

Is Computer Engineering a Good Fit?

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Computer Engineering (CMPE) is an interdisciplinary major that allows students to explore both Electrical Engineering (EE) and Computer Science (CIS). Despite this benefit, people hesitate to study CMPE as the curriculum is restrictive. This guide attempts to demystify the major, explain how it's not as intimidating as it seems, and help you make a more informed decision.

Disclaimer: any suggestions and comments I make are merely my opinions. I highly suggest talking to other people and your academic advisors to get a second or even third opinion.

Introduction

As stated above, the CMPE curriculum is admittedly restrictive and the effects can be seen in two ways. First, unlike EE and CIS, there are no electives within the core engineering requirements. That is, instead of stating "x upper level EE/CIS classes," all 16 CU have been chosen. Second, CMPE cherry-picks from the requirements of both EE and CIS, meaning it does not offer as broad of an exploration into either major. The guide focuses on these points.

However, that is not to say that the CMPE curriculum has no freedom. There are still 4 technical, 7 social studies and humanities, and 3 free electives to help maintain flexibility. If you're in the unique position to do so, for instance through AP credit or placement tests, being able to skip introductory classes can also help free up your schedule.

Comparing Common Requirements

The table compares the courses required by EE and CIS to CMPE's.

Electrical Engineering	Computer Engineering	Computer Science
Source ESE 111 ESE 215 ESE 218 ESE 224 CIS 110 or ENGR 105 CIS 120 or CIS 240	Source ESE 150 ESE 215 CIS 120 CIS 121 CIS 240 CIS 160	Source CIS 110 CIS 120 CIS 121 CIS 240 CIS 160 CIS 262 CIS 320

CMPE vs EE

There are two main differences between the required ESE courses: 111 vs 150 and only 215.

1) ESE 111 vs ESE 150. Comparing them in the most basic sense, they are both freshman only, introductory ESE courses; however, 111 previews all of ESE while 150 focuses on CMPE.

Although 111 isn't required for CMPE, I highly suggest taking it anyway as it's a great class offered in the fall, allowing you to jump right into the ESE department. When asked whether 150 should be taken in addition to 111, however, the answer is trickier. I won't make a suggestion as I think this should be considered on a case by case basis, but I will offer some details. (Note: despite being required, 150 can be replaced by 111 as they both serve as freshman-only intro courses. A petition must be filled out and approved.)

CMPE is restrictive so it makes logical sense not to waste a tech elective on a second introductory course. But if that's the case, why not just take 150? 111 is definitely worth taking as it broadly covers EE, CMPE, and even SSE, which is helpful when trying to choose between these majors. More significantly, 150 is spring only, meaning an entire semester will have gone by without exposure to the ESE department if 111 isn't taken.

If you don't take 150 but still want to take an ESE course, consider ESE 224 (Signal and Information Processing). It's a fitting replacement as it covers parts of 150 that won't be covered by CMPE's other requirements, and it's also a chance to explore EE as an option one last time. If you'd rather save an elective spot, CIS 240 (Introduction to Computer Architecture) is also a great choice. Despite being in the CIS department, the first part of the course covers hardware. However, also consider the rigor of the rest of your schedule!! It might be better just to knock out general requirements if you're already taking many engineering courses (e.g. CMPE's CIS requirements). With that said, there is no shame in wanting to take 150, especially if you're looking for an overview of CMPE; however, I hope this guide does just as good of a job previewing CMPE!

2) Only ESE 215. EE requires three intermediate ESE courses, because they offer a peek into EE's three branches*. 215 (Electrical Circuits & Systems) previews "Circuits and Computer Engineering," 218 (Semiconductor Physics) previews "Nanodevices and Nanosystems," and 224 (Signal and Information Processing) previews "Information and Decision Systems." On the other hand, CMPE only requires 215, because it primarily focuses on the "Circuits and Computer Engineering" aspect of EE, which is evident in the required upper level courses. If you would prefer studying one of the other branches, EE would be a better choice than CMPE.

* Note: these three branches are actually being refined into six official EE concentrations. If you decide that you're interested in CMPE, but don't want to commit to the entire major, consider concentrating in "System-on-a-Chip Design" as it shares many of the same classes. That is, it's like the CMPE concentration of the EE major. If this path is chosen, make sure to take CIS 240 as it teaches C for ESE 350 and is a prerequisite for CIS 371.

CMPE vs CIS

First, note that CMPE does not require 110, as there are already too many other requirements! Beyond that, the only difference between CMPE and CIS is the absence of 262 and 320.

Similar to how CMPE focuses on the circuits/computers aspect of EE, it focuses on the embedded/computer aspect of CIS. More significantly, it veers away from more theoretical topics, which is why 262 (Automata, Computability, and Complexity) and 320 (Introduction to Algorithms) are omitted from the curriculum. If you would prefer to delve into these topics instead, CIS would be a better choice than CMPE. As a note, if you want to take one of these classes for exposure, I've heard that 320 is more useful and can be taken without the 262 prerequisite. It is also worth noting that when Professor Gandhi teaches 121, he covers a lot of the content taught in 320 so that is another way to gain exposure to algorithms.

Finally a small disclaimer, I was personally choosing between majoring in CMPE and EE, rather than between CMPE and CIS. Therefore, I have more to say about the former decision, as seen in the difference in section lengths. If you're deciding between CMPE and CIS, I would suggest speaking to others more knowledgeable about the differences.

Upper Level Requirements

The second restriction that CMPE places is that there is very little freedom with upper level engineering courses within the core 16 CU. To that end, a brief description of each is given to help you decide if the material is interesting. You don't have to love every single one to study CMPE; however, if you find that most of them sound boring, EE or CIS might be a better fit.

Disclaimer: at the time of writing, I have yet to take most of these courses so my descriptions don't do them justice. Visit the catalog for full course descriptions: [CIS](#) and [ESE](#). (CIS also has listings on its own website although I believe it's pretty much the same: [CIS](#).)

ESE 350: Embedded Systems / Microcontroller Laboratory

- This project course is all about building embedded systems. Combining both hardware and software, this is a very CMPE-esque course. Many EE and CIS majors also take this relatively popular course. It is typically offered in the fall.

CIS 350: Software Design and Engineering

- This course veers away from the embedded focus of CMPE, offering a taste of CIS by teaching topics important to software development. It is typically offered in the spring.

ESE 370: Circuit-Level Modeling, Design, and Optimization for Digital Systems

- This course is all about understanding digital circuits! However, it is (was?) notoriously known as the [hardest undergraduate class at Penn](#). It is typically offered in the fall.

CIS 371: Computer Organization and Design Laboratory

- This course continues CIS 240 (Introduction to Computer Architecture), offering a deeper dive into computer hardware design. It is typically offered in the spring.

CIS 380: Computer Operating Systems

- Also a continuation of CIS 240, but provides a deeper look into the software side (operating systems). It is typically offered in the fall.

CIS 441: Embedded Software for Life-Critical Applications

- This course expands on embedded systems by applying them to closed-loop medical devices such as pacemakers and infusion pumps. It is typically offered in the fall.

Networking (ESE 407: Introduction to Networks and Protocols or CIS 553: Networked Systems)

- This course veers away from CMPE topics and explores networks. I think the difference between the two courses is that 407 takes a bottom up approach (from wires up to applications), while 553 takes a top down approach and incorporates programming. 407 is typically offered in the fall. I think 553 is typically offered in the spring.

Concurrency Lab (CIS 455: Internet and Web Systems, ESE 532: System on a Chip Architecture, or CIS 565: GPU Programming and Architecture)

- This slot is the one core course that you can actually choose! I suggest taking a look at the links posted above for a more in depth description about each course. ESE 532 and CIS 565 is usually offered in the fall. CIS 455 is usually offered in both fall and spring.

Conclusion

While I won't deny that the CMPE curriculum seems restrictive, demanding, and honestly a bit daunting at first glance, I hope this guide appeases some of those fears and helps you make an informed decision. If you're curious, the reason I ultimately chose to study CMPE, and not something like a major in EE and a minor in CS, is that the CMPE curriculum lined up with my interests. That is, I wanted to study circuits, so I saw the option to skip 218 and 224 and jump right into upper level courses as a plus! I also had the benefit of coming in with some AP credit, which allowed me to still maintain a good amount of flexibility.

However, the decision about what to major in comes down to what you want to study. Whether you choose CMPE, EE, CIS, or something completely different, I wish you the best of luck at Penn and hope to see you around!

Here is a link to additional resources to help with planning your schedule: [resources](#).