Minutes of the Southeastern Association of Electrical and Computer Engineering Department Heads Meeting, November 10, 2006

Presiding: Mohammad Alam, Chair, Department of Electrical and Computer Engineering, University of South Alabama

In attendance: John Gowdy (Clemson University), Victor Debrunner (Florida State University), Gary May (Georgia Tech), Doug Williams (Georgia Tech), Sarah Rajala (Mississippi State University), Robert Barsanti (The Citadel), Shirshak Dali (Old Dominion University), Paul Devgan (Tennessee State University), Greg Murphy (Tuskegee University), Jeff Jackson (University of Alabama), Gregg Vaughn (University of Alabama at Birmingham), Issa Batarseh (University of Central Florida), Mark Law (University of Florida), David Russomanno (University of Memphis), John Kelly (North Carolina A&T University), Wesley Snyder (North Carolina State University), Lee Casperson (University of North Carolina at Charlotte), Samir El-Ghazaly (University of Tennessee at Knoxville), Daniel Fleetwood (Vanderbilt University), Ashok Iyer (Virginia Commonwealth University)

Dr. Mohamed Alam, president of SECEDHA called the meeting to order at 8 am and asked everyone in attendance to introduce themselves. The meeting agenda included presentations on Innovations in Senior Design Courses, Strategies for Successful ABET Accreditation, and the Engineer of 2020 Initiative. Following lunch, the SECEDHA business meeting and annual SECEDHA survey took place.

Innovations in Senior Design Courses
Panelists: Dr. Issa Batarseh (University of Central Florida and panel organizer), Dr. Doug Williams (Georgia Tech), Dr. Jeff Jackson (University of Alabama), and Dr. Ashok Iyer (Virginia Commonwealth University)

Dr. Issa Batarseh –Director, School of Electrical Engineering and Computer Science, University of Central Florida

Dr. Batarseh said that the idea for this discussion came from the March 2006 ECEDHA meeting held in Hawaii.

The UCF ECE senior design course is offered as a two-semester sequence (EEL 4914C and EEL 4915L) that must be taken in consecutive semesters and that serve as capstone courses for the EE/CmpE undergraduate degrees. Topics include engineering design, project management, ethics, economics, history of engineering education, and engineering management/research.

The instructor and student teams jointly agree on design projects. In these courses, students also work as teams, make presentations, and write reports. Each team must publish a conference paper that is at least 8 pages long, and final documentation of each team project must be a minimum of 120 pages. In order for the team to graduate, the device must work properly. Suggestions for design project problems come from faculty, industry, and students.

Dr. Sam Richie is an EE faculty member whose full-time job is coordinating the senior design courses. A committee of at least three faculty members reviews each project, and in most cases, more qualified external reviewers are added to the project committees. Dr. Batarseh said that the students love this class. Besides hands-on technical skills, students learn about teamwork, conflict management, and the challenge of making a device work. Dr. Batarseh also noted that Disney is a particularly supportive partner of the design sequence, in addition to companies like Harris and Lockheed-Martin.

Since spring 2005, presentations have been organized as a senior design conference with proceedings; the 8-page papers that students are required to write appear in these proceedings. The department also conducts a Senior Design at UCF Student Career and Salary Survey. Conducted as an exit survey, students are asked about any co-op or internship assignments; interviews and permanent job offers/salary offers; and any other information that they would like to share about their experience at UCF. The School conducts a Senior Design Group Peer Evaluation that examines individual group dynamics and effort put forth by each individual. These evaluations are taken into account during the grading process for these courses.

The School of EECS at UCF plans to host a national student design conference. UCF personnel intend to invite the top student design teams from U.S. universities to participate, along with their advisors. Conference presentation proceedings will be published as an educational resource. A faculty session focused on ABET and senior design assessment issues will be held at the same time of the student design conference. Dr. Batarseh said that he and his faculty are excited to see what other universities are doing across the nation, and they welcome participation from SECEDHA schools and other ECEDHA members. Submission deadline is March 15, 2007, with acceptance notifications to be sent by April 1; student travel support will be available. The conference is scheduled for May 10-12, 2007 in the new Harris Engineering Center, the future home of EECS. More details will be available online after December 1, 2006 at http://www.eecs.ucf.edu/sdc2007.

Questions were raised as to how design teams are formed. Dr. Batarseh said that students are allowed to form their own teams. He noted that students with similar ability levels seemed to cluster together. Students who don't have teams are placed in some way. If Dr. Richie sees a team struggling, he may make some suggestions to them. In the end, industry reviewers evaluate student projects, not faculty. Another question was raised about how stragglers were handled. Dr. Batarseh said that students provide weekly progress reports and plans for upcoming weeks. Dr. Richie determines the level of difficulty or ease of the course.

Dr. Doug Williams, Associate Chair for Undergraduate Affairs, School of Electrical and Computer Engineering, Georgia Tech

Dr. Williams said that the ECE faculty at Georgia Tech spent the large part of last year redesigning the ECE senior design experience, which consists of two courses–ECE 4000 and ECE 4006. Though the courses are offered each term, gaps still occur because of co-op assignments, so sometimes it is not possible to keep teams together continuously. Currently, ECE 4000 is a 3-semester credit hour course that covers design methods and practice-related issues such as project scheduling, budget planning, and working in design teams. ECE 4006 is

also a 3-semester credit hour course centered on a team-based design project–and regular formal reports and presentations given by all teams. In any given semester, ECE may offer 8-10 sections of ECE 4006, and the scope of projects is vast. Dr. Williams noted that design teams are not formed in ECE 4000 and that he prefers having faculty help in the formation of teams in ECE 4006.

Problems with the current version of ECE 4000 are relevance. Currently in ECE 4000, students learn about teamwork, but they don't actually practice it until ECE 4006. Additionally, different faculty members teach the 8-10 sections of 4006 that are offered each semester, and they all have their own way of doing things. This variability is a problem when it comes to ABET evaluation, and our evaluators have indeed mentioned this issue in previous reviews.

Dr. Williams noted that ECE students at Georgia Tech have significantly different schedules, due to the large number of students who participate in the co-op program. The two-semester sequence can also delay graduation for some transfer students. At the same time, the faculty members do not want to reduce the total number of credit hours, and they want to maintain the variety to reflect breadth of the discipline. More than 70 group projects must be supervised by various faculty teaching ECE 4006.

A faculty committee met over the last year, and solutions to some of the aforementioned constraints are on the horizon in the form of two new courses – ECE 4001 (two semester credit hours) and ECE 4007 (four semester credit hours). All of the team-oriented subjects previously covered in ECE 4000 will be moved to ECE 4007, where students actually practice teamwork-oriented exercises. ECE 4001 (the new version of ECE 4000) will focus on professional issues for both engineering practice and career development like personal and corporate ethics, professional licensing, intellectual property and start-up companies, manufacturability and reliability, and lifelong learning.

ECE 4007 (the new version of ECE 4006) will feature a once weekly, common lecture that consists of material applicable to all sections as they pursue their design projects on the other days. Dr. Williams feels that having this common lecture will encourage consistency and compliance among all ECE 4007 sections. Instructors from ECE's Undergraduate Professional Communications Program will also participate in ECE 4007, since presentations and reports will be involved in ECE 4007. Both ECE faculty and ECE UPCP staff will review student reports from ECE 4007. He also noted that the students become quickly aware of what professors consider to be important. Dr. Williams also said that direct assessment procedures have been built into both new courses.

A question was raised about which ABET outcomes are addressed by these courses. Dr. Williams said that the courses address criteria A-K.

Dr. Jeff Jackson, Head, Department of Electrical and Computer Engineering, University of Alabama

Dr. Jackson said that the Department of ECE at Alabama is in a state of transition, as changes throughout the entire ECE curriculum are being made. Part of those revisions includes expanding

the senior design experience from one course to two. The ECE Department is not making students take the courses consecutively, and he thinks that the two new courses will address most of ABET's A-K criteria. Students are really pressed in learning all material in one, all encompassing senior design course.

Currently, Dr. Jackson said that one faculty member is responsible for the senior design course and each team has one technical advisor, for a total of three or four faculty involved in each course offering. The current structure is seen as a heavy burden. Typical preliminary and critical design reviews are merged into a single, midterm design review. Introducing "soft" (yet important) skills, like ethics and societal implications, tends to fragment discussion and focus on design issues. In transitioning to a two-semester capstone design sequence, Dr. Jackson said at least one additional single design course would be offered in parallel with the two-course design sequence.

Close coordination between the single design course and the new two-course sequence will be needed to reduce the probability of conflicting advice. Dr. Jackson feels that the two-semester design offers more flexibility and more accurately depicts what happens in industry. The faculty is still considering whether the breakpoint between courses will be at the preliminary design review or later. Each course will be taught each term, which increases the number of involved faculty. Handling co-op students is another critical issue, as they comprise 40 percent of ECE enrollment. Dr. Jackson said that they will be able to participate remotely while on job assignment or have the option to join a new design group for the second course. He sees positives and negatives with both scenarios and will closely watch what happens.

These changes are based, in part, on student input. They like complex projects, but in the current structure, they do not have enough time to do or learn everything that they really need, especially in system testing and component integration. The first capstone design course will be a co-requisite with an ECE senior lecture/lab combination. The second capstone design course will have the first course and the ECE senior lecture/lab combination as prerequisites. The engineering economics class will be deleted from the ECE curriculum, as that topic will be covered in the new capstone courses.

Funding for capstone design teams is set at $500, per three-student design team. Some corporate sponsors are heavily involved with projects; they may participate in project definition and attend presentations. Companies who donate are invited to attend reviews and participate actively. As an example, Dr. Jackson said that the capstone design lab was a corporate donation from BellSouth, thus showing that this senior design project venue gives companies a chance to learn about students and create relationships that could lead to future hires.

ECE Advisory Committee meetings at the University of Alabama are scheduled to coincide with final capstone design presentations. Dr. Jackson said that this opportunity is a good motivator for students to represent the department, not just the involved faculty. Robotics projects seem to excite the students the most.

Dr. Jackson was asked how students are evaluated. He said that peer groups and a technical advisor and a technical administrator evaluate the student projects. They also stipulate that

components of contemporary issues are folded into the courses. He also noted that Alabama ECE students are not required to take the FE exam. In closing, Dr. Jackson took a quick poll of how many ECE departments have two senior design courses or a single course. Most had two.

Dr. Ashok Iyer, Chair, Department of Electrical and Computer Engineering, Virginia Commonwealth University

Dr. Ayer provided some general background about ECE at VCU, which consists of 14 faculty members. The department has no dedicated person for senior design administration. Senior design spans two semesters during the senior year, with about 20 projects a year, 3 to 4 students per project. All students take two, one credit senior design seminars concurrently with senior design. EE students can satisfy the senior design requirement via one of three sequences: microelectronics fabrication, digital systems, or senior design lab. Instructors assign the projects in microelectronic fab and digital systems sequences, while students propose the projects in the senior design lab. CmpE students have only one choice–the digital systems sequence. The senior design seminar features many invited speakers from industry.

Senior design courses are only offered in fall and spring. A proposal, design report, final report, and poster are the assignments required of all senior design projects. In EGRE 435 Training and Design, students learn the background and recipes. In EGRE 436 Fabrication and Test, students work on the project. The prototype needs to be defined, designed, fabbed, and tested. Each project requires reporting and presentation of the results. Dr. Iyer added that the design capabilities in the clean room are pretty good. Examples of EE and CmpE projects are in MEMS, robotics, and unmanned aerial vehicles. Dr. Iyer noted that ECE student teams from VCU have entered the AUVSI competition and have won top prizes.

The senior capstone project is tied to a structured class. The project proposal must be prepared in detail by students and reviewed by the faculty. The device must work in order for students to pass the class and graduate. Downsides are that student project quality can vary widely, as does the quality of faculty advising. In the future, Dr. Iyer would like to add course sequences in DSP and in controls.

Conclusion of Senior Design Course Presentations/Discussion

Dr. Alam said that Dr. Stephen Parke, chair of the Department of ECE at Tennessee Tech, was scheduled to present during this session but was not able to attend the meeting.

Questions were raised about involving students from other disciplines in ECE senior design experiences. One department head stated that a common seminar among all engineering students, with the exception of chemical engineering, was required at his institution. Dr. Alam said that he was trying to involve students from other disciplines at the University of South Alabama. Dr. Batarseh said that he is trying to find ways to engage the UCF commercialization office in their design projects.

Dr. Sarah Rajala from Mississippi State noted that both N.C. State and Mississippi State have entrepreneurship programs and that it may be worth having project presentations from those

programs at a future meeting. Dr. Iyer asked the group what they thought about having a student do a senior thesis rather than take the senior design sequence, if the student isn't planning on attending graduate school. The consensus among the group seemed to be that ABET would not have much sympathy for doing a senior thesis unless a design aspect is addressed in it.

Strategies for Successful ABET Accreditation
Dr. Mohammad Alam, Chair, Department of Electrical and Computer Engineering, University of South Alabama
Dr. Mark Law, Chair, Department of Electrical and Computer Engineering, University of Florida

Dr. Alam's comments

Dr. Alam said that his department was last visited by ABET in fall 2005 and was one of the first schools to use ABET's Criteria 2000. In their assessment, the ABET evaluators stated that both the EE and CmpE programs at the University of South Alabama had weaknesses in criterion one and criterion two. To address those concerns, surveys were designed for alumni and employers who hire the program's students, as well as exit questionnaires for graduating students. To discuss ECE progress and goals for the future, the department now holds an annual retreat, where faculty, students, and advisory board members are welcome to attend, as well as to the community as a whole.

For the 2005 review, Dr. Alam said that his department submitted all of the requirements from the 2001 review to ABET and thought that everything had been submitted correctly. However, the ABET team said that the questions that the department answered were not ones that ABET usually poses. Dr. Alam was told that that would be viewed as a weakness. The ECE Department at South Alabama provided an update within 30 days of the initial evaluation.

Dr. Alam said that the outcomes based assessments of classes by faculty and mapping students' performance to program outcomes are key. Collecting this data is time consuming, as faculty members have to fill out forms for the courses that they teach. One of the meeting attendees asked if some South Alabama ECE faculty failed to fill out the form completely. While Dr. Alam said that that was not an issue, the main faculty reservation was that this activity was just another thing for them to do. However, he and they determined that doing this activity was better than having a weakness identified by ABET again. A meeting attendee questioned Dr. Alam about the English/writing instruction component. He stated that more than one ECE faculty member is involved in reviewing student papers and design projects.

Student feedback regarding preparedness and importance of skills is measured using an exit questionnaire in the ECE Dept. of the University of South Alabama. Students are also required to take the FE (Fundamentals of Engineering) exam, but they are not required to pass it.

Dr. Alam said that employers are also surveyed regarding student preparedness and skills. A discussion ensued about how to define and determine feedback mechanisms for gathering this data. Some meeting attendees noted the lack of response to general surveys. Others recommend getting responses from their school's/department's advisory boards.

Alumni were also surveyed, focusing on 100-200 of the most recent ECE graduates, said Dr. Alam, where they were asked about preparedness and importance of skill in two sets of questions. Personal calls were made to these alumni, followed by emails encouraging their participation. The survey had about a 30 percent participation rate.

Scores in faculty assessment and student/alumni questionnaires were good overall. Faculty assessment of all classes scored over 4.0 on a scale of 5.0. Responses to the student exit questionnaire scored largely in the 3.0 range on a scale of 4.0. Alumni responses rated mostly 3.0 out of 4.0. Dr. Alam noted that ECE student scores on the FE exam are low compared to the national average, as students are not terribly motivated to take the exam.

To have a successful ABET evaluation, Dr. Alam advised making relevant meeting notes and minutes available to the evaluators. His department included minutes from the undergraduate curriculum and advising committees, advisory board, annual retreat, and the Faculty-Student Forum, a very open discussion of what students like, don't like, and how things can be improved. He also said to provide detailed documentation on senior design projects and finally to ask evaluators what they would specifically like to see.

Dr. Law's comments

In the most recent ABET review of ECE programs at the University of Florida, Dr. Law said the evaluator commented on math deficiencies. In response, ECE created its own math course (ECE 3105), which is taught by ECE faculty and not the math department.

For ABET evaluations, Dr. Law said that it isn't sufficient to present objectives and then conduct votes. He said that ABET evaluators like to see evidence that meaningful discussions have taken place about these issues and that they want to see separate input/discussions for EE and CmpE (if you have both degree programs). For alumni surveys, ECE at the University of Florida sent separate surveys to EE and CmpE graduates and collected the data separately. Where/if needed, data could be merged for both programs. On the outcomes for criteria 3, Dr. Law said that it was very important to show what students specifically do, to have standards well defined, and to be prepared to discuss in terms of senior design. A meeting attendee from the University of Alabama seconded Dr. Law's recommendations, saying that doing these things are easy, but keeping the documentation is tough.

Dr. Law provided some additional tips for a successful ABET review: 1) Put all documentation on the department web site, as paper documents can be difficult to track; 2) Keep documentation on course committees, especially those noting improvements made. 3) Show faculty involvement. Additionally, Dr. Law noted that it has been instituted across the College of Engineering to have a trained evaluator on the faculty.

Dr. Rajala is a member of the ABET Accreditation Committee, and she encouraged everyone to complete evaluations on the ABET evaluators, and most importantly, to give honest feedback. She said that ABET really tries to get good quality evaluators. At Mississippi State, she ensures that the identities of which people made what comments are not revealed when evaluation

feedback is provided to ABET. If any concern exists, the ABET Accreditation Committee will investigate the situation and pull an evaluator from the program if needed. Dr. Rajala also stated that any comments that faculty make about the evaluation process would not impact the decisions made about individual programs. At Mississippi State, she said that evaluation forms are sent to all of the departments and not just to the Dean's Office. She advised everyone to define what lifelong learning entails in their departments and to really take time to describe any other aspect that makes their individual programs unique. Dr. Rajala concluded by adding that IEEE very much wants to find high quality evaluators from industry. However, it is important for industry evaluators to know what is expected of them

The group as a whole roundly agreed that more communication should occur between evaluators and their schools.

Lunchtime Presentation: Engineer of 2020 Initiative
Gary S. May, Steve W. Chaddick School Chair, School of Electrical and Computer Engineering, Georgia Tech

During lunch, Dr. May spoke about the Engineer of 2020 Initiative. In the last several years, he has worked with Georgia Tech President Wayne Clough, futurists, and many other thoughtful people from a variety of disciplines, trying to imagine what the world will be like in 2020. They have come to the conclusions that the engineers of the future must have strong analytical skills, good communications skills, and business and management abilities. They should be adaptive leaders and lifelong learners, while exhibiting practical ingenuity, creativity, and innovation. Finally, they should have high ethical standards and be able to put problems in their socio-technical and operational context.

While predicting the future is an inexact science at best, Dr. May said that we can expect some things with a reasonable level of confidence. In 2020, many more people will live on Earth, upwards of 2 billion or more. More of the world's population will be in cities rather than rural areas, producing greater challenges to fill the needs for urban infrastructure. By 2020, if the world's population were to be seen as consisting of 100 people, it is estimated that 56 of those will live in Asia, 16 in Africa, and only 4 in the U.S. Population growth will be thus concentrated in less developed countries where a "youth bulge" will occur, while in advanced countries, the populations will age. Within countries, the demographics will change, including the U.S., where the numbers of minorities will grow rapidly, while those of the traditional majority will decline. All of these factors have major implications for the future of engineering, a profession where minorities and women remain underrepresented.

These emerging demographics bring into focus many other potential issues, primarily surges in the economies of India, China, and other nations. These nations, as well as Russia and the European Union, are all competing with the U.S. for the technological economic sector. Some of this is accentuated by disparities in wages between the U.S. and China and India, but it is also driven by the growing size of the skilled technological workforce in these nations. It is estimated by the National Science Foundation that China, India, and the European Union each already graduate more engineers than does the U.S.

Viewed in a more positive light, this future scenario presents opportunities that will arise for those who are prepared and plan for the realities of the future. The institutional vision at Georgia Tech is to define the technological research university of the 21st century. In ECE, we already play a key role in that process through campuses in Europe and China, plus we are exploring further expansion into India and Singapore.

Dr. May concluded his remarks by saying that engineers must apply their "can-do" spirit to helping define technological universities of the future and to help the nation to compete and to shape a prosperous future.

Business Meeting
Dr. Mohammad Alam, Chair, Department of Electrical and Computer Engineering, University of South Alabama

Dr. Alam reconvened the meeting at 12:30 pm and asked everyone to review the minutes from meetings held in November 2005 and March 2006. In the November 2005 minutes, three typos were found on the first page. In the list of attendees, the spelling of Dr. Mark Russamanno's name was corrected. On the second page, the spelling of Dr. Alam's first name was corrected to Mohammad, and the call to order time for the business meeting was corrected to read 1:15 pm.

No corrections were needed for the March 2006 minutes.

Dr. Alam then conducted an election for SECEDHA secretary to succeed Dr. Gary May. Each fall, a new secretary is elected to a three-year term. The secretary becomes the vice president and the vice president becomes president. Dr. Issa Batarseh was nominated for secretary, and the vote was unanimous in his favor. In turn, Dr. May became vice president, Dr. Mark Law became president, and Dr. Mohammad Alam became past president.

Dr. Alam tentatively set next year's SECEDHA meeting for November 8-9, 2007 at the Georgia Tech Hotel. Potential topics for next year's meeting may include graduate education issues; B.S./M.S. programs; possible recent changes and developments in ABET criteria; math preparation for entering engineering students; professionalism and ethics in academic honesty; and best practices for ECE department chairs.