

Committee on Educational Policy Undergraduate Program Review
Department of Electrical and Computer Engineering
Spring 2010

Review Committee: Professor William Bechtel (Department of Philosophy), Chair
Professor Keith Marzullo (Department of Computer Science and Engineering)
Professor Richard Spencer (Department of Electrical and Computer Engineering,
UC Davis)

The committee met on May 13-14. On the 13th, we met with (1) Larry Larson (Department Chair) and George Papan, (Vice Chair), (2) two groups of faculty (approximately 25 altogether), (3) two teaching assistants, (4) three undergraduate majors, (5) Robert Rome (MSO), Terrence Mayes (Undergraduate Student Affairs Manager) and 3 undergraduate advisors, and (6) two College Deans of Academic Advising. We base our judgment on those interviews, the statement of self-study provided by the department, the statistical data provided to us by the administration, and written comments the College Deans solicited from students. (As informative as the two TAs and three undergraduates were, the small sample makes it hard to assess how representative they were of the larger cohort of TAs and undergraduates.)

The department supports three undergraduate majors: Electrical Engineering (currently 455 students), Engineering Physics (currently 22 students), and Computer Engineering (currently 68 students enrolled through ECE; this major is co-administered with Computer Science and Engineering, which has approximately three times as many students in this major). The number of students in the ECE majors dropped significantly earlier in this decade but has rebounded somewhat in recent years (following a national trend in the field). The Electrical Engineering major is accredited by the Accreditation Board of Engineering and Technology (ABET), resulting in the presentation of considerably more information for that major.

The department's last review, in November 1998, and was largely laudatory but identified four areas of potential improvement: advising, teaching assistant and instructional support, courses and teaching, and the computer engineering curriculum. Serious attention has been given to these issues over the past decade. Coordination between advising in the six Colleges and in ECE seems to be good. Ladder rank faculty members are all engaged in undergraduate instruction, and while CAPE scores vary considerably, there has been overall improvement during the past decade. The computer engineering curriculum has been revised in coordination with the Department of Computer Science and Engineering. Overall, we were very positively impressed with the quality of the educational programs provided by the department and its conscientiousness in maintaining as high quality education as possible with extremely limited resources (that has left the department with a serious shortfall in teaching assistants, which we address further below).

One impressive feature of the department is that it regularly assesses its educational activities and continually adjusts and enhances its offerings in light of these assessments. There appears to be a very effective feedback loop whereby information obtained from students and from alumni is analyzed and employed to refine the curriculum. One of the challenges students in the program face is deciding how to meet their depth requirement; to assist in this process the department has implemented depth workshops during the Winter Quarter to familiarize students with the various depth options. The department provides support for student organizations and has initiated new

activities such as dinners with faculty so as to enhance the overall sense of community between students and faculty.

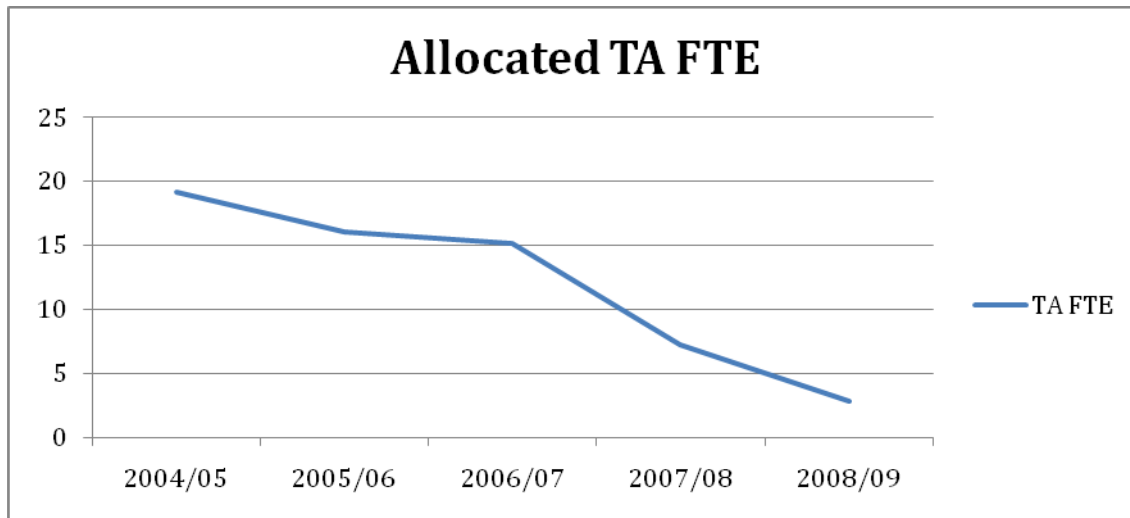
While overall very positively impressed with the efforts of the ECE Department, we have identified a few areas of potential concern or where there are prospects of further improvement. We elaborate on three of these, and then briefly note a few others.

Interface of Theory and Practice. The department has continued to do a laudable job of responding to the criticism in the 1991 review about the need for additional laboratory (“real life”) classes. Putting labs in the lower division is a good move that is consistent with what other programs have done in recent years. One faculty member commented that he thinks the lower-division labs have even helped students in his senior-level theoretical course be more interested in the theory and have a greater appreciation for its importance. There was other anecdotal evidence that these labs may be helping, but we were not shown concrete evidence of their effectiveness.

As examples of the types of things the department might consider changing we offer the following comments. We are told that there isn’t a specific laboratory assignment that teaches the students about the equipment, rather, they are given a handout to read for homework. However, some of the students either do not read it thoroughly, or do not understand it. Moreover, the laboratory assignments can often be completed without having a good comprehension of what is being done because they are recipe driven assignments, they are done in groups, and the students make use of the “autosetup” button on the oscilloscopes. The department might consider adding an introductory laboratory assignment or two that carefully cover the operation of the equipment and then also add one or more assignments that ask the students to make measurements without specifying a procedure.

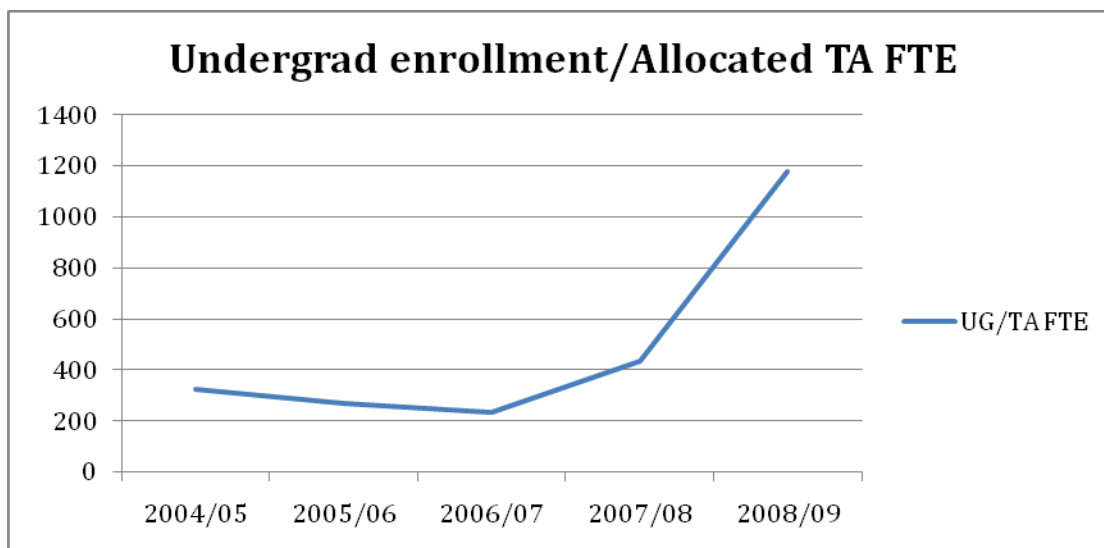
The addition of these laboratory courses has raised two other issues that the department may want to investigate: whether or not the coordination between the laboratory assignments and lectures can be improved; and whether or not the equipment and computing resources available to the students need to be improved. It was noted that the students are sometimes frustrated at how slow the ACS servers are when the students run engineering software packages. An ancillary issue related to the operation of the laboratories is the need for more financial resources to update and maintain equipment and pay for TAs. It would be very beneficial if there were a mechanism to allow the department to use money accrued from lab fees for these purposes.

Teaching Assistants. Because of the formula campus uses to allocate the number of TA FTEs per department, the ECE department has undergone an astonishing cut in TAs since AY 2004/05:



The astonishing part is the actual range of allocated TA FTE: it is hard to imagine how any department can be expected to conduct classes with only 2.8 TA FTEs. According to data that the department provided to us, this places UCSD ECE as the worst in this metric among the top 18 EE departments in the nation.

While it is true that the number of students enrolled in ECE courses has also dropped, the ratio of undergraduate course enrollments to allocated TA FTEs has skyrocketed:



The department has faced this problem by making hard choices:

1. They have turned to faculty buyout for TA funds. The ECE faculty who have done this have shown great altruism and deserve to be recognized. This should not be used as a permanent fix.
2. They have cut the number of TAs per course. Their current formula is 5 hours per 25 students (0 TA hours for 0-24 enrollment, 5 hours for 25-49, etc). Lab sections are allocated 5 hours

and have a minimum number of students per section. This is, roughly, half of the number of TA hours allocated five years ago.

3. To help bridge this gap, the department has turned more to readers and tutors, including hiring graduate students as readers rather than as TAs.

Despite these attempts to ameliorate the effects of the limited university resources, the impact on the program has been negative.

- The TAs with whom we talked reported that the resulting larger sections have driven students away, and have reduced the ability of TAs to provide individualized attention to needy students. Because many students at UC San Diego are intimidated by one-on-one meetings with professors, the professors have not been able to pick up the slack in terms of individual instruction.
- To address concerns raised in previous reviews, ECE for a time allocated TAs to assist with laboratory skills, such as helping students from many classes with questions arising with Matlab. While the better ECE students can pick up these skills by themselves, having such resources offers a valuable educational resource to the rest of the students. With the severe cuts in TA funding, ECE has had to abandon this service.
- Readers are a valuable (and less expensive) resource, but they are limited in what they can do: in any lab section that uses readers, a professor needs to be present. Moreover, there is the problem of rapid turnover among undergraduate readers.

The reasons behind this precipitous drop in allocated TA FTE come from the formula used to determine TA FTE allocation, from the growth spurt UC San Diego enjoyed and, and from the .com boom and bust. With the growth in demand and the available FTEs, faculty FTE increased, and then with the .com bust enrollment dropped. In the long term, ECE is addressing this by creating new courses that have appeal outside of the department and working with the colleges to have them count towards GE requirements. Nonetheless, it is shocking that the campus has not stepped up to help.

In these times of large budget cuts, the experiences of ECE should be kept in mind when considering cuts in TA FTEs.

Preparation in Mathematics. A major source of concern to the faculty with whom we met is the preparation their students have in mathematics. In part the concern focuses on inadequate basic mathematical skills (e.g., in integration and solving differential equations), but there is also concern about the inability of many students to employ the knowledge they have acquired in solving problems faced in engineering. This problem is exacerbated by the fact that at UCSD C- suffices as a passing grade, whereas that level of learning in mathematics does not provide the skills needed for doing well in ECS courses. ECE faculty are exploring whether they should introduce courses that provide relevant preparation for using mathematics in ECE. When asked, some faculty indicated that in the past they have had meetings with the mathematics department to discuss the preparation their students require, but that no meetings have occurred in recent

years. We recommend pursuing such meetings in the near future to determine whether adjustments can be made to better meet the needs of ECE students. A part of the problem is that the same mathematics courses must serve the needs of students in many science and social science majors as well as engineering. One possibility that might be explored with the mathematic department is establishing sections in the Math 20 sequence that concentrate on applications appropriate for specific majors. Another strategy is to build into the early courses in the ECE major illustrations of how mathematical skills will later figure in the ECE curriculum.

Additional issues.

(1) Some of the faculty raised a concern that many students have not developed appropriate study habits and do not put in sufficient effort (time) outside of class. While this is a general problem confronting the university, the department might ameliorate the local issue by emphasizing study expectations during freshman orientation, by instructors being explicit in setting expectations, especially in lower-division classes, and by establishing a program of peer mentoring.

(2) EC15 teaches C, but many other ECE courses require MATLAB. There is no course that teaches MATLAB, so students must learn it on their own. This is not an unreasonable expectation and many students do so very successfully, but others confront difficulties. One solution might be a 2 credit course on MATLAB, perhaps shared with other engineering departments.

(3) Although the Self Study indicates that all students are assigned a faculty advisor when they are admitted, the three students we talked with seemed unaware of this. Moreover, while the staff advisors indicated they knew all students at least by email, they indicated that there are several students who have never come in for advising. The department might want to consider requiring all students to come in personally for advising and to have a meeting with their faculty advisor, a policy that might be enforced by requiring an advisor to sign off on advising forms.

(4) The advisors report spending considerable time helping students understand the requirements, especially the depth requirements. This suggests that the presentation of these requirements in the Catalog might be improved.

(5) While the CAPE scores have improved significantly since the last undergraduate review, there is still significant scatter in the scores. We encourage the department to continue their efforts in this area. With CAPE moving from being paper based to web based, the department might consider how to guarantee meaningful course feedback.



DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
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April, 2011

TO: Committee on Educational Policy and Courses
FROM: Prof. Larry Larson, Chair, Department of Electrical and Computer Engineering
RE: Department response regarding CEP Undergraduate Program Review

A handwritten signature in black ink, appearing to read "Larry Larson".

Dear CEP,

The department would like to thank CEP and the review committee for their thoughtful and thorough review of our undergraduate program in Spring 2010. It is extremely helpful to participate in this process so that we may obtain an outside perspective and gain another valuable input regarding the strengths of our program and areas for improvement.

We would like to respond to items mentioned in the report so that CEP may discuss and finalize it.

Interface of Theory and Practice

The department agrees that a method for evaluating the effectiveness of added lab components in the lower division is necessary. While we have received anecdotal positive response from faculty, students, and ABET reviewers regarding these recent changes, we feel further evaluation is necessary. This will be accomplished first through a review of breadth course grade distributions, performed by our Course Directors. Our upcoming Senior Survey will ask more specific questions regarding content as it relates to the added labs, most of which will have been experienced by students who graduate this year. This will be an on-going evaluation leading up to our next ABET accreditation review in two years, at which point we will have a more significant sample of students who have experienced all of the new labs which have been incorporated into the curriculum.

We appreciate the suggestion of adding introductory lab assignments to cover equipment and measurements, and will work with the involved faculty to determine how best this can be integrated into the current lab structure for each course. Additionally, we have been able to make improvements to lab equipment which are currently pending and will drastically improve the quality of the experience of students in the lab. Improving communication with campus ACMS is also something that is actively being addressed. We will also pursue addressing the long-term equipment issues for our undergraduate laboratories. Currently, university policy does not allow us to use lab fees to address any equipment needs for the instructional labs. This is not sustainable.

Teaching Assistants

The department appreciates the committee's thorough review of our lack of TA funding from the campus, and how this is impacting the quality of our program. Unfortunately to-date we have seen no changes at the campus level and only anticipate further cuts which will impact our level of support for

classes. The department can only try its best to preserve the core of this funding for the required undergraduate courses, though it is wholly insufficient. The resulting impact to our program is pervasive and severely undermines our core educational mission.

Preparation in Mathematics

Since this report, ECE faculty have met with leadership in the Math Department to discuss the issues mentioned regarding student preparation. Results were positive, with Math faculty understanding the issues facing our students and stating that they will be addressing this further in coming quarters. ECE faculty have brought this issue to the other divisional departments so that further assessment can occur on a coordinated, larger scale, since this issue affects multiple disciplines in Engineering.

Additional Issues:

(1) As a result of this input, the department has been more actively working with HKN, the EE honor society, to further develop peer mentoring. Utilizing student-to-student interactions is an extremely effective way to inform students of their obligations regarding study habits, and also to set examples of how this balance can be achieved successfully.

(2) Departmental efforts have been augmented by the student branch of IEEE to offer additional training/workshops.

(3) The department has instituted a program for students who are having academic difficulties which requires them to visit the advising office, and also refers them as needed for peer tutoring, mentoring, or faculty advising. The department will continue to discuss other methods of faculty advising for undergraduates.

(4) A more extensive degree map is being developed and more detailed information regarding the undergraduate requirements has been posted on the website. The department is pursuing whether the catalog copy can be enhanced as well to decrease student confusion over requirements.

(5) The department continues to monitor student feedback mechanisms and saw positive results from the switch to online CAPEs. Course directors continue to play a role in evaluating feedback so that it is useful to instructors, and of course the impact to faculty review files remains important. Additionally, the department recognizes exceptional teaching with a Best Teacher award, annually.

August 31, 2012

PROFESSOR LARRY LARSON, Chair
Department of Electrical Engineering

SUBJECT: Review of the Undergraduate Program at the Department of Electrical Engineering

Dear Professor Larson,

The Undergraduate Council considered the undergraduate program review for the Department of Electrical Engineering (ECE) on November 4, 2011. The Undergraduate Council, which is now responsible for undergraduate program reviews (previously, this responsibility was the purview of CEP), considered the report of the CEP Review Subcommittee and the Department's response. The Undergraduate Council shares the positive assessment of the Review Subcommittee; the report reflects the Department's commitment to maintaining a high-caliber undergraduate program. The Council is also pleased to learn that ECE regularly assesses its education programs and willingly adjusts its teaching and major requirements as appropriate. This level of attention and involvement is commendable.

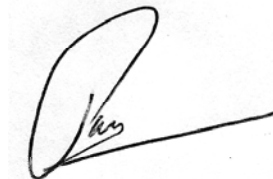
The Council supports the recommendations of the Review Subcommittee and is pleased to see that the Department's response outlines its plans to address the concerns & implement the recommendations outlined in the report. At the time of the follow up review, the Council will particularly focus on the following issues:

1. Interface of Theory and Practice: The Council is supportive of the measures taken by ECE to address this concern. At the time of the follow up review, the Council will ask the Department to report how these efforts have changed how the lab component of ECE courses is structured.
2. TA Support: Has there been any change in the TA allocation for ECE since the time of the review? Are there ways in which the limited resources (both monetary and student time) can be maximized?
3. Preparation in Mathematics: The Council is pleased to learn that the Department is pursuing discussion with Mathematics regarding this issue.
4. MATLAB Instruction: The Council recommends close monitoring if this issue. The plan to include the students in offering training/workshops is a good start.
5. Student Advising: The Council supports the Department's plan to improve student advising information as outlined in the response.

For the Department's post-review follow up (scheduled for AY 12-13), the Department will be asked to provide a brief written summary regarding its efforts to address the issues outlined in the report, particularly those identified above.

In conclusion, the Council wishes to reiterate its positive view of the Department's undergraduate program and to thank the Department for its focused work and engagement on behalf of undergraduate education.

Sincerely,



Partho Ghosh, Chair
Undergraduate Council

cc: D. Hamann G. Masters J. Sobel