

Electrical and Computer Engineering Department
Annual Assessment Report
2006–2007

1 Introduction

The Electrical and Computer Engineering Department stands at a significant crossroads among many shifting currents. In recent years the department has enjoyed usually increasing enrollments and appears to be appreciated at the state and university level for potential contributions of its graduates. This has enabled the employment of new faculty. This has been a good year for state funding of higher education. Through all of this, however, there is a slow erosion over the years of state support and a competitive need to rise higher in national rankings, both leading to increasing exigency for externally-funded research. While there has been enrollment increases in recent years, enrollments this year have taken a downturn. There has also been significant faculty turnover in recent years (having lost three young faculty in 2005, and another in 2004, with some other recent acquisitions), leading to pressures on the department: there are fewer experienced teachers; new faculty are under pressure to achieve tenure; and the more senior faculty must mentor and evaluate the younger faculty. This year we have also initiated remotely-delivered graduate level courses, as well as stepped up our efforts in international graduate recruiting.

We have opportunities now, with the new and still-coming faculty, to make bold steps that will significantly strengthen the department. Our professional satisfaction and student success depends upon us emerging strong and competitive on the regional, national, and international arena.

Traditionally the assessment committee has been charged with overseeing the assessment for the accreditation process. (Sources of data for the assessment are described in section 2.) However, this year a broader range of issues are presented for discussion. Many of these are a result not of formal data gathering procedures, but by discussions among the faculty. Not all of these issues can be resolved by the assessment committee (nor by any committee) in the coming year, but by placing them here they serve as reference points for future discussion and work. The questions are asked not so that immediate answers may be obtained, but so that we may keep them in mind as we shape the direction we move. The following subsections present a laundry list of topics that have arisen in discussions among the faculty and with the students.

2 Assessment mechanisms

The assessment committee is responsible for gathering information regarding the undergraduate curriculum and teaching in the Electrical and Computer Engineering Department. Formal sources of assessment information include:

- The Industrial Advisory Committee
- Alumni surveys
- Senior exit interviews
- Faculty course assessments
- ABET outcome forms for criterion (a)–(k)
- Formal visits with representatives from other departments
- Discussions among the faculty and with students.

The latter method, though informal, needs to be kept in consideration. Observations made by faculty or shared by students that will improve our program should be put in a context where effective changes can be made.

3 Issues under Discussion

In this section, we provide a menu of issues that have arisen from a variety of sources over the course of the year. Not all of these can be acted upon immediately, but the record here can stimulate further efforts at improvement.

3.1 Circuits Teaching

Circuits is the foundation upon which much of our discipline is based. Even engineers who are not designing circuits frequently need to rely on the mathematical/physical modeling framework learned first in a circuits class. For this reason, our circuits teaching needs to be rigorous, well-motivated, and thorough. We have seen different levels of skill emerging from different professors of the first circuits course. How can we achieve better uniformity and quality?

Are we getting enough circuits? After a first semester, we move into a circuits/systems course which covers much of the same material but with a different emphasis. Is this serving our needs? Would our students do better having more of the more traditional circuits background? Do we have too much signals emphasis at the undergraduate level? Are there other concepts that might be taught in the signals courses that would have fundamental applicability?

3.2 Technical Writing/English/Verbal Presentation Skills

The students and graduates have commented often on the need for more formal instruction in writing and giving presentations. We are in the rather peculiar situation of not having a technical writing course for our students. Students take English 2010, "Intermediate Writing: Research Writing in a Persuasive Mode," as a final English course, with no dedicated professional-level technical writing course. (The course in the catalog that seems best suited is English 3400, Professional Writing, a course that is limited to English majors only.)

The current writing instruction is obtained by getting feedback from English student reviewers on documents that students write for the Senior Project.

Is this adequate? Feedback from students and graduates suggest that it is not. How can we fit more effective English instruction into our curriculum?

3.3 Additional Physics

We have sought to provide our EE students with additional physics to prepare them for work in the semiconductor industry, as well as other areas such as sensor development or space. The current class, taught by physics, has been assessed at Senior Exit Interviews as being not very effective.

What do the students really need? Is there justification for more than one physics course?

3.4 Electronics

Some of the area industries which hire our students desire strong electronic design skills. Some of these industries hire our students for other purposes. We can benefit our students by preparing them with a strong electronics background. This is part of the motivation for strengthening the physics classes. We are becoming well positioned to provide the kind of instruction the students need, with Chris Winstead and Paul Israelson on the faculty.

Is the course sequence well designed to take advantage of this strength? Are there other courses that should be in place? Are the individual course sequences providing what students will need to know?

Information regarding what is needed must be obtained from the constituents, in this case companies that need to hire engineers with these skills.

3.5 Teaching practices; PowerPoint

There is a growing frustration among students regarding teaching using PowerPoint. Some discussion about best practices is warranted: when is PowerPoint appropriate? What types of material are best presented by PowerPoint?

3.6 Coordination with Industry

There is much that could be gained from the University side by improved coordination with industry. Students gain access to co-ops, internships or other worthwhile employment. Senior project ideas and/or support opens up. Even research possibilities open up.

To the extent that the University is responsive, there is also much to be gained by companies working with the university. Instruction can be tuned to better suit their needs, and students can emerge prepared to be more productive faster.

The geographical isolation of USU puts it at a disadvantage relative to other universities (e.g., UofU or BYU) in the region with regard to local industry. USU is also at a disadvantage in comparison with schools in more metropolitan or industrialized areas. There are a few local industries that employ engineers, but certainly not what would be available in more metropolitan areas. Moving somewhat further afield, there are industries that continue to hire from USU,

such as Micron, HP, L3, or AMI, but for whom we have no geographical advantage. It thus behooves us to aim to be particularly responsive to their employment needs to overcome the geographic disadvantage. This may require visits to their locations, discussions with their managers, and so forth, with an expressed willingness to meet their needs.

One local industry that we do have (and given the current business and legal arrangements, it should be regarded as its own business and not part of the University) is SDL. Because of all the advantages that can come to our students and to the University, we need to continue to be responsive to SDL, finding ways to cooperate and share.

3.7 Probability Course

For years we have had a discussion about whether to teach our own probability course. Under quarters we taught it. With the shift to semesters and modifications in ABET, we moved probability to the math department. We continue to have comments from students about the content and its applicability.

This is a course that can be both fun and applicable, if taught with the appropriate emphasis.

With more faculty hires on the horizon, we are getting to the point that teaching probability ourselves again becomes a viable proposition. Furthermore, there are assurances from ABET that we can fill math/science requirements, even if the course is taught in our department.

While the math department would probably have grief over this (because of the students they would lose in that course), we need to address first the needs of our students.

3.8 Math courses in general

Do the math classes meet the students needs?

Currently the math department is taking another look at calculus, in part to be able to coordinate teaching among the universities. Calculus is probably generally fine, but students feel the absence of application.

Is the single course on differential equations and linear algebra sufficient? There seem to be deficiencies in linear algebra. Students emerge neither with core understanding (e.g., vector spaces) or the ability to effectively compute with linear algebra.

Can we return to the separate class mode, with a class for differential equations and a class for linear algebra?

3.9 Technical electives

Our program is very rich in technical electives, with hardly any courses required at the senior level. One reason given is that this provides population for our senior/graduate classes, allowing them to be carry and providing potential research students. Is this sufficient reason? Can we rely on students to have the maturity to select courses with long term benefit? Should there be a swing back to more required courses? Should we eliminate some of these choices in favor of other courses such as English or more math?

3.10 Foreign vs. Local Recruiting and Support

Students have commented, both in Senior Exit Survey and in other settings, of a perception that preference is given to foreign students in financial aid for teaching assistantships. This perception generates resentment: Why should we bring in unproven (and probably less prepared) students in preference to those good students that we know? Why is it better to recruit internationally than locally, particularly if the stated primary goal is to grow the graduate program (without regard to source)?

We need to both counter this perception, perhaps with a discussion about how financial support is provided, and to continue to recruit from among the best students we have available to us.

3.11 Junior Design and Software Engineering

Students have commented that there is significant overlap between Junior Design and Software Engineering. To some extent, this may be unavoidable, since some elements of the design process are discussed in software engineering, and electrical engineers do not take software engineering. But if the courses are well taught, the overlap should be minimal. Is software engineering doing what it should? Are we pushing the students hard enough in this course?

Junior design is also stumbling in its current form, combined with mechanical engineering. Are there other ways that we can provide a multidisciplinary experience?

3.12 Gap between pre-professional and professional courses

Students have commented on the gap between pre-professional and professional courses. This may depend on who the students have for circuits, as a primary pre-professional course.

It is well established that the junior-year courses are difficult; this is necessary since they form the heart of our technical curriculum. If there is a gap, and it is to be narrowed, it must be done by raising the level of technical content and expectation of the pre-professional courses, both within and outside the department.

3.13 ECE Department Storefront

The contrast between the new engineering building and the engineering lab building puts the neighborhood of the ECE Department in dismal comparison. While the department office itself has a new, modern, attractive look, the exterior doors and hallway and ceiling lights leading to the department look, frankly, shabby. There has been some discussion of finding funds for improvement. Progress needs to be made in this direction.

3.14 PCB layout experience

Comments from the students indicate a desire for more experience with practical implementation in the form of PC board layout. While this is more a technician skill than engineering, in some employment it may be valuable.

Presently students in ECE 3710 build a microprocessor using wire wrap methods. This design could alternatively be done using PC boards, which would lead to faster construction in addition to the layout experience.

This possibility is enhanced by new web-based businesses that provide PC board fabrication at low cost.

This possibility should be further pursued.

3.15 Programming

A fundamental problem is that the two-semester course in programming is taken during the freshman year. For many (if not most) of our students, this is followed by a two-year LDS mission. Most electrical engineering students will not have any programming experience in their classes the first year they return. It is not until their junior year (3620/3640 and 3710) that they have opportunity to program again. By this time, students seem overwhelmed and floundering.

Discussions with a representative of the CS department (Dan Watson, Aug. 27, 2007) who has taught this course, and whose background is in electrical engineering provide reassurance that, as a whole, the CS sequence seems to be covering the right material. The first semester is devoted to fundamental programming concepts (essentially, the “C” part of “C++” — variables, control structures, etc.), while the second semester moves on to classes, file operations, and elementary data structures (lists, trees, queues).

In the course of the discussion with Dan Watson, a few suggestions were made to improve student’s understanding. First, a discussion of the calling mechanism — how are variables passed when a function is called. Second, a discussion of where variables occur in memory when they are declared (specifically, that automatic variables are put on the stack; this has ramifications when large arrays are declared). And third, a discussion about the sizes of variables, chars, ints, etc. Dan indicated that he would pass this information along to the other teachers of this material.

The major issue, though, is the retention of the programming skills between the time the students learn it and when they get to use it again.

3.16 Off-campus programs

A program is underway to bridge the gap between the EET training at Weber State and electrical engineering courses. We will need to make sure that these courses also undergo assessment.

International degree programs, sharing teaching with international schools with research performed at USU, are also being started. Our teaching standards must be maintained.

3.17 Freshman Course

Does the freshman course provide both the enticement to the profession and a solid introduction that will serve the students through the rest of their program?

3.18 Computer engineering degree

There continues to be a need to upgrade, modernize and solidify the computer engineering degree. Brandon Eames was charged to carefully examine ECE 3720. The question of course content, and the degree to which assembly language needs to be worked, have been addressed. His results were presented at the August department retreat. He has also looked at ECE 3710.

3.19 Faculty Issues

The new faculty raise several issues. For the long-term development and stability of the department, it is important that we retain good faculty. This means that they must be given full opportunity to develop their research programs, even though that limits their ability to do curricular development.

An increasing amount of our teaching is carried by lecturers, who don't have the burden of tenure requirement laid on them. With the absence of research, are they sufficiently stimulated, stimulating, and up-to-date in their teaching? Are they treated as fully participating members of the faculty?

3.20 Senior Design Series

There are many issues relating to senior design that bear examination and improvement. Many schools have a regular program of sponsored senior projects. We have examined this in the past, but it bears re-examination.

We have one course, ECE 5770, that provides a measure of direction in the senior project. Students appreciate this, and it produces generally good projects. Should this concept be expanded to other senior projects?¹

The current Junior Design class is also reported to be problematic. In the interest of creating a multidisciplinary framework, this class is held with Mechanical Engineers. The EE students feel that the class is too light weight, and there is a mismatch in preparation between the two departments. Should the senior project be reconsidered? Can we achieve a multidisciplinary setting in other ways?

There is some student resentment about the amount of time faculty spend on research, at the expense, they feel, of effective teaching time. Increasing involvement of undergraduate students in research will help them understand what research is, and lead to superior senior projects.

3.21 Safety/Ethics Exam

There is currently an online exam on safety and ethics. It has been in place for several years. Does it need updating?

3.22 TA Training and Assessment

TAs and graders are usually thrown into the job immediately, with no training. Inattentive lab TAs have been observed by the faculty. There is no reason to expect uniformity in grading, or an understanding of grading standards. Do we need a TA introduction class? (Math has as course for graduate teaching assistants; maybe something similar is necessary for us.)

3.23 Coordination with other schools in the state

One of the issues that we face is how to coordinate what we teach at the pre-professional level with teaching at other schools in the state. Any changes that we make at that level have a system-wide implication.

3.24 Positioning relative to neighboring institutions

In many ways we compete with UofU and BYU for students. What can we do to position ourselves in the most competitive posture so that we attract the best possible students? Many students go to BYU for BYU's reasons, which we cannot quite achieve. We are also at a geographic disadvantage relative to UofU, since it is closer to population centers. We must be that much stronger to be competitive.

We also compete with established major equipment infrastructure at these institutions. Both have some fabrication facilities. Should we explore such acquisitions ourselves? This would require closer ties with semiconductor industry than we currently have. It also brings expenses associated with operation and maintenance. How could these be obtained.

¹ Starting Fall 2007, the 5320, Spacecraft System Design class, offered senior project credit for projects in that class.

3.25 Space-related efforts

For years USU has been known for its strength in space operations. This has led to marketing efforts as a “Space Grant University” featuring posters at airports. It is almost a trademark of the university.

However, for a variety of reasons there has been increasing distance between USU and SDL. At the college and department level there is a decreasing sense of support for space related efforts, including a very small number of faculty working in this area.

Is the university committed to maintaining its role as a space grant university? Are there benefits to this? Or is it time to move on to the “next big thing”? (whatever that may be). If the role of space grant university is important, what can be done to strengthen the space grant status, making it so in fact and not just in word?

3.26 Optics?

Should strength in optics be developed? Current strength draws from the physics department and sometimes SDL. Several faculty have expressed a need in this area, but no hires have been made.

3.27 Math fundamentals review

The college has initiated a math fundamentals review program, for people who have been away from the institution for some time, or who feel the need for reminders. Is this working?

3.28 Alumni connections

One of the students commented on the importance of professional “networking.” It is clear that having a network of connections can help students find employment, or find products or services that would help. There are no current efforts on the part of the department to develop alumni relationships. Should there be? Should these be worked at the college level?

3.29 On-campus promotion

Is there anything that can be done to promote our department on campus? Is there a way to get the message out about what engineers do, why it is worthwhile, and why students might want to join us? Some efforts at local recruitment should not cost much, and for the money invested may have a big payoff.

3.30 Increasing women in engineering

There is another vast pool to draw from for recruitment purposes. It is widely recognized that women are under-represented in engineering. Our department stands below the national average. Is there a way to get the message out to women, including those who are already on campus?

3.31 Use of Solutions Manuals; Cheating

In virtually all of the classes we teach, solutions manuals are available over the internet, and using solutions manuals as a homework “aid” is increasingly prevalent. What steps can we take to discourage inappropriate use of solutions and encourage students to dig in and solve problems for themselves?

Cheating may not be rampant, but it does take place. How can we discover when cheating occurs? How can it be reduced?

3.32 New Directions

With several faculty positions open, we have the capability to move in new directions as a department, to introduce new areas of research and strength into our department.

In contemplating new directions, some caution is necessary. Due to the perceived difficulty of obtaining tenure, we have tended to hire in areas where we already have something going, so that new professors will have mentors and teammates to work with as they build their program. Someone hired in a new area might not have that mentorship.

On the other hand, if all we hire are faculty in areas where we already have strength, then how will we acquire, as a department, fundamentally new ideas?

On a strategic level, then, how much should we be looking for faculty in new directions? What new directions would be desirable?

4 IAC Input

The IAC met on November 10, 2006, and on February 23, 2007. Minutes are on file in the department office. In highlight, the following topics were discussed:

- New faculty
- Engineering state
- UStar
- USU IP policies
- Distance learning and globalization initiatives
- Anderson wireless lab
- ABET/senior project evaluation
- teaching evaluation
- Research by Brandon and Reyhan
- Strategic planning

Members of the IAC were also present on campus to help with the senior project evaluations.

5 Results from Alumni Survey

The alumni survey for 2006 is in appendix A. We have mapped the questions on the survey to the objectives used in 2006. These objectives are:

- **Education in the fundamental sciences and mathematics that underlie engineering with a general breadth and depth in engineering analysis and design;**
- **Awareness of current technology and the fundamental background to be able to stay informed and adept at new technologies;**
- **The ability to put ideas into practice through effective analysis, problem solving, requirements development, design, and implementation;**
- **A broad awareness of the world around them through general education so they are prepared to achieve their potential and make contributions in their professional and personal lives;**
- **The foundation of communications and teamwork skills and professional attitudes and ethics.**

Tabulated results indicate number of outcomes from question rubric (1 = no/never/not at all, 5=yes/always). All written comments are also presented. In the summary tables below, electrical engineering respondents are on the left side of the double line || and computer engineering respondents are right side.

The mapping from the questions to the objectives is as follows:

Objective 1: Questions 6, 18

Objective 2: Questions 7, 8

Objective 3: Question 9 (which contains four questions)

Objective 4: Questions 10, 11, 13

Objective 5: Questions 14, 15, 19

Number of surveys requested 40

Number of surveys returned 12

EE vs Comp Eng. 8 EE; 4 Comp Eng.

Year of graduates 2003.

Working in EE or CompE professional area: 11.

Q6: Preparation in fundamentals

1	2	3	4	5	6	7	8	9	10	11	12	avg
3	4	5	2	4	5	4	5	3	4	5	5	4.1

“It is fine for a digital designer or an embedded systems programmer, but for EM or device level or optics/quantum behaviour it doesn’t measure up.”

Q7: Learn how to learn

1	2	3	4	5	6	7	8	9	10	11	12	avg
3	4	4	4	3	5	4	3	5	5	4	5	4.1

Q8: Right out of the box

1	2	3	4	5	6	7	8	9	10	11	12	avg
3	2	3	4	3	3	4	4	4	3	4	4	3.4

Q9: Problem solving

1	2	3	4	5	6	7	8	9	10	11	12	avg
4	4	4	5	4	4	2	3	4	4	4	5	3.9

Q9: Requirements development

1	2	3	4	5	6	7	8	9	10	11	12	avg
3	3	4	4	3	4	4	3	3	4	2	5	3.5

Q9: Design; creativity

1	2	3	4	5	6	7	8	9	10	11	12	avg
2	4	3	4	4	5	4	2	4	2	4	4	3.5

Q9: Implementation

1	2	3	4	5	6	7	8	9	10	11	12	avg
1	2	4	3	2	3	2	2	3	2	4	4	2.7

Q10: General education and the world

1	2	3	4	5	6	7	8	9	10	11	12	avg
3	1	3	3	3	4	5	2	4	4	2	5	3.2

“French literature coursework that I had was helpful, but my ‘general education’ has occurred after my undergraduate as I realized how lacking in substance it was.”

Q11: Choice of general ed Note: Scores reported are complemented with respect to 6, so higher is better.

1	2	3	4	5	6	7	8	9	10	11	12	avg
2	4	4	2	5	3	5	4	3	1	3	5	3.4

“I would not let my major keep me from taking other classes I want even if they do change the program and only give us 4 weeks notice to rearrange our schedules”

“I’d rather have more of a structured curriculum in the classic liberal arts. ‘Gender studies’, English composition, Carribean literature are all fluff compared to classic Greek thought.”

Q12: More or less Gen Ed?

1	2	3	4	5	6	7	8	9	10	11	12	avg
2	1	2	1	2	2	2	2	2	1	2	3	1.8

“What would we cut back on ? We don’t get enough of the technical.”

“Although I would not have said that while taking gen ed classes.”

Q13: Achieve potential

1	2	3	4	5	6	7	8	9	10	11	12	avg
2	5	5	5	3	4	5	4	4	4	3	2	3.8

“Without the university experience at USU and beyond I would not be who a I am today.”

Q14: Preparation for interaction

1	2	3	4	5	6	7	8	9	10	11	12	avg
5	3	2	3	4	4	3	2	3	2	4	4	3.25

“It did a good job of this, especially with IEEE and undergrad research with SDL and the professional environment there.”

“Need more networking not reputation”

Q15: Written and verbal communication

1	2	3	4	5	6	7	8	9	10	11	12	avg
2	3	5	2	2	3	4	3	4	4	3	3	2.9

“More technical writing”

“Mandatory English classes for engineers or engineering related/verbal classes.”

“More presentations to smaller groups. More consistent with work experiences.”

“Technical writing instead of persuasive and research papers.”

“Better professors, less general education, more real world problems.”

“More emphasis on teaching & doing, less on research. The professors are usually stretched way too thin. I’d like to see dedicated teaching professors. Also, build PCBs, not just breadboard circuits. PCB design is a major piece missing from my education.”

“There was not a lot of meaningful writing education as an undergraduate. I received much more as a high school student in AP classes and as a graduate student writing papers. Nothing I wrote technical was subject to *enough* scrutiny.”

“More teacher/student interaction”

“Instructors should insist on proper writing skills, formats, etc. and major industry paper formats should be taught (e.g., IEEE).”

“More professional level projects”

Q17: Things to improve on OK as is (5); more physics (3); more programming (3); more math; more English (2); more business; more electronics (2); more digital

“VHDL instead of Verilog may have been better.”

“More business ethics”

“Young engineers have the most recent exposure to programming so they are often asked to do programming.”

“Compared with the European system, our basics are shaky. Our graduate math courses are their prep courses before engineering. A classic EE math course of study is not adequate for real graduate studies. [English] not from the English department. We need true technical writing.”

“More flexible for combining majors and minors”

“*Semiconductor physics*”

More “technical application” i.e. design and layout of PCBs.

Q18: Comparison with peers

1	2	3	4	5	6	7	8	9	10	11	12	avg
-	3	4	3	3	3	5	4	4	5	2	4	3.4

“All others from other places have several years experience so they are not good comparisons”

“I had hands-on experience as an undergrad that was better because undergrads at USU do masters things and masters students do PhD things because PhD students don’t exist.”

Q19: Contributions to society

1	2	3	4	5	6	7	8	9	10	11	12	avg
4	4	4	4	4	4	4	3	4	3	4	5	3.9

“I think it is a great education for someone who is not headed for grad school. Maybe I should have dual-majored in math had I known the holes I’d see in my education as a grad student.”

Q20: Best things “Being done with it”

“Approachable instructors who try to help students individually despite pressures to do research, publish, etc.”

“Learning how to think, and think well.”

“It was small enough that undergrads are noticed and conduct real research. The environment was friendly, but hostile between students.”

“The variety of courses within ECE that weren’t part of the core curriculum.”

“Certain professors seem to genuinely care about your success, particularly Dr. Bose, Dr. Gunther, and Dr. Budge.”

“Senior design, extracurricular program (i.e., SDL); labs”

“The ability to pursue interests”

“Great professors who care about the students”

“ECE 5770 — upper level real world use of everything for a project.”

“Great theory teaching, good knowledge by professors.”

“The time in the labs doing things hands on”

Q21: Changes “By the time I found my interests, I graduated. With so much to learn I don’t know it could be different.”

“Hire better professors”

“I feel that theory is taught strongly, but there is a big lack in teaching how these theories are applied practically.”

“While in grad school I realized that professors are required to spend 95% of their time with research and 5% with students. I understand why this is so, but I don’t agree with it. Were a public educator to do likewise they would be considered negligent. A re-focus on teaching is paramount to ensure that USU turns out future good engineers. A teaching professor can develop extra-curricular learning opportunities for the students and turn out a better crop of engineers each year. Let them research educational methods. Also, encourage ECE students to take the FE!!!”

“Don’t waste our time with math courses taught by math professors from math books. Half a semester on probability with cards, but a week on random variables. Sophomore writing on essays, not technical writing. Programming on card games and tic-tac-toe, not numerical solutions of Diff. eqns. If we’re not going to have a real math education, then let’s not waste course time on math that doesn’t help an EE. A similar argument for the other out-of-department courses holds.”

“It would be nice to see EE (or CE for that matter) to be broken up a bit into several different focuses. At my first EE job, I needed to know a lot about motors and heavy duty control systems. I had no idea what a contactor was. At my second EE job I mostly do software and use the digital side of things more. It would be nice to say I had a specific focus, but I guess that is what the MS degree is for.”

“Theory should (almost) always be applied to real world application, demonstrating to students how the stuff they learn will be manifest outside of the classroom.”

“Prepare electrical and computer engineers to take the FE.”

“More labs in other classes.”

“Give more opportunities for internship networking, cater to the engineering companies. Micron ‘7’ just doesn’t cut it for all engineering students.”

“OK, enough. I had a great time at USU, and would recommend to any undergrad, but not to grad! Go Aggies!”

“More classes with an emphasis in design. Rather than signals and systems I don’t know hardly anyone who uses Laplace & Fourier transforms.”

“Have a smoother transition from Cmp E bachelors to Masters. Make students more aware of pre-requisites since almost none are required for CmpE BS.”

5.1 Discussion on Alumni Survey

Summarizing these scores as associated with the department objectives, we see the following:

- Fundamentals: 3.75
- Current and future: 3.75
- Design aspects: 3.4
- General education and world awareness: 3.5
- Communications and teamwork: 3.35

In each case, all of the objective scores are better than the 3 “average” score. This suggests that at some level we are achieving our objectives. But there is clearly room for improvement, both in the delivery of the education to raise these scores, and also to provide more incisive assessment of them.

Considering some of the particular questions, the following areas are most in need of improvement.

- Written and verbal communication. Currently the advanced writing is obtained as a result of the senior project process. This feedback, and the comments associated with it, suggest that a dedicated technical writing class would be in order.
- Implementation. This was the lowest score overall, which is surprising given that the students have commented on, and we strive to achieve, a hands-on experience. Given the nature of the comments, it would seem that the deficiency is in the area of PC board layout. Some students do this for senior projects, but there is no course that covers this. This has been regarded as technician work, not engineer work. But as frequencies move higher and higher, and as components move increasingly to surface mount, it becomes increasingly necessary to build even prototypes on PCBs.
- There is concern about the distraction that research is to the teaching operation.
- There is also a sense that the math is inadequate, without sufficient depth or applicability.
- While many students felt the program was “OK as is,” a need for more physics and programming seemed pretty strong.

6 Issues Observed from Senior Exit Interviews

There were many comments made from students. Here are some that seem pertinent at the departmental level.

- There is a strong feeling that the faculty are understaffed. Recent turnovers and need for restaffing is definitely felt, as is the fact that so many faculty are relatively inexperienced.
- Students commented about courses that would be helpful: computer engineering (computer and processor architecture), VLSI design, RF/EM circuits, etc.
- PowerPoint was denigrated again.
- Jump between pre-professional and professional courses was mentioned as being too high.
- Signals sequence was mentioned as being too hard. This may be related to the previous issue.
- Software engineering was viewed as being too much overlap with Junior design.
- Probability should be taught in engineering.

- There is a strong sense that the English is not doing the job. The Intermediate composition 2010 is not helping the students with writing, and there is no technical writing course to compensate. More emphasis on verbal communication.
- Curriculum was viewed as being too heavy on the theory; more application would be helpful.
- Advising drew some comments. Kathy Bayne’s was viewed as being too directed toward graduation requirements, and not enough toward students’ individual objectives.
- Professors need to become better acquainted with students in their classes, help them feel like individuals.
- On the positive side, nearly every ECE class was somebody’s favorite.
- Senior projects are deemed to be very valuable.

Students also entered about how they felt about the ABET (a)-(k) Outcomes. Average scores are as follows:

Outcome	Average Score (5=max)
a	4.33
b	3.84
c	3.94
d	3.78
e	4.11
f	3.78
g	3.67
h	3.72
i	4.22
j	3.22
k	3.94

All of these scored above “good.” There is still a perception on the part of the students that their knowledge of contemporary issues is weaker than other aspects. Effective communication and general education also rated pretty low.

7 Issues Observed from Faculty Course Assessments

In the following, brief summary information gathered from the course assessments is presented. In particular, if the information seems to be of a nature that the committee should be aware of this and/or act upon it, or if a commitment of resources could help improve things, then it is noted here. But if an instructor makes a comment relevant to in-class issues, it is not noted here. The intent is to provide a document that will help us close the loop in improving the process.

ECE 1000 (Baker) Course should be taught twice yearly.

Safety/ethics exam needs to be looked at again.

ECE 3410 (Winstead) Students prepared overly long lab reports, leading to time wasted and delays in grading lab reports. There should be department level discussion on lab reports, and training them to be efficient.

Need to have a linux-based circuit design lab.

ECE 3710 (Ovaska) Students had less knowledge of pnp and npn transistors than expected.

ECE 5630 (Gunther) This course was taught via the distance program to HAFB. Local students were well prepared, while the distance students had forgotten much of the fundamental material.

Students appreciated having a roadmap for the course. (Jake has demonstrated this kind of roadmap in our Fall 07 retreat. It was very effective.)

ECE 5750 (Eames) Students were not prepared with background material, due to the nature of the undergraduate preparatory courses (e.g., 3720).

This class would benefit from a lab component.

ECE 5780 (Eames) International students seemed less prepared for rigorous programming exercises. Possibly require them to take an introductory programming course.

ECE 5930 (Winstead) Students need better preparation at the 3410 level.

A linux-based circuit design lab is essential.

Students need instruction on unix os operations and etiquette.

ECE 6030 (Bose) Students appreciated being able to go back and review the class.

ECE 6620 (Budge) A couple students had not had the prerequisite material.

ECE 6670 (Gunther) Not all students had had the prerequisites, or had studied at other universities. Bringing everyone up to speed slowed the presentation and made covering some topics impossible. Will enforce prerequisites in the future.

A real-time radio project would significantly add to this course.

8 ABET a–k Outcomes from Classes

This year (2006–2007) we have initiated a program to obtain more direct measurements of the a–k outcomes. As explained in the document “Assessment Processes in the Electrical and Computer Engineering Department, Spring 2006,” specific assignments in several classes have been identified to provide measurement data on these outcomes. These do not provide the only means of measurement, since the classes have been mapped to the outcomes and we have assessments for the classes as well. But these measurements are more direct and hence, it is hoped, more valuable for assessment purposes.

Scores on these measurements are measured using a 0, 1, 2 scale: 0 meaning “does not meet expectation,” 1 meaning “meets expectation,” and 2 meaning “exceeds expectations.”

As this is the first year that we have been working with this system, there are several questions that have arisen. We discuss these here briefly.

One question that emerges from this measurement process is: What does it mean if the score for a student on an assignment is a 0? Certainly, for that assignment the student could have done better. Can the claim also be made that the student is completely lacking in that area?

On one hand, if all students were given scores of 2 on all assignments, this would indicate that the measurement bar is too low. If all students were given 0, this would either indicate that the measurement bar is too high, or that in fact the students were not provided with the tools to achieve the desired results. A mixture of scores is probably a good indication that the measurement bar is set about right. Having some scores that are low provides room to measure whether improvement is made over the years.

Another question that arises is exactly how to perform the evaluation. The original plan for many of these classes was as follows: students perform the designated assignment, then return their work. Rather than having the work graded in the usual fashion by a grader and/or professor, it was to be evaluated by the committee, resulting (it was hoped) in a more unbiased evaluation of the student. In the committee’s first gathering at the end of Fall semester, 2006, a sort of feeling of “what do we do with this stuff” arose: the professor who had created the assignment (Dr. Moon) knew what he was looking for. The rest of the committee felt out of place and not necessarily prepared to evaluate. This same feeling arose at the end of Spring semester, when several assignments were presented for committee evaluation. If the evaluation assignments are to be meaningful, they should not be trivial. They make use of specialized knowledge from the respective classes, which others on the committee are not prepared to evaluate. Thus, the committee evaluation become meaningless. Committee members may be less prepared make an effective evaluation than the teacher and assistants who are already involved.

Another problem that arose is the simple practicality of getting the evaluation performed in a timely way at the end of the semester. In a couple of the classes, the assignment was the last lab of the semester. It was difficult to get the committee together to evaluate the assignment, while lab books were being graded and students needed them back to study for final exams.

As a result of these difficulties, there is some amendment in the process. In order to make sure that the assignments are evaluated by someone who is qualified to make a judgment, the respective classroom assignments will be graded as usual. However, the committee provides some oversight, making sure that the assignment does in fact provide a measure of what is intended and that there is some measure of quality control. This actually has provided some useful information; in one committee assessment it was found that the grader had been far too generous, giving scores that

were much higher than the committee felt was appropriate. (For example, giving nearly a perfect score to a lab the committee felt merited a 0 on assessment.) The assignment was sent back to be rescored.

Another thing that was learned about this process is that the students must understand the importance of this: this is not just another assignment, or part of an assignment. The particular sub-items which are being evaluated need to be understood by the students. Probably the most important thing that can be done to improve the assessed results is more explicit communication with the students about this process.

Outcomes associated with one class was, in fact, evaluated by a committee. This is the senior project class. In this case, a jury, drawn largely from members of the department IAC, evaluated the outcomes on the basis of the senior project display, poster, report, and presentation. This provides a very direct and unbiased evaluation. Since we value a design-oriented approach in our curriculum, this effort by the IAC is appreciated and important.

The results for the different measures are tabulated below.

Class	Outcome	Number of evaluations			
		0	1	2	
3620 F	A	41	11	13	17
3640 S	B	48	6	26	16
3710 FS	B	51	6	18	27
3820 S	C	50	0	10	40
4850 S	C	56	0	21	35
3820 S	D	50	3	11	36
4850 S	E	54	0	22	32
3820 S	G	50	0	17	33
4850 S	G	56	0	7	49
3820 S	H	50	3	0	47
4850 S	H	56	0	9	47
3820 S	J	50	0	0	50
3410 S	K	24	0	5	19
3710 S	K	15	0	0	15
5530 S	K	8	0	3	5

Outcome I is assessed on the senior exit survey, where it received a 4.22 average score out of 5, and the CIL exam, which all students must pass in order to graduate.

8.1 Discussion of results

There is room for improvement in these scores. 3620, in particular, had several 0s, due largely to students not understanding the assignment. There are several components to the assignment, but only part of them have been selected as the measure of outcome A. Students should have had the ABET assessment tool handed out with the assignment, but were not. A similar problem exists in 3640.

For the senior project-connected results, students did well, but perhaps too well. Being jury evaluated, we can't claim bias on the part of the instructor, but perhaps the jury needs to be instructed to more stringent.

9 Recommendations from last year

Here is the response to the issues that were identified as significant last year. We have not dealt with all of them, but some changes have been made. The issues are expressed in SMALL CAPS and the departmental response to them is in regular (Roman) font.

- ASSESS IMPACT OF NEW PHYSICS COURSE.

STUDENTS ARE NOW REQUIRED TO TAKE THE PHYSICS COURSE. WE HAVE NO SPECIFIC INFORMATION YET ABOUT HOW STUDENTS ARE DOING IN THE PHYSICS COURSE, NOR HOW IT IS AFFECTING THE ELECTRONICS. THIS YEAR WE SHOULD BE ABLE TO GATHER SOME INFORMATION IN THIS REGARD FROM THE THE GRADUATING SENIORS.

After evaluating this both in terms of content and from student feedback at the senior exit interview, we are moving a new direction. This fall, Paul Israelson will be teaching a course in solid state physics to bolster the offering in the electronics area.

- **HIRE NEW FACULTY AND INCORPORATE THEM INTO THE PROGRAM.**

The new faculty hired last year are on their way. We have just hired Bedri Cetiner in the area of electromagnetics, and are attempting to identify someone in the computer engineering area. Additional searches are still underway.

- **RESHAPING THE COMPUTER ENGINEERING DEGREE.**

There have been discussions about this, but work is impeded by the need for more faculty, and the effort the computer engineering faculty need to make progress toward tenure.

- **KICK OFF THE NEW (A)–(K) SPECIFIC ASSESSMENTS.**

The new assessment process is underway. We have both been gathering information and learning how to improve the information gathering process.

- **REVISE ALUMNI SURVEY.**

This has been done, but is also ongoing.

- **ASSESSMENT OF DISCRETE MATH.**

In the senior exit survey, some students complained they had learned nothing; it was all a repeat of what they had learned in data structures. After some exploration among the students, it became apparent that there is one teacher in the math department that was teaching useful, interesting material and challenging the students, and other teachers were not. The math department head was contacted to commend him for the good teacher and to encourage him to continue to use the effective teacher for that class. (This also is good information for the effective teacher, since he can use our commendation when he goes up for tenure.)

10 Curricular/assessment work this year

Of the many questions that were raised in the first section, we have identified some particulars to work on this year.

- **Teaching practices:** We will push for a discussion of teaching practices at the faculty retreat in the fall.

Note: This was done at the Fall retreat (August 21, 2007). A discussion on effective teaching, peer teaching evaluation, and cheating, was held.

- **English:** Discussions have been initiated with the English department about how to shape a course more to the engineering students' needs. This dialogue needs to continue through the year. (It is complicated, because we need to coordinate with other engineering departments.)

- **Math courses:** We will be discussing having separate linear algebra and differential equations courses at the fall retreat.

This was brought up at the Fall retreat. Faculty were generally supportive. A discussion with the math dept. head indicates support for these classes. We will try to move ahead and make the change this year.

- **Programming.** A fruitful channel for discussion is open with Dan Watson of computer science.

- **Senior Design:** Dr. Wheeler is examining what we are doing, contemplating an overhaul starting with junior design.

- **Cheating.** This was discussed briefly at the fall retreat. More discussion and enforcement is needed.

- **Linux-based circuits lab.** A new 30-seat laboratory was put into place Fall 2007 semester.

- **Examination of computer engineering curriculum**

Brandon Eames was tasked with suggesting a modified 3720 syllabus. He presented his framework at the fall retreat.

The faculty as a whole have been challenged to suggest an alternative to what we are doing in 3710, possibly including PCB layout experience. This will address some of the concerns about implementation issues.

11 Refining our assessment process

There is need for ongoing change in the assessment process. Here are some directions we need to move.

- More insightful, probing questions in the alumni survey.
- In the (a)-(k) assessment initiated this year, we have encountered some awkwardness. It would be good to streamline the process. Near the end of the semester (when everything is already busy), it is difficult to gather the information we need.

A Appendix: Alumni Survey 2006

Utah State University Electrical and Computer Engineering Department Alumni Survey 2006

Whether you buy a toaster or a video camera, it seems that everyone wants to know how you like the product and the service that came with it. Ideally, this information is used to improve the product in the future.

Well, you paid a lot of time and money for an education from Utah State University, and we want to know how it went for you. We are not merely casually interested. We are charged by our accreditation board (ABET) to produce students who meet certain objectives — objectives which are defined *years after* graduation! We need to hear from you to see how well what we provided to you while you were a student here has served you in achieving our objectives that we hoped for you.

Here are the objectives — the long-term goals — that are established for the Electrical Engineering and Computer Engineering Majors.

The educational objectives of the Electrical and Computer Engineering programs at Utah State University are as follows: To provide graduates with:

- **Education in the fundamental sciences and mathematics that underlie engineering with a general breadth and depth in engineering analysis and design;**
- **Awareness of current technology and the fundamental background to be able to stay informed and adept at new technologies;**
- **The ability to put ideas into practice through effective analysis, problem solving, requirements development, design, and implementation;**
- **A broad awareness of the world around them through general education so they are prepared to achieve their potential and make contributions in their professional and personal lives;**
- **The foundation of communications and teamwork skills and professional attitudes and ethics.**

Please provide a thoughtful response to the following questions and return it to us in the envelope provided. Please circle responses as appropriate. Also, please feel free to add additional written feedback on the lines provided.

1. What size T-shirt would you like? **(M, L, XL, XXL None)**
(To say thanks for helping us out with this survey, we will send a T-shirt back to you if you send in this survey. We'll try to send the size you indicate.)
2. If you want a T-shirt, we will need your address to send it back to. (This means that your comments won't be anonymous.) Your address:

3. Were you an Electrical Engineering Major or a Computer Engineering Major?

Electrical Engineer Computer Engineer

4. Are you employed as an engineer or in an engineering-related position? Yes No

5. If the answer to the previous question is “no,” have you found that your engineering education at USU has helped you arrive at your current position? Yes No

6. Have the technical courses at USU equipped you with *fundamentals* in math and science appropriate for your current position?

1 = not at all 2 3 4 5 = very much

7. A technical education can be viewed as consisting of two parts: An ability to learn based on fundamental background, which allows you to adapt to new technology and demands by building on this foundation; and an immediately useful set of tools, which allows you to be effective and useful “right out of the box,” that is, immediately upon employment.

To what extent do you feel like the fundamentals you received helped you “learn how to learn,” so that you are able to stay informed and adapt to new technologies?

1 = not at all 2 3 4 5 = very much

8. To what extent do you feel like you had useful skills that your employers were able to use “right out of the box.”

1 = not at all 2 3 4 5 = very much

9. Please indicate the degree to which your education at USU prepared you with the following engineering skills.

- Problem solving skills: an ability to formulate a problem, determine a direction of attack, and proceed toward a solution.

1 = not at all 2 3 4 5 = very much

- Requirements development: figuring out what you will need in order to approach and solve a problem.

1 = not at all 2 3 4 5 = very much

- Design: Considering tradeoffs; employing creative ideas; making informed decisions.

1 = not at all 2 3 4 5 = very much

- Implementation: Understanding how to actually build or manufacture your solution.

1 = not at all 2 3 4 5 = very much

10. In addition to the technical classes, your education also had general education courses. To what extent have the general education courses that you took, and the habits of self education you may have acquired, helped you maintain an awareness of the world situation?

1 = not at all 2 3 4 5 = very much

11. Now that you are finished with your undergraduate degree and looking back, to what extent would you change the choices of the general education courses that you chose to take?

1 = not at all 2 3 4 5 = very much

12. Would you have wanted more general education courses, less general education courses, or about the same?

1 = less 2 = about the same 3 = more

13. To what extent has your education generally contributed to your ability to “achieve your potential.” That is, to what degree do you feel like your college education has helped you accomplish things in your professional and/or personal life that you would not have been able to accomplish without it?

1 = not at all 2 3 4 5 = very much

14. To what extent has your education at USU prepared you for interaction with other people in your professional life?

1 = poorly 2 3 4 5 = strong

15. To what extent has your education at USU provided you with appropriate written and verbal communication skills?

1 = poorly 2 3 4 5 = strong

16. How could the program be modified to further strengthen these skills?

17. Are there ways in which your education at USU could have been modified which would have improved your abilities to make professional and societal contributions? Circle all that apply

OK as is more physics more math more electronics more English
more digital more programming more EM more business more biology

Other (please specify): _____

18. Compared to your professional peers with similar education levels from other institutions, how do you feel the technical aspects of your engineering education compare to theirs?

very poorly weakly about equal stronger in some areas generally stronger
1 2 3 4 5

19. What is the extent to which your engineering education at Utah State University has helped you make contributions to your profession and to society.

not much a little some quite a bit a great deal
1 2 3 4 5

20. What did you like best about our ECE program?

21. If you could change one thing in the program, what would it be?

Thanks for your input!