

EE SFC Final Report

Student Members:

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Faculty Members:

- Prof. Azita Emami
- Prof. Glen George
- Prof. Victoria Kostina
- Prof. Alireza Marandi
- Prof. Richard Ohanian

Overview:

The student committee of the SFC put together a survey and sent it out to the undergrad EEs. The student and faculty committees then met multiple times in order to discuss the survey feedback and decide on recommendations. These recommendations were presented at the 2023 EE SFC. In addition, many of the recommendations were approved by the EE faculty in the weeks afterwards, and are on track to be approved for the 2023-24 catalog.

Survey:

The survey got 35 responses out of 41 EEs who are sophomores or above, for a response rate of 85%. Respondents were asked to indicate their year of study, gender identity and ethnicity. They were then asked the following questions:

- Which of the classes below they had taken, and how relevant they had felt those classes were towards their goals and interests in EE.
 - EE 10ab, Ph 2abc, ACM 95ab, ACM 116
- Whether the elective requirement should be increased by the same amount of units if some previously required classes were no longer required.
- What EE requirements they were glad they took, but would not have signed up for if they were not required.
- Their experience in EE 40 and how sets could be changed.
- Whether EE 13 should be a required course.
- Whether EE 85 should be a required course.
- Courses that should be cross-listed as EE electives.
- Whether the track listings on the Caltech EE department website are useful.
- Whether students should be more strongly encouraged to follow elective tracks.
- What electives they wanted to take but had not been offered during their time at Caltech.

- What elective courses they wanted to see added.
- The current funding situation for EE 90/91 and the extent to which projects should be reimbursed.
- Whether EE 91 should be increased to two terms.
- Whether they would be interested in taking or teaching student-taught classes in EE.

Due to the sheer range of the questions asked, we decided to narrow our focus to what we felt were the most pressing matters.

Topic 1 - Physics Requirements

Survey Results and Background

When asked about their opinions on the Ph 2 track, many respondents generally felt Ph 2a and Ph 2b were relevant to their interests in EE, but not Ph 2c. In addition, some respondents mentioned that they wished that APh 23/24 counted towards the degree, especially since those classes currently suffer from low enrollment and often get canceled. Other respondents mentioned that it felt excessive to require the entirety of the Ph 2 track when many other engineering majors allow students to pick two classes out of the three. During our discussions with the faculty committee, they expressed that Ph 2ab were important, while Ph 2c was arguably not necessary for all EEs to take, especially since many of the semiconductor-specific applications of statistical mechanics are extensively covered in other EE classes.

Recommendations

We presented a variety of suggestions at the SFC:

- 2 terms of Ph 2abc are required
- 2 terms out of Ph 2abc or APh 23/24 are required
- Ph 2ab are required, APh 23/24 count for electives
- Ph 2ab are required, one of Ph 2c or APh 23 is required

Conclusion

The EE faculty amended the physics requirement to simply be 18 units out of Ph 2abc or APh 23.

Topic 2 - Math Requirements

Survey Results and Background

When asked about their opinions on the ACM requirements, many respondents responded generally positively about ACM 95a, but not ACM 95b. Responses regarding ACM 116 were more polarized, as some felt that it helped improve their understanding of probability significantly, while others felt that it was a repeat of content already covered in EE 55. Other respondents mentioned that they wanted other ACM classes like ACM 104 to count towards the major as well.

Recommendations

The student committee initially proposed that the requirement for ACM 116 and ACM 95ab be changed to 27 units of ACM 100+ classes. However, the faculty committee felt that ACM 95ab was too important to remove as a requirement. In the end, the student committee recommended that the ACM 116 requirement be replaced with any 100+ class in ACM.

Conclusion

The EE faculty amended the ACM requirement from explicitly requiring ACM 116 and ACM 95ab to picking three out of ACM 104, ACM 116 and ACM 95ab.

Topic 3 - EE 13 / EE 85 / EE 90

Survey Results and Background

Many students expressed support for EE 13 becoming a required class in advance of EE 90, especially if other requirements were removed. A smaller subset of students supported the addition of EE 85 becoming a requirement if other requirements were removed. Professor Ohanian had advocated strongly for EE 85 to be added as a prerequisite for EE 90, since he felt that students were not entering with enough background. However, many students mentioned that EE 85 was difficult to fit into schedules as is since it does not count towards the degree.

Recommendations

The student committee recommended that EE 13 be added as a prerequisite for EE 90, so that the material covered could be treated as assumed knowledge for EE 90. In addition, Professor Ohanian expressed interest in tentatively restructuring EE 85 into a 100+ class on modern communication hardware that would also prepare students to do RF-based projects in EE 91. During the discussion with the faculty committee, it was also agreed upon that the course content of EE 90 should be re-examined, since students nowadays have less practical electronics experience than in prior years.

Conclusions

EE 13 was not adopted as a prerequisite for EE 90 due to concerns about adding in additional requirements. We will need to follow up on possible restructuring of EE 85 and 90.

Topic 4 - EE 91

Survey Results and Background

Many students in EE 91 in Fall 2022 mentioned that they were unable to fully complete their projects due to the time crunch of completing the project in a single term. One of the survey questions asked whether EE 91 should be extended to two terms to allow for more time to complete projects, and to allow for PCBs to be shipped in group orders over winter break. 67%

of students who had taken EE 91 before agreed that EE 91 should be extended to two terms, while only one explicitly disagreed (the rest were neutral).

Recommendations

Based on discussions with the faculty committee, the student committee recommended that EE 91 be extended to a two-term class, with EE 91b being a 3 or 6 unit class in which students assemble and test the PCBs they design and order in EE 91a.

Conclusions

The EE faculty approved the change of EE 91 into a two-term class.

Topic 5 - EE 90/91 Funding

Survey Results and Background

Students are currently expected to pay out of pocket for both EE 90 and 91. In previous years, the Caltech IEEE student club had reimbursed students, but there were concerns about this being unsustainable. On average, Caltech IEEE had reimbursed \$100 per group in EE 90 and \$500 per group in EE 91. Some of the high costs of EE 91 had also been attributed to the time crunch of having to complete the course in a single term, and needing to pay for expedited shipping. Students were asked whether paying for the EE 90/91 projects would be a financial burden, and whether the department should subsidize them to some extent. 77% of students agreed that paying for EE 90/91 projects would be a financial burden, while 96% of students (unsurprisingly) agreed that the department should pay for EE 90/91 projects.

Recommendations

The student committee recommended that each group in EE 90 and 91 be given a budget, as long as they got purchases approved and kept receipts. It was also decided that TAs would coordinate PCB orders so that the class would not have to pay for individual shipping for each group's board. The student committee was instructed to send a funding proposal to Professor Emami to bring to the EAS department leadership.

Conclusions

The EE SFC co-chairs are currently actively discussing the funding issue with Professor Emami and Professor George.

Topic 6 - Elective Requirements

Survey Results and Background

Students were asked whether CDS classes should be cross-listed with EE classes in the survey, for which there was significant support. Many students also requested that other classes in ACM and APh also count towards the elective requirement.

Recommendations

After discussion with the faculty committee, it was agreed that it would be more widely publicized that students can go to the Option Rep to request that specific non-EE classes count towards the elective requirement.

Conclusions

The faculty approved a change to the wording of the advanced elective requirement to say “any EE course numbered over 100 or any other EE-related engineering or science course numbered over 100 (such as CDS 110 or CNS/Bi/Ph/CS/NB 187) with approval of the Undergraduate Option Representative).” In addition, the faculty approved new tracks in EE (separate of the SFC recommendations) that allow students taking tracks to take count classes in relevant departments for their electives.

Topic 7 - Elective Offerings

Survey Results and Background

Students were asked what classes they wanted to take but had not been offered in their time at Caltech. Of the 25 respondents to that question, 14 of them mentioned EE/MedE Mixed-Mode Integrated Circuits. Students were also asked what other courses they wanted to see added to the elective offerings. Of the 17 respondents to that question, 6 mentioned they wanted more signal processing and practical communications, 6 mentioned they wanted more options in RF and antenna design, and 5 mentioned they wanted power electronics classes.

Recommendations

During the discussion with the faculty committee, Professor Emami mentioned she would offer EE 124 once her term as Executive Officer is set to expire in 2023. She also mentioned that she would try to reach out to a potential lecturer in power electronics; she had previously reached out to them per the recommendations of the 2021 EE SFC, but they had been busy with their new startup. As for RF and antenna design classes, Professor Ohanian had tentatively agreed to consider restructuring EE 85 into a class on modern communications hardware.

Conclusions

The student committee will need to follow up with the faculty on the status of EE 124, the power electronics elective, and the restructured EE 85. In addition, future EE SFCs should look into hiring lecturers in signal processing and practical communications.

Topic 8 - 3/2 Transfer Students

Survey Results and Background

Once EE 45 was moved to a third term classes, it technically became impossible for transfer students to complete EE 45, EE 90 and EE 91 in two years, if they wanted to obey the

pre-requisites. One 3/2 transfer student ended up doing a senior thesis instead, while another stayed for another term to take EE 91.

Recommendations

Based on discussions with the faculty committee, it was agreed that 3/2 transfer students would be required to meet with the Option Rep when they first arrive at Caltech to map out a course of study. That way, they would not be blindsided by EE 45, 90 and 91. In particular, 3/2 transfer students would be strongly recommended to take classes like EE 7 and EE 13 to get hands-on experience so that they could take EE 90 concurrently with EE 45.

Conclusions

The student committee will follow up with Professor George on making the initial meeting required for 3/2 transfers.

Follow-Up:

- EE 90/91 funding
- Elective offerings, specifically EE 124, power electronics, and practical communications
- Possible restructuring of EE 90
- Evaluation of changes implemented in the 2023-24 catalog, and how they have impacted students
- Student experiences in the option with regards to their gender identity - this was inadvertently left out from the 2023 SFC since we were not aware it was one of the follow-up points from the 2021 SFC
- Survey topics we did not address:
 - EE 40 sets
 - Student-taught classes in EE