Utah State University

Department of Electrical and Computer Engineering

Electrical Engineering Assessment Report

Academic Year 2001–2002

October 30, 2002
1 Introduction

The ECE Assessment Committee met on October 28, 2002, to review the courses offered during the 2001-2002 academic year and to make recommendations for the present year. The goal of this process is to evaluate how well our curriculum succeeds in developing students who attain our specified program objectives. Our analysis approaches this task from two directions: first, we look at the degree to which our curriculum actually enables students to attain these objectives, and second, we review reports from former students, employers, recruiters, and the ECE Industrial Advisory Committee to determine whether these objectives are actually being met in practice.

The analysis of the curriculum is based first upon the assessment reports of individual courses. These reports, prepared by the faculty teaching the courses, should address the following issues:

- whether the specified course outcomes have been met
- whether the students were adequately prepared to take the course
- significant issues from student evaluations
- appropriateness of the specified course outcomes

The faculty are responsible for determining their own methods of addressing these questions. The relation of course outcomes to program objectives is then used to determine the degree to which graduates should be prepared to reach the program objectives.

The second phase of the analysis determines whether our graduates actually are, in practice, reaching those objectives. This analysis is based upon feedback from graduates, from those who recruit and employ our graduates, and from the ECE Industrial Advisory Committee.

Following this analysis we work backwards to determine whether any changes are required, first in the program objectives, then in the overall curriculum, and finally in the individual courses and sequences. We conclude with an analysis and any necessary modifications of the assessment process itself.

There is a context to this assessment process that affects where we are and what we are doing. As a University, in the Fall of 1998 we underwent a major change in curriculum from quarters to semesters. In the process of that change, we implemented an extensive review of our entire curriculum. While we have always taken occasion to tune, tweak, modify, and hopefully refine our curriculum, the switchover provided a major impetus for a closer look. Since the transition, we have had experience to suggest that the change went well. However, we still feel the repercussions, and continue to evaluate the curriculum on the basis of both our current curriculum, and where we were under quarters. (In other words, did things really get better under the mandated change? If not, what can we do to make it better?)

2 Review of course assessments

Faculty were first requested to rate the level to which course outcomes were attained on a scale of 0, 1, or 2 (unsatisfactory, satisfactory, or excellent). The average score over all outcomes of all courses was 1.3 with a standard deviation of 0.5. One outcome in each of two courses were not met, and the issues have been dealt with constructively.

Faculty next evaluated how well the students were prepared upon entry to the class; those responding indicated that the incoming students were generally adequately prepared (this question was not phrased well, and some faculty interpreted the question as requesting a statement of the course entrance requirements). During the review meeting some members of the committee noted that the skills in the second-year math topics and probability were not as strong as desired.

The reports then addressed curricular issues with specific outcomes, their implementation, and their evaluation. No major issues appeared, and the several minor matters that came up appear to be adequately handled. Some course outcomes were modified somewhat. There is some concern that topics below the level of outcomes may not be tracked appropriately with the present approach. The committee will take a look at this over the coming year.

2
2.1 **Summaries of assessment reports**

In the following subsections, we summarize comments about the courses and/or sequences in the electrical engineering major, pointing out issues in the course to be addressed (or which have been addressed).

### 2.1.1 Circuits: ECE 2410, ECE 2420

We have one course entirely dedicated to circuits, ECE 2410, and its associated lab course, ECE 2420. This is regarded as a foundation course in engineering analysis and modeling, so we feel it important for students to succeed in this course.

Students must have completed Math 1210 (Calculus II). However, this is not yet adequate, since students could benefit from having had Math 2250 (Linear algebra and differential equations) to prepare them for the systems of linear equations that arise, and to give them background for the differential equations associated with circuits.

The specific outcomes are attained, and this course has appropriate outcomes and objectives. Assessment of outcomes was by means of laboratories, homework, and examinations.

The course consists of a lecture and a lab. No major semester project is involved. Because of the lab and the typically large class sizes, TA support is critical, but has been generally adequate.

It has been noted by the students that the course seemed to start slowly, then pick up too fast at the end of the semester. Some of this may be due to adjustments in the level of preparation of the students at the beginning of the course. An adjustment to fix this is being implemented.

It has also been noted that the labs did not synchronize with the lectures well, and that students have difficulty with the lab equipment. This has been addressed by introducing a new lab on equipment use, which both aids the synchrony and provides the necessary equipment background.

### 2.1.2 Electrical Engineering for Nonmajors: ECE 2200

ECE 2200, Electrical Engineering for Nonmajors, presents basic concepts of analog and digital circuits, basic lab practices, and lab equipment. As a service course, the pre-requisites are kept to a minimum (Calculus I), and these are adequate for the needs of the class. As determined by homework problems, quizzes, and a final exam, the specified outcomes are attained.

As a general service course, this is not “on the road” to anywhere in our curriculum. In one sense, therefore, assignment of topics is straightforward, as it does not have to coordinate with other courses we offer. On the other hand, there are expectations from the other departments we serve, particularly Mechanical and Aerospace Engineering, about what their students learn. The reality is that their needs exceed what can be obtained from a single course of electrical engineering. The feeling is currently that the textbook in use is inappropriate, and a more user-friendly book is being sought.

Technical support in the lab was very good. However, some additional effort to tune the labs to the needs of MAE is perceived as needed.

We are in ongoing contact with our major customer, MAE, on the topics covered in the course and the lab.

### 2.1.3 Digital Circuits: ECE 2530, 2540(L)

Prerequisite are minimal, and students are generally adequately prepared. Students prepare a project, and present orally; there is thus a strong design and communication components. Lab facilities seem adequate.

### 2.1.4 Circuits/Signals/Systems: ECE 3620, ECE3640

We note the effect of the change from quarters to semesters: Under quarters, there were two quarters of circuits, and students took a full quarter of differential equations and another quarter of linear algebra. These were followed by a full year (three quarters) of signals and systems. This preparation provided opportunity for some really unique and challenging design problems, such as a speech recognition system.

Under the semester system, only a single semester of circuits and a single semester of DifEq/Linear algebra are prerequisite for the signals sequence. Material that “fell out” of the circuits course must be picked up in the signals sequence. This includes second-order systems (i.e., the introduction to solving
circuit differential equations). Additionally, the students have much less comfort with complex numbers and sinusoidal steady-state analysis than they used to.

The impact on the course seems to be that the students feel very challenged at the beginning of the semester. They are not as well prepared at the beginning of the semester as they used to be. (One teacher observed that it is like pulling students out of the La Brea tar pits at the beginning.) However, within a few weeks they become more comfortable with the level of the material. One effect of the change and the difference in the level of preparation is that the speech recognition project no longer seems to be approachable. Perhaps with additional tuning and experience, it (or something comparably challenging and interesting) can be re-introduced. It is also important to hold regular help sessions, so that student questions about homework and course perspective can be gained.

The specified course outcomes are attained, as measured by homework, quizzes, programming assignments, and examinations. The material covered seems to be a reasonable mapping from the overall curriculum.

The presentation format consists of lectures and help sessions. While there are no major projects, students gain computer exposure through introductions to Matlab and Simulink, and write programs in C/C++ each semester to exercise the concepts learned in class and keep programming skills sharp. Teaching support is adequate for these purposes.

Another minor change is needed in the catalog listing for the course. 3620 and 3640 should be considered as a single unit; there is no need to artificially divide them into two classes, and the dividing point may vary somewhat from year to year. In addition, considering them as a single unit (and listing them as such) will give more flexibility to the teacher in the order of presentation of concepts.

2.1.5 The Science of Sound: ECE 3260

This is a general education course, with prerequisites being math through algebra. Students are properly prepared with this background. The course moves through a lot of material, and students have commented on the difficulty of assimilating it all.

Students were able to achieve the stated outcomes, as assessed using exams, homework assignments, web activities, and home experiments.

The course was implemented by lecture and demonstration. Facilities and support are adequate.

2.1.6 Electronics: 3410, 3420

Prerequisites for 3410 is 2410 (circuits) and 3620 (circuits and signals). In reality, however, 3620 is frequently taken concurrently, and 3620 will be stated (in the near future) as being a co-requisite. There do not seem to be any problems with 3620 being a co-requisite.

The course objectives are being achieved, as measured by homework problems, quizzes, and lab exercises.

The allocation of topics is an ongoing discussion. While we have been satisfied with the material covered in the past, the march of technology leads us to reconsider our priorities. Taking a comprehensive look at the electronics sequence is one of the current efforts of the undergraduate assessment committee.

The course is presented by lectures and lab exercises, including computer exercises using SPICE. The lab equipment seems sufficient for the course. However, it was noted that a full-time technician, fully versed in electronics, as well as a new professor, familiar with industrial practice, would greatly strengthen the lab.

2.1.7 Microcomputer hardware and software: ECE 3710

Students enter with a strong background in digital design, and a year of programming experience, which seems to be adequate. Not all outcomes were met (most recently), due to a parts shortage. This is something that is straightforward to address, and should not be a problem in the future. There is a concern by the students that too much time is required for the labs. They also did not like taking exams over the net. These concerns will be addressed.

2.1.8 Microcomputer systems programming: ECE 3720

Students are prepared by ECE 3710, and it seems adequate. All outcomes were achieved. In the lab, the students noted a lack of adequate TA support. Also, more equipment would help.
2.1.9 Engineering Software: ECE 3780

Students were well prepared in terms of programming in C++, but needed additional training in software engineering practices. The students had concern about the training on some of the software tools, but the issue is being addressed with additional training.

2.1.10 Design I, II: ECE 3820, ECE 4840

In Design I, students begin a paper design. Students stated a preference to begin their actual senior design projects.

These courses have been taught most recently by people who have moved on to other institutions. This problem is being addressed (by means of the Hewlett grant), and we should soon return to the traditional strength that we have had in this area.

2.1.11 Electromagnetics/Transmission Lines: ECE 3860, ECE 3870

The computer engineers take a 1-hour course (ECE 3860) on transmission lines, which consists of the first one-third of the electromagnetics course (ECE 3870). This dual-purpose class raises some interesting questions, such as how to make sure that all students are fairly graded, given that the EM students have additional coursework and tests.

The pre-requisites are Electrical Circuits (ECE 2410), Physics 2220 (General Physics II), and Math 2250 (Linear algebra/differential equations). Since there is only a single semester of circuits, students come in with fairly weak circuits skills, but these are immediately strengthened by developing the transmission line model. Overall, other than the desire for more circuits strength, the prerequisites seem adequate.

The course outcomes are attained, as measured by homework and performance on tests. There are no labs associated with this course.

The course consists primarily of lectures, with occasional in-class demonstrations. Teaching support is adequate.

There is a bit of difficulty in obtaining the conventional student assessments in the transmission line course. Typically, student assessment is done near the end of the semester. Since the transmission line course ends after five weeks, the assessment did not take place when the course was first offered last year. However, we have become aware of the problem this year, and will take steps to obtain the assessments.

2.1.12 Control systems: ECE 4310, ECE 5320

ECE 4310 is required of all electrical engineering students, and ECE 5320 is a technical elective. ECE 4310 is also dual-listed as MAE 5310, and the class is occupied by both electrical engineering and mechanical engineering majors, and teaching is shared by both departments. The EE prerequisite is ECE 3640 (signals and systems), ensuring that the EE students have a strong background in Laplace transforms and system concepts. The MAE prerequisite is MAE 3340 (Instrumentation and measurements), ensuring that there is some knowledge of sensors and data acquisition. It has been observed that the EE background is weak in terms of system modeling (writing the equations of motion for physical systems), and the MAE background is weak on transform concepts. (Even the MAE students experienced difficulty with electromechanical systems.) Despite these deficiencies, it is felt that having the course shared between the departments provides more advantages than deficiencies.

To compensate for the missing backgrounds, there are special sessions held to bring EE students up to speed on dynamics, and MAE students up to speed on system concepts. The groups then come together synergistically for the remainder of the course.

The course outcomes are attained, as determined by homework, quizzes, labs, and exams.

2.1.13 Communications: ECE 4660, ECE 5660

ECE 4660 is required of all electrical engineering students, and ECE 5660 is a technical elective. The prerequisite for ECE 4660 is ECE 3640 (signals and systems) and Math 5710 (Introduction to probability). The signals background appears adequate, but strengthening the probability background would be desirable.

Students commented that the work load seems high. This has been addressed, and lab assignments are modified. There is also a student comment that the course is too theoretical. However, this theoretical
emphasis is precisely what we wanted to convey.

For ECE 5660, the same probability course is prerequisite. However, in this course probability is really used as a significant tool, the probability deficiencies were very evident, and slowed the course development.

In both courses, the stated objectives were achieved.

In evaluating what we want to do with communications, we are implementing a change. The ECE 4660 is being moved to become ECE 5660, and is now a technical elective. This will for a more focused and (it is hoped) better-prepared audience. At the same time, ECE 5660 is being moved to ECE 6660, with stochastic processes and more math as a prerequisite. This will allow for more in-depth and focused coverage than was possible when students lacked these tools.

Course material is presented in both of these classes using lectures and labs, and facilities seem adequate.

2.1.14 Computer and data communications: ECE 4740

Students have no anticipated background in the area, since it is a new area for them. What they need more of is background in operating systems, and more background in transmission lines. The transmission line problem should be resolved with the new TL requirement for computer engineers. Outcomes were achieved.

2.1.15 Computational Methods for Electrical Engineers: ECE 5020

Prerequisites are ECE 3870 (Electromagnetics) and programming. These seem to be adequate. All outcomes were achieved.

Students write their own programs in Matlab. There seemed to be no problem with student access. Students felt confident with programming abilities after the course.

2.1.16 Microwave engineering: ECE 5810, ECE 5820

All outcomes were achieved. As usual, students commented on the amount of material covered. In the lab course (5820), there are only two network analyzers, which makes coordinating the work difficult when the class is large.

2.1.17 Electro-acoustic systems: ECE 5280

The prerequisite is ECE 3260 (general education course on the science of sound) which has very modest technical requirements for our students. The prerequisites seems adequate.

All outcomes were achieved. Students have commented that too much material is covered.

There is only one TEF analyzer available. This makes some of the labs difficult.

2.1.18 Spacecraft Systems Design: ECE 5230

The prerequisites are either ECE 2200 (Electrical Engineering for nonmajors) or ECE 2410 (Electrical Circuits) and ECE 2530 (Digital Circuits). Objectives were achieved. However, some room for improvement in this course has been noted: more time should be allocated to come up to speed on STK; the classroom was stifling and enervating — a better classroom would help student focus.

2.1.19 Advanced Electronic Circuits: ECE 5430

This course was not taught in the 2001-2002 year.

2.1.20 Digital VLSI System Design: ECE 5460/ECE 5470

Preparation requires familiarity with top-down design using verilog, as is obtained from our ECE 3530. Students learn primarily from an in-class project, but they have expressed an interest in more lectures at the beginning to lay a foundation. However, students appreciate the project-based approach.
2.1.21 Electromagnetic Compatibility: ECE 5480

Prerequisites are not listed in the catalog for this course. Students should have an understanding of electromagnetics (from ECE 3870), of systems (from ECE 3640), and electronics (from ECE 3410). No problems were noted on the basis of prerequisites.

The outcomes were achieved. Students appreciated the hands-on aspects of the course, and no major problems were noted.

2.1.22 Introduction to Digital Signal Processing: ECE 5630

Prerequisites are ECE 3640 (Signals and Systems) or equivalent, and facility in programming. We have always found trouble with incoming graduate students having uneven preparation; many are strong in textbook knowledge but weak in programming. This course helps even the knowledge base.

The outcomes were achieved. Students commented on the textbook with some concern. However, these concerns were both expected and have been addressed, since the book used was a book in progress.

2.1.23 Real-Time Processors: ECE 5640

Prerequisites are ECE 3640 (signals and systems) and ECE 3710 (microcomputer hardware and software). Students seemed adequately prepared, although those that had not also had ECE 5630 (intro. to dsp) seemed to have trouble with Z-transforms. Students that may not have taken 5630 more are more frequently the computer engineers or foreign graduate students. Some advising may help with this, as well as making certain that the undergraduate signals course properly prepares students.

Outcomes were achieved. Students experienced more trouble dealing with finite register effects, which is the most theoretical part of the course, and which was also drawn from material outside the main text. There was also concern about the length of time required for the labs.

2.1.24 Concurrent programming: ECE 5740

Students appeared to be adequately prepared for the course, and those that didn’t have much experience with WIN32 were able to pick up what they need readily. Students commented that the workload was heavy for a 3-hour course.

2.1.25 High-performance microprocessor architecture: ECE 5750

Students seemed well prepared. Again there was a concern about workload for a three-hour course. Students also wanted more hand-holding on Vtune (which they were expected to learn on their own.)

2.2 Analysis of the Electrical Engineering Program

In many of the course assessment summaries above, there were some course-specific items to be addressed by the professor of the course. In addition these, however, some issues transcend the domain of concern for a particular course, and from these some general programmatic issues emerge from the body of the assessments.

- Review of the student post-course comments from several courses showed a significant number complaints that the work load was too heavy for the credit awarded. We suspect this is due to the fact that many of us are now turning to more significant projects, and these projects tend to show up at the end of the term.

- Support for teaching assistants is not adequate. For example, our laboratories are often complex enough that only students who have been through the courses can serve as TAs. These students, however, often have jobs on- and off-campus that pay significantly more and are very difficult for us to hire.

- Several reports commented on the inadequacy of the classrooms for state-of-the art lectures and demonstrations. None of the rooms normally assigned to ECE classes have built-in display systems. The Department does have a few digital projectors and attached computers on (often clumsy) carts; competition for these is great. A few fully-equipped and networked classrooms would help tremendously.

- Students may not be as well-prepared in math and probability skills as we would like.
A particular point of discussion is the probability course, taught by the math department, which serves the entire campus and, as a result, may not be suitably tailored to our needs. We may need to return that course to our department; the additional faculty we are looking to hire may help us in this.

![Figure 1: Number of course outcomes contributing to each program outcome](image)

Figure 1: Number of course outcomes contributing to each program outcome

In addition to issues which emerge from these assessments, there are issues which we perceive as we examine the curriculum as a committee which are under examination:

- Looking at the electronics sequence, to ensure that it meets industry needs, and will contribute to the VLSI courses.
- Taking a close look at the offerings in the microwaves/EM area. There are a lot of classes in this area, too many to teach on a regular basis with the faculty and student population we have.
- Addressing the probability question: should we teach it? how can we introduce more applications in our courses? what do we displace to do this?
- Renumbering communications (4660), and making it a technical elective.
- Refining the syllabus for transmission lines.

Figure 1 shows the number of course outcomes that map to program outcomes. These numbers must be interpreted with care. For example, outcome ‘l’, “knowledge of probability” has only 4 counts. However, one of those counts comes from an entire course devoted to it. Outcome ‘a’, “apply knowledge of math, science and engineering” has 130 counts — but this is because multiple course outcomes in many courses contribute to this program outcome. This being said, the numbers are somewhat indicative of where the strength is placed in the curriculum.

Figure 2 shows the average score (on the 0, 1, 2 scale) for each program outcome. All of these score above 1 (satisfactory) except ‘f’ (professional and ethical responsibility) and ‘l’ (knowledge of probability), which are only satisfactory. More courses with specific outcomes in these areas would serve to strengthen these scores.

3 Review of external assessments

We obtain external assessment via on-campus recruiters, alumni, the industry advisory committee, and senior exit interviews.
3.1 Senior exit interviews

The department conducts a written senior exit survey of all graduating students. (Note that the interview covered the students’ entire academic careers, and some comments refer to classes no longer taught or problems that have been addressed in previous years. Note also that EE and CE responses are not differentiated; they will be in the future.) Figure 3 shows the grads’ rankings of how well we covered outcomes a-k (l, m, and n will be added next year). The lower ranking items (below 4) are c (design a system, component, or process to meet desired needs), d (interdisciplinary teamwork), f (understand professional and ethical responsibility), g (communicate effectively), h (understanding the impact of engineering solutions in global and societal context), and j (knowledge of contemporary issues). This seems consistent with the fact that these outcomes (aside from c) rank 5th, 2nd, 6th, 4th, and 2nd lowest in the number of course outcomes addressing the topics (Figure 1). Faculty evaluation of how well the students achieved these outcomes ranged from 1.0 to 1.4 — a bit on the low side; the average over all outcomes was 1.3.

The most common positive comment was that the students appreciated greatly the labs, hands-on experience, and projects tied to real-world problems. Students also appreciated the enthusiasm and helpfulness of (most of) the faculty. The interviews showed that 16 of the 28 students completing the forms were intending to go to graduate school (this may reflect fewer job offers). On the negative side, the heavy workload came up again.

Several students commented that the Junior Design course was a problem and was not coupled to Senior Design; this course was revised significantly for 2001-2002 and the reviews (as noted above) were much better. Other comments requested more competent TAs for upper division classes, another full-time advisor, and more involvement of undergrads in research projects.

3.2 On-campus recruiters

Regarding the on-campus recruiters, recruiters were asked regarding design experience, problem solving skills, knowledge in engineering, multidisciplinary experience, preparation for the interview, oral and written communication, computer skills, and resume preparation. Averaging the scored responses of the interviewers, scores were near 4 out of 5 in all cases. The lowest average scores were in multidisciplinary experience and resume preparation (3.73 and 3.63, respectively), and the highest average scores were in preparation for the interview and knowledge in engineering (4.42 and 4.25, respectively). On this scale a “4” represents “above average,” while a “5” represents “excellent.” Since most scores were above 4, at least some recruiters were giving “excellent” responses. The overall score given by the recruiters of the students is a 4.1 — above
“above average.”

On this scale, it is perhaps the outliers which are most interesting. We received a “below average” from two recruiters in the area of multidisciplinary experience, and “below average” from one recruiter in design experience. These occasional low responses indicate that there is still need to continue improvement. Strengthening the senior design project will help address any perceived deficiencies in these areas.

Regarding specific comments, most recruiters indicated that our program objectives are appropriate to their needs. Some recruiters mentioned some industry-specific needs that they might be interested in (but we can’t meet every one of those needs), but most felt quite comfortable.

3.3 Industrial advisory committee

From the IAC (industrial advisory committee) we get ongoing encouragement. They generally endorse what we are doing. They do continually mention a need for more interdisciplinary work.

3.4 Alumni reports

The Spring 2002 survey of alumni three years after graduation (summarized in figure 4) requested ratings of how our program fared on outcomes a–k (items l, m, and n will be added to the survey in future years). All outcomes except h (understanding the impact of engineering solutions in global and societal context) rated good or excellent; h came in just under good, and the next lowest outcomes were g (communicate effectively) and j (knowledge of contemporary issues). This seems consistent with the fact that these outcomes rank 2nd, 4th, and 5th lowest in the number of course outcomes addressing the topics (but their scores — 1.3, 1.3, and 1.4 — are at or above average). Outcome f (understand professional and ethical responsibility) was tied for second lowest in outcomes and received a rating just above good from the alums.

A comparison of the Exit and Alumni interviews shows that alums felt better about their design, multidisciplinary training, and knowledge of contemporary issues than the graduating seniors, but worse about understanding the impact of engineering solutions in global and societal context. All of the responding alums were engaged in some type of professional training, ranging from in-house seminars through external courses to graduate degrees. The alums felt our program objectives and outcomes were generally appropriate.

It is interesting to compare the scores from the graduating seniors with those of the alums. In most categories, the alums’ scores are higher than the graduating seniors. One reasonable interpretation of this is that the seniors here have no strong basis for comparison, but after being in the field for a while, they begin to appreciate the strength of the degree they have. We hope this is the case! (Another interpretation is that
we used to teach better, so the alums have better scores; and the graduating seniors have lower scores. This interpretation seems unlikely, since it is perceived achievement of the outcome that is being scored.)

Several alums mentioned that they would have appreciated more work on teams — particularly multidisciplinary teams with non-technical members, such as graphics artists and business types. Other suggestions included: more work on design for testability and marketability (noting that the optimal design is not always needed), experience in project scheduling and documentation (an interesting comment, since this is hit pretty solidly in our senior project sequence), and added material on professional ethics, societal impact, and contemporary issues.

![Figure 4: The degree to which 3-year alums felt they attained electrical engineering outcomes](image)

4 Review of the assessment process

The assessment process is designed to be helpful to the overall process of teaching, without being an undue burden on the faculty who are doing the teaching (as well as the research, the advising, the proposal-writing, the committee-working, etc., etc.) We think that the procedure is generally quite effective.

In regard to the process, we have a few suggestions to make in its implementation. Currently, there is no fixed deadline for the end-of-semester course assessment reports to be turned in. There is usually a significant delay, because reports are held until the student evaluations are returned from the university system, which could take many weeks, or even months. The delay is problematic in at least three ways. First, if the course is taught again the following semester (say, Spring semester after Fall semester), the assessment is not on hand to provide feedback to the professor. Second, as time passes, memories of significant issues may fade. Third, we have had the experience of a faculty member moving to another institution without completing the assessments. This makes it hard to get the information.

We therefore recommend that an initial assessment be prepared and turned in with the final grades from the course. This will reflect immediate concerns, provide timely feedback if necessary, and make sure that the job gets (mostly) done. Later, when student evaluations are returned, a final assessment is put together. This may benefit from some reflection time, and the student input. This does represent somewhat more work, but in most cases will be an addition to the initial assessment, not a complete re-working.

The yearly assessment report must be completed in time to be discussed at the Annual Faculty Retreat (held in August).

Another recommendation is to actually make sure that there is follow-up: professors teaching a course should take the time to review the written assessment from the last time the course was taught, as well as
converse with the last professor.

Another minor change is to make sure that the question of prerequisites addresses the level of preparation of the students, and not simply the catalog prerequisite listing.

4.1 Other aspects of assessment

In addition to the assessment process applied to each course each semester, there is a departmental undergraduate assessment committee that meets regularly (about monthly) to address issues relating to the undergraduate curriculum. Some of these issues are perceived as part of the formal assessment process, and some emerge simply as a result of the teaching process. We always are evaluating what we do, and we always have been! As an example of some of the recent issues that have been addressed by the members of the committee:

The Freshman course Should we have such a course? How should it work in with transfer students? What should the content be? Should there be content? Should it cover CIL requirements?

The communications sequence Moving 4660/5660 to 5660/6660 and changing the first to a technical elective was recently discussed and approved by the committee.

The electronics sequence There is a need to strengthen the electronics sequence, both to reflect industry needs and to work better in conjunction with the VLSI offerings. We are discussing this (but have not settled yet on our course of action).

Digital design gap Since 3530 was moved to 5530, students may feel that they have no digital design courses in the junior year. 5530 can be taken in the third year, however, by those who have completed 2530. Students should be advised (and it should be placed on checksheets) that 5350 can be taken as early as the third year.

Changing courses to one time per year In the interest of helping lighten faculty work loads, it is contemplated to change some courses which are currently offered twice a year to have once-a-year offerings. The courses under consideration are ECE 2410, ECE 2530, and ECE 3410. For many reasons, the former two will still be taught twice, but 3410 will be changed to once a year.

Probability Under quarters, the ECE department taught its own probability course. With the switch to semesters, the responsibility was given back to the math department (the primary reason being that there was concern that the number of hours of math/science credit would not otherwise meet ABET requirements.) However, it has not been viewed as being successful. We have ongoing discussion about recovering the course, and tailoring it to better suit engineers’ needs.

5 Changes required

In the course of reviewing the course assessments, some items requiring change have been noted. Some changes are already underway; others are noted here for additional follow-on.

5.1 Changes in program objectives and/or outcomes

At a programmatic level — affecting potentially many courses or sequences, the response external reviews indicates a need to more thoroughly address the following outcomes in our curriculum:

- d – multidisciplinary teaming
- f – understand professional and ethical responsibility
- g – communicate effectively
- h – impact of engineering solutions in global and societal context
- j – knowledge of contemporary issues
As there is currently no “slack” in the curriculum, improvement in these areas will probably be by incremental advances — spreading the concepts across courses and discussing implications of these technical topics as they are introduced.

Since 1999 we have been increasing our effort to provide multidisciplinary teaming experiences. These have been implemented in the joint ECE/MAE controls course (ECE 4310) and in the Junior Design course (ECE 3820). Not all students enroll in ECE 4310, and Junior Design has not been dealing with projects that run to implementation. We need to look at expanding the multidisciplinary experience to all students; at the least, we should be able to find some solid EE/CE projects that address distinct problems.

Regarding the design preparation, feedback from external reviews is mixed — some rated it very high, while others not so high. This could simply be a matter of individual record. (For example, a recruiter might have talked to a student who produced a weak senior project, but whose other course-based design would be otherwise adequate. Or it may be a reflection of the elective courses taken by a student.)

We have long had discussions about increasing interdisciplinary teaching. We appreciate the need, but haven’t yet found the proper way to address the problem. With regards to particular courses and sequences, we have identified the following areas:

- Transmission line course: Make sure it gets evaluated, and placed on a somewhat firmer footing relative to the expectations in the course.
- Microwave/EM courses: ECE 5490 (Radar I), 5810 (Microwave engineering I), 5820 (Microwave engineering II), 5850 (Antennas I), 5860 (Antennas II), 5870 (Wireless communications), 5880 (Wireless communications laboratory): There is a burgeoning swell of courses. The placement and sequencing of these courses needs careful evaluation.
- Electronics: Evaluate what is taught in 3410 in light of industry needs, and in light of follow-on classes. Evaluate what should be taught in 5430, in conjunction with connections with VLSI, and needs for other areas such as communications.

5.2 Changes required at the sequence/course level

- As an across the board consideration: In many of the courses, students complain of too much homework. This is not a new phenomenon in engineering — we have all been there and done that. But we need to realistically evaluate whether the complaint has merit. There are many courses offered with projects as a primary means of assessment, and a project can easily grow to gargantuan proportions.
- Freshman engineering course: A high proportion of our graduates are transfer students. As a result, we need to make sure that what we offer is generally compatible with transfer students. If we put too much content in the freshman course, we have to address what to do with transfer students. If we put too little content, we are wasting students’ time. How should CIL considerations be addressed? What do we really want out of the freshman course, particularly in light of recruiting interests?
- There is currently a feeling that lab facilities are generally adequate, with some exceptions (for example, lab equipment for the acoustics courses). However, TA support is consistently regarded as critical to the success of the program. How can we address the need for additional TAs?
- Address the probability question: Should we teach it? Identify outcomes. Also, can we strengthen the use of probability in other courses? If so, we will need to displace something else to find effective time for it. What would be displaced? From where?
- Is there any way to strengthen the students prior to 3620? Or is it, in fact, the course where the necessary muscles are gained for the courses that it leads into?

5.3 Other issues for change

- Catalog description: Make Math 2250 be co-requisite with 2410.
- Catalog description: remove ECE 3160 (transmission lines) from the catalog
- Catalog description: 5480 list prerequisites
• Catalog description: Combine listing for ECE 3620 and 3640; slightly modify description (for more flexibility in teaching and cohesion in description)

• Catalog description: 3620 (circuits and signals) should be a co-requisite for 3410 (electronic systems), and not a pre-requisite. (Under the new one-a-year teaching schedule, it is not possible for it to be a prerequisite.)

5.4 Changes required in the assessment process

• Overall, professors need to understand the intent of the assessment question about prerequisites: What is needed is an indication of whether incoming students are generally adequately prepared. This provides a measure of feedback about the prerequisite classes. While the statement of course entrance requirements (e.g., from the catalog) is helpful, it is the students’ preparation that is primarily sought in the course assessment.

• Make sure that transmission line course gets student evaluations.

• Recommend that an initial assessment be turned in with the final grades for each course, rather than waiting until student evaluations are available.

• Recommend that each professor review assessments as part of the preparation for each class.