended we work to shorten them.

ECE has two programs of study, Electrical Engineering (EES) and Computer Engineering (CES). The EES program has significantly more flexibility, because of the breadth of electrical engineering, with eight broad domains, one of which is computer. The EES students have a “depth” requirement and a “breadth” requirement. The CES program has historically been much more constrained, the argument having been that by selecting the computer option, students had, in effect, already selected their “depth” domain, so they needed less freedom. This reasoning also led to the unintended consequence that there were some topics in ECE that computer students could not take at all for credit, such as electromagnetics, semiconductor physics, and power. Yet all are relevant: computers rely on integrated circuits, communicate over WiFi and fiber optics, and must minimize their power consumption.

The field of Computer Engineering has expanded quite a bit, so that now its breadth is comparable to that of Electrical Engineering. Thus the department felt that the curriculum choices available to students should reflect that. The desire is to make the Computer Engineering program much more flexible, to parallel the electrical program.

It may be beneficial here to compare the current EES and CES programs. Both consist of a group of “correlate courses,” which includes things like math, physics, chemistry, statistics, engineering economics, programming, and fundamentals of engineering, followed by groups

of major courses, technical electives, and the general education requirements. In ECE, we have a minimum number of technical electives (in ECE, and some in Computer Science and Engineering), plus the option to take courses from a list of Directed Electives. This is a list of courses, selected by ECE, that are in other departments and may be of use to our graduates, such as other courses in other fields of engineering, hard sciences, additional math, courses in business and law, and others.

Table 1 shows a broad overview of these requirements for the two programs. It shows clearly that CES students have much less flexibility in selecting electives and exploring other fields.

Table 1. A broad overview of requirements for EES and CES.

Electrical Engineering		Computer Engineering	
Correlate courses	43 hrs	Correlate courses	43 hrs
Major Core Courses	34 hrs	Major Core Courses	45 hrs
Engineering Electives	27 hrs	Engineering Electives	16 hrs
Major electives	≥16 hrs	Major electives	≥9 hrs
Directed Electives	≤11 hrs	Directed Electives	≤7 hrs
General Education	Same for both	General Education	Same for both

Proposal

The first change is to remove chemistry as a requirement (it is still allowed as a Directed Elective). This reduces the number of “correlate hours” from 43 to 39, Table 2. Electrical engineering students need chemistry because they will study semiconductor devices; computer engineers are not required to take semiconductors, so have no need for chemistry unless they want it.

It should be noted that our accrediting body, ABET, requires a minimum number of Math and Basic Sciences; the proposed curriculum still meets that minimum.

Table 2. Proposed removal of chemistry from required courses.

OLD CES		NEW CES	
Correlate Courses		Correlate Courses	
Engr 1100.15	Introduction to Ohio State and Electrical and Computer Engineer	Engr 1100.15	Introduction to Ohio State and Electrical and Computer Engineer
Engr 1181	Fundamentals of Engineering I	Engr 1181	Fundamentals of Engineering I
Engr 1182	Fundamentals of Engineering II	Engr 1182	Fundamentals of Engineering II
Math 1151	Calculus I	Math 1151	Calculus I
Math 1172	Engineering Mathematics A	Math 1172	Engineering Mathematics A
Physics 1250	Mechanics, Thermal Physics, Waves	Physics 1250	Mechanics, Thermal Physics, Waves
Physics 1251	Electricity and Magnetism, Optics, Modern Physics	Physics 1251	Electricity and Magnetism, Optics, Modern Physics
Chem 1250	General Chemistry for Engineers (will accept Chem 1210)	CSE 1222	Introduction to Computer Programming in C++ for Engineers an
CSE 1222	Introduction to Computer Programming in C++ for Engineers and	Math 2568	Linear Algebra (will accept Math 2173 & 2174)
Math 2568	Linear Algebra	Math 2415	Ordinary and Partial Differential Equations (will accept Math 217
Math 2415	Ordinary and Partial Differential Equations	Stat 3470	Introduction to Probability and Statistics for Engineers
Stat 3470	Introduction to Probability and Statistics for Engineers	ISE 2040	Engineering Economics
ISE 2040	Engineering Economics	Total	39
Total	43		

The second change is to reduce a long prerequisite chain of Computer Science and Engineering courses from six courses deep to four courses deep. Not shown in Table 3 is CSE 1222, which is a prerequisite for the entire CSE chain but is counted in the correlate courses group. This change

reduces the required courses for CES students by an additional 5 credit hours. The removed courses are still allowed as electives.

Table 3. Reduction of prerequisite chain by two courses. The two courses are still allowed as electives.

OLD CES		NEW CES	
Major Core Courses		Major Core Courses	
ECE 2060	Introduction to Digital Logic	ECE 2060	Introduction to Digital Logic
ECE 2020	Introduction to Analog Systems and Circuits	ECE 2020	Introduction to Analog Systems and Circuits
ECE 2050	Introduction to Discrete Time Signals & Systems	ECE 2050	Introduction to Discrete Time Signals & Systems
ECE 2560	Introduction to Microcontroller-Based Systems	ECE 2560	Introduction to Microcontroller-Based Systems
ECE 3020	Introduction to Electronics	ECE 3020	Introduction to Electronics
ECE 3027	Electronics laboratory	ECE 3027	Electronics laboratory
ECE 3561	Advanced Digital Design	ECE 3561	Advanced Digital Design
ECE 3567	Microcontroller Lab	ECE 3567	Microcontroller Lab
ECE 5362	Computer Architecture and Design	ECE 5362	Computer Architecture and Design
ECE 3906	Capstone Design I	ECE 3906	Capstone Design I
ECE 4905	Capstone Design II	ECE 4905	Capstone Design II
CSE 2221	Software I: Software Components	CSE 2221	Software I: Software Components
CSE 2321	Foundations I: Discrete Structures	CSE 2321	Foundations I: Discrete Structures
CSE 2231	Software II: Software Development and Design	CSE 2231	Software II: Software Development and Design
CSE 2451	Advanced C Programming		
CSE 2431	Systems II: Introduction to Operating Systems		
Total	45	Total	40

A comment is needed here, however. The prerequisite chain to get to the final course CSE 2431 in the current curriculum is actually one course longer for Computer Science and Engineering (CSE) students than for Computer Engineering (ECE) students. During the change from quarters to semesters, CSE created a special course for ECE students, CSE 2451 Advanced C Programming, which was meant to prepare them for CSE 2431 Systems II: Operating Systems so they could avoid that extra course. If this proposal is approved, there will be no need for CSE 2451 to exist, making it harder for ECE students to get to the operating systems course. In discussions, with CSE, however, they noted that there is another operating systems course CSE 3430 Overview of Computer Systems for Non-Majors, which covers topics in operating systems and advanced C programming. It so happens that the prerequisites for CSE 3430 happen to be in the required list in our new proposal, making it possible for our Computer Engineering students to get to Operating Systems easily if they choose. They could also choose, with the proposed increase in elective hours, to take the entire CSE sequence if they are interested in heavy-duty operating systems.

The last change is the creation of “domains” of electives for computer engineering students. The proposal here is to require at least two courses for CES students in one domain (for depth), but they are free to select electives from the other domain at will. Further, one of the domains is called “Additional breadth courses,” which includes any other electrical engineering courses that the computer engineering students couldn’t count before (except two service courses for other departments). Note students are not allowed to select “additional breadth” as their “depth” domain. An example would be a student who is interested in computer hardware, down to the chips, could take the introductory semiconductor course, and use that to support other courses in

integrated circuit technology, and even opt for the undergraduate certificate in Semiconductor Devices, which they cannot currently access easily.

Previously, computer engineering students were provided a list of course categories, as suggestions, for example, “If you are interested in robotics, consider these courses.” There was no requirement to pick any particular distribution across the categories.

The proposal was approved by the ECE faculty on March 8, 2024. The faculty was presented with the following choices:

The proposal as described here (76% found acceptable)

The proposal as described here with the difference that CSE 3430 Overview of Computer Systems for Non-Majors would also be required (88% found acceptable)

One is preferred over the other (47% found proposal as described here preferable, 29% preferred the proposal that required CSE 3430)

Neither is acceptable (6%)

Also 18% found both proposals acceptable but didn't have a preference

Credit Hours

There is no net change in credit hours.

Effective Date

Autumn 2025 (see Transition Plan, next).

Transition Plan

For students already in the Computer Engineering Program of Study, we propose that students be given a choice of whether to satisfy the old program requirements or the new ones. Note that any student satisfying the old requirements automatically satisfies the new ones.

Attachments

Current BSECE Advising Sheet, Computer Engineering Program of Study

Proposed new BSECE Advising Sheet, Computer Engineering Program of Study

Program of Study: Computer Engineering 2023-2024

General Education		
For detailed GE curriculum requirements and course lists click here .		
*Philosophy 1332 is required of all ECE students. This course will fit into the "Historical and Cultural Studies" category		
The most efficient path to complete the GE theme requirement is to take two 4-hour courses		

Correlate Courses		Hours
Engr 1100.15	Introduction to Ohio State and Electrical and Computer Engineering	1
Engr 1181	Fundamentals of Engineering I	2
Engr 1182	Fundamentals of Engineering II	2
Math 1151	Calculus I	5
Math 1172	Engineering Mathematics A	5
Physics 1250	Mechanics, Thermal Physics, Waves	5
Physics 1251	Electricity and Magnetism, Optics, Modern Physic	5
Chem 1250	General Chemistry for Engineers (will accept Chem 1210)	4
CSE 1222	Introduction to Computer Programming in C++ for Engineers and Scientists	3
Math 2568	Linear Algebra	3
Math 2415	Ordinary and Partial Differential Equations	3
Stat 3470	Introduction to Probability and Statistics for Engineers	3
ISE 2040	Engineering Economics	2
Total		43 hrs

Major Core Courses		Hours
ECE 2060	Introduction to Digital Logic	3
ECE 2020	Introduction to Analog Systems and Circuits	3
ECE 2050	Introduction to Discrete Time Signals & Systems	3
ECE 2560	Introduction to Microcontroller-Based Systems	2
ECE 3020	Introduction to Electronics	3
ECE 3027	Electronics laboratory	1
ECE 3561	Advanced Digital Design	3
ECE 3567	Microcontroller Lab	1
ECE 5362	Computer Architecture and Design	3
ECE 3906	Capstone Design I	4
ECE 4905	Capstone Design II	3
CSE 2221	Software I: Software Components	4
CSE 2321	Foundations I: Discrete Structures	3
CSE 2231	Software II: Software Development and Design	4
CSE 2451	Advanced C Programming	2
CSE 2431	Systems II: Introduction to Operating Systems	3
Total		45

Engineering Electives (16 hours)

Major Technical Electives (choose at least 9 hrs)

<ul style="list-style-type: none"> Must select at least one 5000 level from the ECE or CSE technical elective list below Students must waitlist CSE courses on this list and will only be admitted if space permits. No more than 3 hours of S/U graded courses may count towards Electives
Humans & Justice: ECE 5570 (4), 5050 (3), 5550 (3)
VLSI & Computer Aided Design: ECE 5020 (3), ECE 5560 (3)
Cyber Security: ECE 5555 (3), ECE 5561 (3), ECE 5567.01 (3), ECE 5567.02 (3)
Microprocessor Based Systems: ECE 5465 (3), ECE 5466 (3)
Digital Design and Computer Architecture: ECE 5462 (3)
Computer Networks: ECE 5101 (3), CSE 3461 (3), ECE 4567 (4) (counts as 5000 level)
Signals & Systems: ECE 3050 (3)
Robotics and Control Automation: ECE 3551 (3), ECE 5463 (3)
Digital Signal/Image Processing, Machine Learning: ECE 5200 (3), ECE 5206 (3), ECE 5460 (3), ECE 5307 (4) or CSE 5523 (3)
Database/Algorithms: CSE 3241 (3)
High Performance Computing: CSE 5441 (3)

Directed Electives (choose at most 7 hours)

At most 7 hours of non-ECE courses approved by the ECE department see link here: https://ece.osu.edu/students/program-highlights/worksheets-curricula-information
At most 7 hours of physical or biological science courses below the 2000-level

Other details:

- Minimum 128 hours required for degree
- At least 30 hours of ECE courses must be completed at Ohio State
- Must complete 30 hours of Basic Math and Science Courses
- Need both Major and Cumulative GPA to be a 2.0 or higher to graduate
- Philosophy 1332 is required of all ECE students. This course fulfills Historical and Cultural Studies Foundations GE
- The most efficient path to complete the GE Theme requirement is to take two 4-hour courses

Computer Engineering Sample Schedule (128 hrs)

	Autumn		Spring	
Year 1	Engr 1100 – Survey	1	Engr 1182 – Fund of Eng II	2
	Engr 1181 – Fund of Eng I	2	Math 1172 – Eng Calculus II	5
	Math 1151 – Calculus I	5	ECE 2060 – Digital Logic	3
	Physics 1250 – Physics I	5	CSE 2221 – Dev Software I	4
	CSE 1222 – Programming C/C++	3	GE Launch Seminar	1
		16		15
Year 2	Physics 1251 – Physics II	5	ECE 2050 – Discrt Time Sig & Sys	3
	CSE 2231 – Dev Software II	4	ECE 3020 – Intro Electronics	3
	CSE 2321 – Foundations I	3	Math 2568-Linnear Algebra	3
	ECE 2020 – Analog Sys & Circ	3	Chem 1250-Chem for Engr	4
	ECE 2560 – Microcontrollers	2	GE Foundation	3
		17		16
Year 3	Math 2415 – Diff Eqns	3	Stat 3470 – Prob & Stat	3
	ECE 3027 – Electronics Lab	1	ECE 3567 – Microcont Lab	1
	ECE 3561 – Adv Digital Design	3	ECE 5362 – Comp Arch Design	3
	CSE 2451 – Adv Prog in C	2	GE Theme	4
	GE Theme	4	GE Foundation	3
	GE Foundation (philos 1332)	3	ISE 2040 – Eng Economics	2
		16		16
Year 4	CSE 2431- Systems II	3	ECE 4905 – Capstone Design II	3
	ECE 3906 – Capstone Design I	4	Engineering Elective	3
	Engineering Elective	3	Engineering Elective	3
	Engineering Elective	3	Engineering Elective	1
	Engineering Elective	3	GE Foundation	3
		16	GE Foundation	3
				16

Program of Study: Computer Engineering SAMPLE

General Education		
For detailed GE curriculum requirements and course lists click here .		
*Philosophy 1332 or Philosophy 2338 is required of all ECE students.		
The most efficient path to complete the GE theme requirement is to take two 4-hour courses		

Correlate Courses		Hours
Engr 1100.15	Introduction to Ohio State and Electrical and Computer Engineering	1
Engr 1181	Fundamentals of Engineering I	2
Engr 1182	Fundamentals of Engineering II	2
Math 1151	Calculus I	5
Math 1172	Engineering Mathematics A	5
Physics 1250	Mechanics, Thermal Physics, Waves	5
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CSE 1222	Introduction to Computer Programming in C++ for Engineers and Scientists	3
Math 2568	Linear Algebra (will accept Math 2173 & 2174)	3
Math 2415	Ordinary and Partial Differential Equations (will accept Math 2173 & 2174)	3
Stat 3470	Introduction to Probability and Statistics for Engineers	3
ISE 2040	Engineering Economics	2
Total		39 hrs

Major Core Courses		
ECE 2060	Introduction to Digital Logic	3
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ECE 2050	Introduction to Discrete Time Signals & Systems	3
ECE 2560	Introduction to Microcontroller-Based Systems	2
ECE 3020	Introduction to Electronics	3
ECE 3027	Electronics laboratory	1
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ECE 3567	Microcontroller Lab	1
ECE 5362	Computer Architecture and Design	3
ECE 3906	Capstone Design I	4
ECE 4905	Capstone Design II	3
CSE 2221	Software I: Software Components	4
CSE 2321	Foundations I: Discrete Structures	3
CSE 2231	Software II: Software Development and Design	4
Total		40

Engineering Electives (25 hours)

Major Technical Electives (choose at least 12 hrs)

<ul style="list-style-type: none"> • Must select at least one 5000 level from the ECE or CSE technical elective list below • Must select at least 6 hours from one track. "Additional Breadth" does not count as a track • No more than 3 hours of S/U graded courses may count towards Electives • Students must waitlist CSE courses on this list and will only be admitted if space permits
Humans & Justice: ECE 5570 (4), 5050 (3), 5550 (3)
Cybersecurity: ECE 5561 (3), ECE 5567.01 (3), ECE 5567.02 (3), ECE 5555 (3)
Machine Learning: ECE 5500 (3), ECE 5307 (4), ECE 5460 (3)
Signal Processing and Applications: ECE 3050 (3), ECE 5200 (3), ECE 5206 (3), ECE 5013 (3), ECE 5000 (3)
VLSI: ECE 3030 (3), ECE 4021(3), ECE 5020 (3), ECE 5021 (3), ECE 5560 (3)
Robotics & Control: ECE 3050 (3), ECE 3551 (3), ECE 5200 (3), ECE 5307 (4), ECE 5463 (3), ECE 5500 (3), ECE 5500 (3)
Computer Networking: CSE 3461 (3), ECE 5101 (3), ECE 4567 (4)
Computer Architecture and Embedded Systems: ECE 5560 (3), ECE 5465 (3), CSE 2431 (3), ECE 4567 (4), ECE 5466 (3), CSE 5441 (3)
Operating Systems and Databases: CSE 2421 (4), CSE 2431 (3), CSE 3241 (3), CSE 3430
Additional Breadth: Any ECE course not listed elsewhere (except ECE 2300 and 2360)

Directed Electives (choose at most 13 hours)

At most 13 hours of non-ECE courses approved by the ECE department see link here: https://ece.osu.edu/students/program-highlights/worksheets-curricula-information
At most 7 hours of physical or biological science courses below the 2000-level

