SELF-STUDY REPORT

Electrical Engineering Program

Submitted by
Department of Electrical and Computer Engineering
Parks College of Engineering, Aviation and Technology
Saint Louis University
Saint Louis, MO 63103

June 2006

Engineering Accreditation Commission
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A. Background Information

1. Degree Titles

Department of Electrical and Computer Engineering at Saint Louis University (Parks College of Engineering, Aviation, and Technology) offers' one undergraduate degree, Bachelor of Science in Electrical Engineering. The program **offers a concentration either in Electrical Engineering or Computer Engineering**. Information is available on the department website: http://www.slu.edu/admission/profile/electrical_and_computer_engineering.html

2. Program Modes

Electrical Engineering is a **day program**. Almost all core courses and laboratories are offered during the day from 8:00 a.m. till 5:00 p.m. Advanced Electrical Engineering elective courses taught by adjuncts from local industry may require offering such a course in late afternoon or evening hours.

3. Actions to Correct Previous Shortcomings

3.1 Departmental Level Shortcomings

There were no program deficiencies identified in our ABET visit (2000). There were two program concerns.

Concern 1: Criteria I.C.1.d..: Faculty

The stability, continuity, and morale of the faculty are important to the program. It is a concern that, if the college does not establish a permanent Chair in the very near term, the electrical engineering program may not continue to meet the latter criterion. This critical leadership supports the faculty's energy and vision, now and in the future.

Response (1)

A search for a permanent department Chair was initialized. The search was not successful in identifying a suitable candidate for department Chair. Dr. H.S. Mallik, Associate Professor of Electrical Engineering Department accepted the position of the department Chair. Upon completion of his three years term Dr. H.S. Mallik stepped down as department Chair Dr. William Ebel accepted to serve as department Chair from 2002 till June 30, 2005. Dr. Ebel stepped down as department Chair at the end of June 2005. Dr. Roobik Gharabagi, tenured

Associate Professor, accepted the position of the department Chair starting July 1, 2005. Hence department has eliminated the stated concern.

Concern 2: Criterion I.C.3.d (3): Engineering Topics

While the design content of the curriculum meets the general and program criteria, a great deal of effort was required to ascertain the design content as displayed in some course material provided. This entailed further faculty interviews and research to find the demonstrative material necessary to perform an adequate analysis. It is a concern that adequate review material be maintained in the future for ready review in design as well as other key areas.

Response (2)

The department has taken steps to improve the collection of course materials to enable regular course assessment and assist future evaluators. The concern has been removed.

3.2 Institutional Level Shortcomings

In the previous ABET Final Statement (dated August 16, 2001), the following institutional concern was noted:

It was noted that, in more than one laboratory and/or class, the students were not able to access programs that were intended to be used in their data analyses. It appeared that the issues revolved around the inability to load software on the computers that were accessible to the students. While it is recognized that centralized implementation of information technology is in progress, the ability for the students to access some assigned analytic techniques needs to be improved. It is essential that this issue be resolved for the programs to continue to meet ABET criteria.

At the present time there are three (3) general purpose computer classrooms, hosting 76 personal computers, in McDonnell Douglas Hall. In addition, there is one (1) public-use computer lab which hosts 20 personal computers for a total of 96 computers available for all students to use. Each personal computer has the same complement of engineering, mathematical, desktop productivity and multimedia software, as defined by the engineering faculty, that is necessary for students to work on class assignments, research projects and the like. Information Technology personnel, both central and on-site, manage and maintain these hardware and software systems. Also, students have access to the Saint Louis University network via high-speed wireless connectivity in McDonnell Douglas Hall and the Biomedical Engineering building. Under the college's Mobility Computing (MC) initiative, tablet PCs are being used by several faculty and students to examine technological implications as well as the teaching-learning pedagogy. College-wide implementation of an MC/laptop program is possible in the near future.

In the previous ABET Final Statement (dated August 16, 2001), the following institutional observation was noted:

Key administrators of the college do not have a background in engineering to provide the perspective of engineering in the decision making of the college. Appointment of an associate dean for engineering has been discussed and would appear to meet the perceived concerns of the faculty. Failing to address this issue could have an adverse effect on the morale of the faculty.

At the time of the previous ABET visit, the position of Associate Dean for Engineering had been created but not yet filled. That position was subsequently filled in 2001 by Dr. Swami Karunamoorthy, a professor in the Department of Aerospace and Mechanical Engineering. In 2003, Dr. Charles Kirkpatrick, dean of Parks since 1994, resigned his position to continue his teaching and research activities in SLU's Department of Chemistry. Dr. Bjong 'Wolf' Yeigh (Ph.D. in Mechanical Engineering) was recruited to fill the position of dean. Dr. Yeigh eliminated the position of Associate Dean for Engineering, instead appointing Dr. Alan Stolzer (previously Associate Dean for Aviation) as Associate Dean for Parks College. Dr. Yeigh resigned in December 2005 as part of a college-wide reorganization, and Dr. Neil Seitz, professor of Finance, was appointed interim dean. Discussions are now underway to begin a search for a permanent dean.

It should be noted that the leadership team at Parks College has considerable academic administration experience, both in engineering and other fields. The three engineering department chairs, Drs. Ravindra, Barnett and Gharabagi, are all long-time faculty members at Parks and have been chairing their respective departments for several years. Dr. Stolzer has served for more than 10 years as a department chair and another 10 at the associate dean level. Dr. Neil Seitz served as dean of SLU's John Cook School of Business for 9 years. Collectively, these individuals form a team that possesses the vision, leadership and management skills, and knowledge of engineering programs to successful administer all of the programs offered by Parks College.

4. Contact Information

The following Faculties are identified as primary contact persons.

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B. Accreditation Summary

1. Students

Parks College of Engineering, Aviation and Technology of Saint Louis University prepares students for careers in engineering, aviation, and technology. Satisfying this mission demands excellence in academic programs that integrate the education of the whole person, in the liberal and Jesuit traditions, with classroom and laboratory experiences in the major fields of study. Education at Parks College provides opportunities for students to develop intellectually, stay abreast of changing technology, learn more about themselves and the world in which they live, and to prepare for a lifetime of learning.

1.1: Evaluation for Admission to the Electrical Engineering Program

The office of admission at the Saint Louis University determines students' eligibility for admission to the university. In addition to general admission and matriculation requirements of the University, Parks College of Engineering, Aviation and Technology has the following additional requirements. The recommended academic requirements for admission to Bachelor of Science in Electrical Engineering program are as follows:

I. Grade range B+ to A from high school or 2.7 college transfer average.
II. Fifteen units of high school work: three or four English; four or more Mathematics-Algebra I and II, Geometry, and Senior Mathematics with Trigonometry; three or four sciences-General Science, Introduction to Physical Science, Earth Science, Biology, Physics, or Chemistry; two or three Social Sciences-History, Psychology, or Sociology; and three electives.

Students who participate in Advance Placement programs in high school are eligible for exemption and/or advanced placement credit. Exemption and placement examinations in mathematics will be given to new students upon arrival on campus. Guidelines for the exemption examinations are as follows:

Math Placement Examination – required of freshman and transfer students who have not completed transferable mathematics course before coming to Parks College.
Students should contact the College of Arts and Sciences for information about advanced placement in humanities courses. Test results must be received from The College Board (hhtp://www.collegeboard.com/).

1.2: Evaluation Procedure and Policies of Transfer Students Credits for Courses Taken in Other Institutions.

Students who have attempted 12 or more semester hours or 15 or more quarter hours of full-time course work at another ABET accredited program excluding developmental or remedial courses,

are classified as transfer applicants. This policy does not include any advanced college credits earned in high school. Students wishing to transfer to Electrical and Computer Engineering Department of the Saint Louis University from unaccredited college/university/program will consult the University's office of Undergraduate Admission concerning special terms of admission. In general, transfer applicants must present at least a "C" grade average for both overall college-level course work and in course work taken immediately preceding enrollment at Saint Louis University. In addition to the University minimum requirement, Parks College of Engineering, Aviation, and Technology requires a grade point average (GPA) for transfer students is 2.7. Transfer students with GPA of less than 2.7 may be accepted in consultation with the Department Chair.

Parks College of Engineering has set up matriculation agreement with several local Community Colleges. Credits earned in these Colleges with grade "C" or better are transferable to Parks College.
Engineering courses completed in a non-ABET accredited program require the approval of the department Chairperson. In all cases, equivalence of course content is determined by the Chairperson, or designated faculty members of the department. Decisions are made through a review of catalog descriptions, course syllabi, textbook, etc. In certain cases, an exemption examination may be required for transfer credit.

Upon admission and enrollment, transfer credits are incorporated into the permanent record in terms of semester hours. The grade point average will only include the grades from those classes attempted at Saint Louis University. Transfer credits are applied where appropriate in fulfillment of program and degree requirements of a specific school/college of the University as comparable to courses offered here. In some cases applicants may be asked to provide a catalog containing a written description of the course(s) from the other institution. No more than 64 semester hours earned at the community college level can be applied toward the bachelor's degree at Saint Louis University.

Current students are required to get prior approval for any coursework taken for transfer to Saint Louis University. Students must receive permission from their advisor, the Dean's Office, and have a cumulative GPA of 2.0 in order to be authorized to take courses off campus. The student must provide a course description if the course has not been evaluated previously. The SLU department that would normally offer the requested course will evaluate the transferability of the proposed course. Upon completion of the course, the student must provide an official transcript from the other institution and the SLU Registrar's Office will verify that the student had prior approval. A grade of "C" or higher is required for acceptance of transfer credit. Transfer credit hours will apply to the permanent record but the grade will not be recognized and will not count toward the student's GPA. Students must complete the last 30 credit hours of the degree program in residence. Rarely, the residency requirement will be waived in cases of great hardship.

International Baccalaureate coursework will be posted to the student's SLU transcript after it has been evaluated by Academic Services. Acceptance of IB coursework is determined by the governing department and subject to change. IB coursework is accepted only for particular courses. Students may also take external examinations for credit, including CLEP supplemental examinations. Students need to consult the current undergraduate catalog for a list of exam options, as well as the score needed in order to earn credit.

The 1818 Advanced College Credit Program provides an opportunity for qualified high school juniors and seniors in participating high schools to begin experiencing the academic rigors of college course work while still in high school. In addition to receiving credit toward high school graduation for selected academic courses, students may opt additionally to dual enroll in courses approved for college credit through Saint Louis University.

1.3: Advising, Monitoring and Mentoring.

Students accepted to the program are assigned a full-time faculty member from the department who advises and monitors academic progress of the student. Each student is required to meet and consult with his/her advisor for early registration each semester. Academic advisors work with individual students to meet their academic needs. Any academic difficulties can be discussed at this time and/or after midterm exams. Students are made aware of and encouraged to take advantage of various resources (free of charge) available to them through the university. Academic tutoring centers and counseling centers are available to students free of charge. Students with academic problems are referred to the Academic Board of Parks College. The Academic Board of Parks College consists of faculty members representing all of the Parks College departments, and the advisors are responsible for overseeing the academic progress of any student on academic probation.

The faculty advisor ensures that humanities and social science electives are taken from the following fields: fine arts, economics, history, literature, philosophy, political science, psychology, sociology, and theology. The advisor further ensures that technical electives are taken from the approved list for the Electrical Engineering Program.

The Department Faculty are actively involved in mentoring students in career counseling, professional development mentoring, curriculum advising, student professional organization such as IEEE, and other departmental activities related to students. Department maintains a locally developed software program that keeps track of students progress during their stay at the department.

1.4: Graduation Requirements of Electrical Engineering.

The Electrical Engineering Department requires cumulative GPA of 2.0/4.0 at the time of graduation. Student is responsible to petition for graduation during their last semester of study. Student's academic advisor, the department Chairperson, and the Dean's office independently review each prospective graduate's file to ensure all course work and credit hour requirements are met. Students entering the Electrical Engineering Department in the fall of 2005 are required to complete 127 credits for the Electrical Engineering concentration and 128 credits for the Computer Engineering concentration.

2. Program Educational Objectives

2.1 Introduction

In this section we detail the program educational objectives, the process by which these objectives are determined, how the program ensures these objectives are achieved, and the system of ongoing evaluation that demonstrates continuous program improvement.

2.2. Department, College, and University Missions

2.2.1. Department of Electrical and Computer Engineering Mission:

Within the context of Saint Louis University and Parks College of Engineering and Aviation, the mission of the Electrical Engineering Program is to adequately prepare graduate to enter into the engineering profession, especially in the areas of analysis, design, and development of electrical and/or computer systems and components.

2.2.2. Parks College of Engineering, Aviation, and Technology Mission:

The Mission of Parks College of Engineering and Aviation is the pursuit of excellence in educating students as whole persons in the spirit of the Jesuit tradition, with integration of knowledge, values, and skills in preparation for professional careers in Engineering, Aviation, Physics, Technology, and related disciplines.

2.2.3. Saint Louis University Mission:

The Mission of Saint Louis University is the pursuit of truth for the greater glory of God and for the service of humanity. The University seeks excellence in the fulfillment of its corporate purposes of teaching, research and community service. It is dedicated to leadership in the continuing quest for understanding of God's creation, and for the discovery, dissemination and integration of the values, knowledge and skills required to transform society in the spirit of the Gospels. As a Catholic, Jesuit University, the pursuit is motivated by the inspiration and values of the Judeo-Christian tradition and it's guided by the spiritual and intellectual ideals of the Society of Jesus.

In support of this mission the University:

- Encourages and supports innovative scholarship and effective teaching in all fields of the humanities, the natural, health and medical sciences, the social sciences, the law, business, aviation, and technology.
- Enables an academic environment which values and promotes free, active and original intellectual inquiry among its faculty and students.
- Maintains and encourages programs which link the University and its resources to its local, national, and international communities in support of efforts to alleviate ignorance,

poverty, injustice, and hunger, to extend compassionate care to the ill and needy, and to maintain and improve the quality of life for all persons.
- Strives continuously to seek means to build upon its Catholic, Jesuit identity, and to promote activities which apply that intellectual and ethical heritage to work for the good of society as a whole.
- Welcomes students, faculty and staff from all racial, ethnic and religious backgrounds and beliefs and creates a sense of community which facilitates their development as men and women for others.
- Nurtures within its community an understanding of and commitment to the promotion of faith and justice in the spirit of the Gospels.
- Wisely allocates its resources to maintain efficiency and effectiveness in attaining its mission and goals.

2.3. Program Educational Objectives (PEOs)

Since last ABET accreditation visit in 2000 the department has been engaged in several activities in developing the Program Educational Objectives. The central goal of the department is to provide the best educational experience for our students. Several faculty attended ABET sponsored workshops and trainings to be educated about ABET 2000 criteria. During academic year 2002-2003 the department held several meetings to discuss ABET 2000 assessment and continuous quality improvement process. As a consequence of these meetings the faculty of the department developed its first set of program educational objectives, program educational outcomes, and various assessment tools. In the spring of 2005, Drs. Gharabagi and Mallikarjuna attended ABET sponsored workshop in Portland, Oregon. Dr. Mallik attended an ABET workshop in New Orleans, LA in spring 2005. As a result of the 2005 workshops and input from constituencies PEOs were redefined clearly distinguishing them from Outcomes. Department Program Educational Objectives are posted on the department web site: http://parks.slu.edu/department/ece/index.php

Outcomes will be discussed in a later section.

The Objectives of the Electrical and Computer Engineering Department at Parks College of the Saint Louis University is to produce graduates with following abilities:

D1. To pursue scientific and technical careers beginning with entry-level electrical engineering positions in industry or government.

D2. To pursue continuing education through graduate studies in related engineering fields, as well as law, business, or management.

D3. To fulfill the needs of society in solving technical problems using electrical engineering principles, tools, and practices

The objectives stated above are consistent with mission statement of the department. The following is the mapping of the departmental objectives to the Parks College objectives.

Parks College of Engineering and Aviation Objectives are given below.

C1. To provide an education with knowledge in Mathematics, Science and Information Technology
C2. To enhance Written and Oral Communication Skills
C3. To provide an education of values in the Spirit of Jesuit Tradition
C4. To provide an experience in Cultural Diversity
C5. To provide an education with Capstone Experience

2.3.1. The PEOs of the ECE Department Relation to the Parks' College Objectives

ECE Dept. Program Educational Objectives	Parks College Educational Objectives	
D1	C1, C2, C3, C4, C5	
D2	C1, C2, C3	
D3	C3	

2.4. Program Constituencies

The constituency of the Electrical Engineering program includes the following:

Students: Are expected to acquire the knowledge and skills to become competent and productive engineers, to meet the needs of society, who also can pursue continuing education through graduate studies in engineering, law, business, or management.

Faculty: The heart of an institution of higher learning mentor and guide students in learning process and is responsible for the program educational outcomes relative to program educational objectives.

Alumni: Expect continued improvement in quality of Electrical and Computer Engineering program at the Saint Louis University. They are also ambassadors of an institution that are expected to continue learning and growing in both professional as well as personal goals.

Industrial Advisory Board: Team of dedicated Alumni, members of local industry and potential employers to provide valuable insight and advice in assessment process to continually improve department's mission, goals and objectives.

Industry/Employer: A constituency that continues to support the program through hiring and providing a continuous feedback, through our alumni, in maintaining and improving our mission, goals and objectives.

The program educational objectives were developed by faculty in consultation with its various constituencies.

- Alumni
- Industrial Advisory Board/Employers
- Faculty
- Students

2.5. Process for Establishing and Reviewing Program Educational Objectives

The Electrical Engineering program was accredited from 2000 until 2007 under the old ABET criteria. In the year 2001 the department faculty met to develop a road map for the program to be accredited under the new EC 2000 criteria. As first step several faculty attended ABET workshops to become familiar with EC 2000 criteria. Dr. William Ebel, the incoming Chair of EE Dept. attended ABET Evaluators workshop in spring 2002. After consulting with the constituencies the Program Educational Objectives and Program Outcomes were defined in 2003. Program Educational Objectives were revised in 2005 for clear distinction between Objectives and Outcomes.

Departmental meetings and discussions were conducted to establish the assessment process. Key loops were identified (See Figure 1). These loops were identified at course level (fast loops), the program level (Slow loop), and slowest loop is reserved for program educational objective. Fast loops are to be used to evaluate students learning outcomes in meeting program educational outcomes. Fast loop is at course level and assessment at this level is carried out at the end of each semester. Slow loop is to measure achievements of outcomes at program level annually. The slowest loop is used to evaluate Program Educational Objectives every four years as shown in the **Table B1**, and figure 1.

Availability of resources and support at all levels within the institution plays an important role in establishing a process and achieving a continuous evaluation and improvement in terms of outcomes and objectives. Constituencies such as Industrial Advisory Board, Alumni, faculty, and students were identified to be key players in establishing the assessment process. Results of surveys from faculty, current students, alumni, and IAB/Employers were employed to develop and evaluate PEOs in 2003 and were revised in 2005.

Continuous Assessment timeline till academic year 2012-2013

	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13
Outcomes a,b,c,d		X	X	X	X				X		
Outcomes e,f,g,h		X	X	X		X			X		
Outcomes i,j,k		X	X	X			X			X	
Outcomes l,m,n			X	X				X		X	
Program											

Educational Objectives	X		X				X				X
IAB/Employer Meeting		X	X	X	X	X	X	X	X	X	X
Graduate Survey	X	X	X	X	X	X	X	X	X	X	X
Employer/IAB Survey		X	X	X	X	X	X	X	X	X	X
Town hall meeting (Students & Faculty)		X	X	X	X	X	X	X	X	X	X
Senior Exit Interview	X	X	X	X	X	X	X	X	X	X	X
Senior Outcomes Survey	X	X	X	X	X	X	X	X	X	X	X

Table B1: ABET Actions Timetable

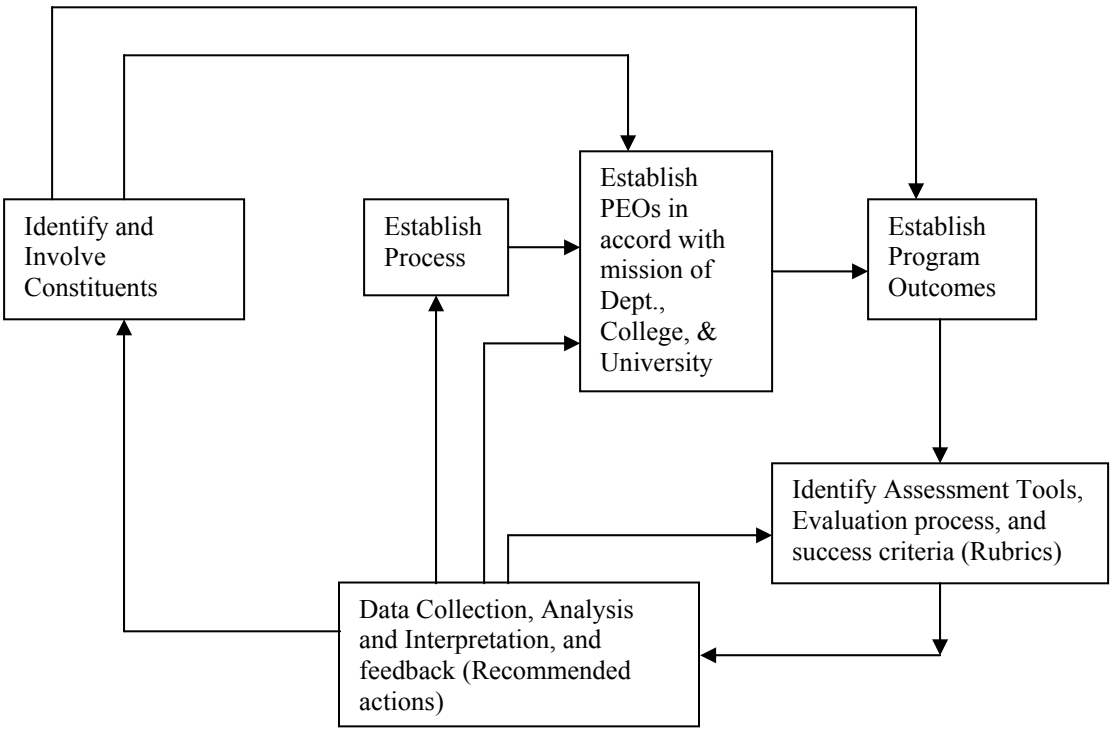

Figure1. Process of Continuous Improvement

2.6. Process for Achievement of the Program Educational Objectives

The faculty of the department in consultation with its constituencies prepared a set of PEOs consistent with the mission of the Department, the College, and the University. The process for reviewing to ensure the appropriateness of stated objectives is fully integrated in our continuous assessment process. The Program Educational Objectives are set to be reviewed every 4 years (please refer to Table B1).

Key constituencies for assessment of PEOs are identified to be Alumni, Industrial Advisory Board (IAB) members, students, and department faculty. These assessments are carried out through surveys (Alumni, IAB members, and students), focused groups (IAB members and faculty), and town hall meetings of faculty and students. The copies of different survey forms employed can be found in Appendix I.

Surveys were prepared and distributed to solicit input from various constituencies. The survey provides five levels of achievements/testing. These levels are 1.Strongly Disagree, 2.Somewhat Disagree, 3.Neutral, 4.Agree, 5.Strongly Agree. The department has set minimum acceptable level of performance to be level 3 neutral (average) or better.

2.7. Documentation to Demonstrate the Level of Achievement of Program Educational Objectives and Evidence of Ongoing Improvements

2.7.1. Alumni

Survey was prepared and forwarded to graduates of past several years.
The results of alumni survey shown below indicate a high degree of satisfaction with the Program Educational Objectives.

	Strongly Disagree	Somewhat Disagree	Neutral	Agree	Strongly agree	Average
PEO1	0	0	0	5	8	4.62
PEO2	0	1	1	3	8	4.38
PEO3	0	1	0	4	8	4.46

Alumni Survey

Name	Objective One	Objective Two	Objective Three	Graduation Date	Employment
Hoa Tong	**5**	**5**	**5**	**May 2004**	**Boeing**
David Woodress	**4**	**4**	**4**	**May 2003**	**Radioshack**
Bill Blechle	**5**	**5**	**5**	**Dec 2002**	**Boeing**
John Keaveny	**5**	**5**	**5**	**May 2002**	**Boeing**
Jim Elking	**4**	**3**	**2**	**May 2004**	**Boeing**
Casey Miller	**5**	**4**	**5**	**May 2003**	**Boeing**
Alisa Franklin	**5**	**5**	**5**	**May 2000**	**Shell Chemical**
Susan Olson	**4**	**5**	**5**	**May 2001**	**Rockwell Collins**
Maria Jorgenson	**4**	**2**	**4**	**Aug 2005**	**Corozal Com Col**
Dan Emge	**4**	**4**	**4**	**May 2003**	
Chris Sidden	**5**	**5**	**5**	**May 2004**	**Daimler Chrysler**
James Grigsy	**5**	**5**	**4**	**May 2005**	**DCCI**
Nael Shahen	**5**	**5**	**5**	**Aug 1998**	**JDSU**
Average	**4.62**	**4.38**	**4.46**		

Strongly Agree = 5
Somewhat Agree = 4
Neutral = 3
Somewhat Disagree = 2
Disagree = 1

Alumni Survey Comments (summer of 2005):

1. I would strongly suggest incorporating more programming/simulation into more of your classes. I have found that simulation in C/C++ or Math lab has proven to be necessary when seeking a job or when pursuing an advanced degree (MS or PhD). Simulation not only helps to understand a system but also leads directly into implementation. Plus it makes a student more marketable.

2. Require IEEE membership. Department should be able to pay the student fees. It was a great learning experience, and I don't see why anyone should miss out on the opportunity to participate. Also, adding a graduate program and more professors would obviously help continuing education and would keep people at Parks.

3. After working with individuals who graduated predominately from South Dakota State University, Iowa State, and the University of Iowa, I am fully satisfied with my educational experience at Saint Louis University. I feel this school was difficult and pushed my intelligence far beyond my co-workers. Of course the curriculum will need to continue to be updated to support growth in technology.

4. Have a junior level design centric course where design and management techniques are presented around simpler problems. Have department sponsored internships. Provide more mentoring both with professors and upper class men. Have the department push internships both inside and outside the engineering field [instead of just at the internship office]. At least engineering economics should be required.

5. Almost everyone I know who graduated around the time I did are working in the defense industry or off to grad school. The program is good for entry level positions in such an industry, but I can't say, with such results, that the program fills the need of society.

6. I feel that the department is headed in the right direction. Broadening the department by pursuing the Computer Engineering aspect is a very big positive and will help keep this department very competitive and will also bring in more people due to the wide range of choices of degree programs.

7. SLU needs more placement programs for their recent graduates that are looking for a full time job.

8. None to mention. The staff is dedicated and committed to the growth and success of the student.

2.7.2. Industrial Advisory Board (Fall of 2005)

In 2005 a survey was prepared and forwarded/presented to ECE department IAB members. A sample of the survey is shown in Appendix I.
The results of IAB survey shown below indicate a high degree of satisfaction with the Program Educational Objectives.

	Strongly Disagree	Somewhat Disagree	Neutral	Agree	Strongly agree	Average
PEO1	0	0		1	4	4.8
PEO2	0	1	0	3	1	3.8
PEO3	0	1	0	0	4	4.4

IAB Member Survey

Name	Objective One	Objective Two	Objective Three	Educational Background	Company/ Affiliation	Position
David Massey	**5**	**5**	**5**	**BSEE UMC**	**Insight Technology**	**Vice President**
Glenn Archer	**5**	**4**	**5**	**BSEEUMR**	**Epic Vision Solutions**	**Director of Business Development**
Edward Wooldridge	**5**	**4**	**5**	**Ph.D. UMR**	**Boeing**	**Technical Fellow**
Sal Gianino	**4**	**4**	**2**	**MBA Wash U**	**Boeing**	**Software Engineer**
Craig T. Hartmann	**5**	**2**	**5**			
Average	**4.8**	**3.8**	**4.4**			

Strongly Agree = 5
Somewhat Agree = 4
Neutral = 3
Somewhat Disagree = 2
Strongly Disagree = 1

2005 IAB member survey comments

1. Pursue non-technical activities for a well-rounded outlook on life. This will provide a new perspective on the technical issues being confronted.

2. I somewhat disagree with PEO item 2 because in my opinion a recent graduate of 2 - 5 years should be concentrating on becoming a registered Professional Engineer. I have been working in the AEC field in one capacity or another and have not taken the PE exam. Time and again the lack of a professional license has held back my ability to earn the salary my background and experience would demand. Having a PE license would greatly change that situation. It has now become one of my top priorities.

Having a PE license will also help the industry as a whole. Most of the public has a neutral to negative attitude about engineers. One factor is the negative press engineering receives whenever something fails in a spectacular way; the space shuttle tragedies, KC Hyatt Catwalk collapse, Tacoma Narrows Bridge, etc. The public does not view-engineers in the same was as lawyers, architects, and doctors even though we are a group of professionals just as much as any of those groups. In my opinion having all engineering practitioners licensed as professionals can only help our standing in the public eye.

Therefore I would suggest revising PEO item 2 to indicate a strong commitment to obtaining a PE license within 5 years of graduation. I would then suggest adding two more PEO. The first would be using abilities gained as an undergraduate for continuing education after establishing oneself as a professional. This continuing education would be in one's area of expertise and would be needed to keep current with changing technology. The second PEO would be the pursuit of continuing education and additional degrees after becoming established as an engineer. My responses are based primarily on the information presented at the 6 Oct 05 briefing. My department manager offered the following (in an email, so excuse punctuation/grammar) in what is desirable in an engineering new hire's preparation. I concur with the assessment, and from what I observed, the SLU EE program is right on.

3. I like curriculums that give students a solid foundation in mathematics, science (physics and chemistry) and the basic engineering disciplines. This reflects my own "educational philosophy" and the fact that many students will find themselves in "systems engineering" roles, which requires an appreciation of many different specialties.

I also like curriculums that give student the opportunity to work in teams to design and implement projects. This has many benefits. It is a good way to introduce the "systems engineering" activities (requirements management, risk management, configuration management) without taking too much time away from fundamental technical instruction. It gives students the opportunities to practice their "teamwork" skills, which are very important in most companies. Also as the team divide up the work (hardware, software, algorithms, management, whatever), it seems to be a good opportunity for the students to start to figure out what they really like to do based on what they gravitate to during the project.

The students who have good, meaningful, team oriented project experiences really standout from both a resume standpoint and being able to navigate an interview.

I don't have any bright ideas on this, but it would be good if universities could find a way to encourage students to pursue advanced course work in some of the "harder" disciplines. The particular thorn in my side is electromagnetic. I am sure there are others. Of course the advanced courses have to exist before students can pursue them... "

4. EE graduates (more generally engineering graduates) typically accomplish significantly more than solving "technical problems". I would recommend the following – Effectively communicate their technical knowledge and skill set in professional careers.

2.7.3. Students (Spring 2006)

A survey was prepared and presented to students currently enrolled in the program. The results of student survey shown below indicate a high degree of satisfaction with the Program Educational Objectives.

Number of students surveyed: 34

	Strongly Disagree	Somewhat Disagree	Neutral	Agree	Strongly agree	Average
PEO1	0	0	1	15	18	4.5
PEO2	0	0	4	17	13	4.3
PEO3	0	0	4	13	17	4.4

How do our stated objectives meet with your expectations?

1. The objectives meet my expectations well. I think that continuing education is important.
2. These goals are why I choice to attend Parks College.
3. That the courses with labs bring us very close to the information we have been taught.
4. It's what I expected.
5. All the objectives listed above match up exactly with what I hope to do upon graduation.
6. If objective become real, they completely meet with my expectations.
7. I expect to find a job after graduation and then possibly further my education in engineering.
8. Very well.
9. These objectives (at least the first one) is the reason I came here to be an electrical engineer.
10. I think they are complete because they cover all my basic expectations.
11. Yes.
12. Very well.
13. They are what I would expect of the university. The third one is applicable to all graduating students and is probably the only necessary one as it allows for the first two within itself.
14. They meet them well.
15. Overall, very well.
16. I do not know exactly what to expect when entering into industry.
17. Put hands-on experience in there.
18. The objectives meet my expectations.
19. I believe all three are very well met.

20. They fit what I would expect.
21. They meet my expectations.
22. The professors do their best to prepare students for the real world.
23. Number one meets my expectations of what college is about.
24. I am confident that I will be hired into an electrical engineering position that I can grow and be successful.

What other objectives you would suggest for our program?

1. Relating the ideas and concepts of classes to real life and practical ideas.
2. More computer training and hands-on examples to support theory.
3. Focusing more not only on teaching the course but making the student see and experiment what they learn in classes.
4. For the furthering education objective, add medical field.
5. Getting a great job.
6. To move some non-engineering but mandatory classes to Parks. Sometimes you are late because right before one class in Parks you have one in another facility area.
7. None.
8. Have the ability to purse a major of EE through a wider variety of courses.
9. I can't think of any other objectives.
10. I think that each student should be taught how to learn by themselves. Because that is going to be one of our major skills when we enter into industry.
11. Better internship, co-op program. More inter-discipline studies, like bio-electrical. Encourage a mechanical engineer who loves EE and motors to take some EE classes)
12. More focus on practical applications and ethics of engineering decisions.
13. For the most part, it is what I expected.
14. Some sort of job placement program.
15. Maybe more hands-on activities or demonstrations.
16. Senior design project can be a little out of scope for knowledge presently known.
17. I like encouraging students to diversify their studies.
18. All of the objectives are fine.
19. None.
20. None.
21. None that I can think of.
22. Apply more real-world problems and hands-on.
23. None.

Please provide us with the additional comments and suggestions:

1. Only thing is computer science course for programming.
2. I find it difficult to understand what some of the teachers are trying to convey. This is usually due to how smart they are and they think we understand what they are talking about.
3. I like the clarity and conciseness of the above objectives. However, I believe #2 should state that the "undergraduate program provides the basis upon which the student may pursue a graduate program and/or continuing studies."

Recommended Actions:

Results of the survey from the IAB members, Alumni, and students were evaluated for further action. The result of the survey of PEOs by Alumni, IAB members, Faculty, and Students indicated high level of agreement in graduates achieving the program educational objectives. Faculty of the department did not recommend any changes to the PEOs. As a part of the ECE department's continuous assessment the Program Educational Objectives will be revisited in academic year 2008-2009 as shown in Table B1. The established Program Educational Objectives are posted on the departmental web site as well as departmental brochure distribute to prospective students and parents.

3. Program Outcomes and Assessment

The program curriculum is developed to instill the skill set or program outcomes that directly relate to Program Educational Objectives. The courses in the curriculum have identifiable outcomes drawn from the published outcomes. This illustrated below

Program Objective

↓

↓

Program Outcomes

↓

↓

Curriculum

↓

↓

Coursework

(Well defined with identifiable outcomes)

Outcomes vs. Objectives	a	b	c	d	e	f	g	h	i	j	k	l	m	n	
Objective 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Objective 2	X	X	X	X	X	X	X	X	X	X	X		X		
Objective 3	X	X	X		X	X	X	X	X	X	X	X	X	X	

3.1. Program Outcomes Selection Process

In 2002-2003 initial Program Outcomes were developed primarily by the Electrical Engineering Faculty at the same time as the Program Educational Objectives. The faculty felt the Outcomes should directly support the Educational Objectives. The faculty felt the ABET Outcomes (a-k) and program specific outcomes encompass skills, abilities, and knowledge that the students should attain by the time of their graduation. If students can demonstrate achievements of the outcome by the time of their graduation then the graduates are prepared to attain the stated Program Educational Objectives. Outcomes were revised for the academic year 2005-2006 to include program specific outcomes (l, m, and n).
The Program Outcomes adopted by the department are given below.

At the time of graduation, the students obtaining a Bachelor of Science degree in Electrical Engineering program will have:

a) an ability to apply knowledge of mathematics, science, and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) an ability to function on multi-disciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
l) knowledge and application of probability and statistics, advance math
m) knowledge of mathematics and basics sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic systems which may include hardware and software.
n) knowledge of discrete mathematics.

3.2. Program Outcomes Relation to Program Educational Objectives

As a result of the faculty meetings related to ABET and attending ABET workshops by the faculty further clarified the purpose and relation between outcomes and objectives. As a consequence the faculty approved the following table that provides the mapping of Outcomes to Objectives (Outcomes support stated Objectives).

Outcomes vs. Objectives	a	b	c	d	e	f	g	h	i	j	k	l	m	n	
Objective 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Objective 2	X	X	X	X	X	X	X	X	X	X	X		X		
Objective 3	X	X	X		X	X	X	X	X	X	X	X	X	X	

3.3. Program Outcomes in Relation to the College and the University Outcomes

3.3.1 Five Dimensions of the Saint Louis University Experience

Reflective of its mission, Saint Louis University strives to engage its students in five interrelated dimensions contributing to the development of the whole person: scholarship and knowledge, intellectual inquiry and communication, community building, leadership and service, and spirituality and values.

D1. Scholarship and Knowledge
By developing a well-rounded educational foundation which incorporates learning through experience, by becoming scholars in their chosen fields, and by dedicating themselves to the advancement of knowledge, students are prepared for advanced study, for their careers, and for lifelong learning.

Indicators of a student's engagement with this dimension include:

- Being prepared for advanced study
- Being prepared professionally for work
- Demonstrating substantial knowledge and understanding of at least one field of study.

D2. Intellectual Inquiry and Communication
By developing the abilities of intellectual inquiry and communication, students are able to learn effectively, express ideas and concepts clearly, and apply their knowledge to new situations they encounter.

Indicators of a student's engagement with this dimension include:

- Utilizing the tools and methods of research
- Understanding and applying technology and other resources
- Demonstrating the skills of:
    - Communication
    - Critical Thinking (application, integration, analysis, synthesis, evaluation)
    - Problem-Solving
    - Inquiry

D3. Community Building
By welcoming and working with others, regardless of race, ethnicity, religion, or gender, students build an inclusive community which leads to respect and compassion for human life and the dignity of each person.

Indicators of a student's engagement with this dimension include:

- Working collaboratively
- Demonstrating acceptance of and respect for other's differences

- Advocating diversity

D4. Leadership and Service
By serving others and by promoting social justice, students become men and women for others who lead by their example.

Indicators of a student's engagement with this dimension include:

- Devoting time and effort to help others in need
- Serving as an example for others to follow
- Demonstrating an understanding of the interconnectedness of global and local concerns

D5. Spirituality and Values
By developing their spirituality, values, and openness to the transcendent, students determine principles to guide their actions and their relationships with others.

Indicators of a student's engagement with this dimension include:

- Defining and articulating one's own values and beliefs
- Practicing self-reflection
- Making informed and ethical decisions in personal and professional situations

3.3.2. College Learning Outcomes and Mapping to Five Dimensions of the Saint Louis University Experience

Parks College Learning Outcomes

C1. Ability to communicate effectively using written and oral methods
C2. Ability to apply computer skills
C3. Ability to apply mathematical concepts in solving problems
C4. Ability to apply scientific principles in finding solutions to problems
C5. Exposure to the need for faith and spirituality
C6. Exposure to the need for philosophy and ethics for personal growth
C7. Exposure to the value of service to others and society
C8. Ability to integrate knowledge in a capstone experience
C9. Exposure to the value of cultural diversity in community building

College Outcomes	Dimensions of University Exp.	Indicators of Student Engagement
C1	D2	Demonstrating the skills of communication, inquiry
C2	D2	Critical thinking and problem solving
C3	D1, D2	Being prepared for advance study, problem solving
C4	D1, D2	Being prepared professionally for work, inquiry
C5	D5	Defining and articulating one's own values and beliefs, practicing self-reflection
C6	D5	making informed and ethical decisions in personal and professional situations
C7	D4	Devoting time and effort to help others, professional society service, serving as an example for others
C8	D1, D2	Being prepared for advanced study, professional work, demonstrating substantial knowledge and understanding of at least one field of study, inquiry critical thinking, application of technology
C9	D3	Working collaboratively, demonstrating acceptance of and respect for other's differences, advocating diversity

3.3.3. Department Learning Outcomes Mapping to College Outcomes Matrix

The department educational outcomes are consistent with the College Outcomes which in turn are consistent with the five dimensions of Saint Louis University experience.

Program Educational Outcomes/ABET Outcome	Parks College Outcomes	
a	C-2, C-3, C-4	
b	C-3	
c	C-3, C-8	
d	C-8	
e	C-4, C-8	
f	C-5, C-6	
g	C-1	
h	C-5, C-6, C-7, C-9	
i	C-7	
j	C-5, C-6	
k	C-2	
l	C-3	
m	C-2, C-3, C-4	
n	C-3	

3.3.4. Relationship between Courses and Program Educational Outcomes

ECE course coordinators have developed a relation between required courses and Outcomes for both concentrations. In addition to core courses ECE students are expected to take additional advance ECE courses as electives. In addition to ECE courses, the science, math, and other engineering courses play an important role in meeting the program objectives and outcomes. Furthermore, the liberal arts core is essential in developing the whole person and at the same time the student will attain communication skills and ethics which are part of program outcomes. The following two matrices illustrate mapping of courses to outcomes for both electrical engineering concentration and computer engineering concentration.

Electrical Engineering Concentration
Total of at least 56 Engineering Credits is required.

ABET Criteria 3	Faculty Coordinator	a	b	c	d	e	f	g	h	i	j	k	l	m	n
EENG 101	Dr. Ebel						X								
EENG 205	Dr. Mitchell	X	X	X		X						X		X	X
EENG 206	Dr. Mitchell	X	X	X	X	X		X				X			X
EENG 210	Dr. Rahman	X	X			X						X			
EENG 211	Dr. Rahman	X				X						X			
EENG 212	Dr. Mitchell	X	X	X	X	X		X				X			
EENG 301	Dr. Ebel	X		X		X		X				X			
EENG 302	Dr. Rahman	X				X	X			X		X			
EENG 303	Dr. Gharabagi	X		X		X			X	X	X		X	X	
EENG 305	Dr. Mitchell	X		X		X								X	X’
EENG 306	Dr. Mitchell	X	X	X	X	X		X			X	X		X	X’
EENG 307	Dr. Mallik	X		X			X	X	X	X	X	X			
EENG 309	Dr. Gharabagi	X		X		X					X	X		X	
EENG 310	Dr. Gharabagi	X	X	X	X	X		X	X			X’		X’	
EENG 403	Dr. Ebel Dr. Rahman	X	X	X		X				X		X	X		
EENG 404	Dr. Mallik	X		X		X						X			
EENG 407	Dr. Rahman	X		X		X				X		X			
EENG 490	Dr. Mallik Dr. Ebel Dr. Mitchell Dr. Gharabagi Dr. Rahman	X	X	X	X	X	X	X	X	X	X	X	X’	X	
EENG 491	Dr. Mallik Dr. Ebel Dr. Mitchell Dr. Gharabagi Dr. Rahman	X	X	X	X	X	X	X	X	X	X	X	X’	X	

Map of program outcomes and required courses (current version-2006)
X’ indicated newly identified outcome

Computer Engineering Concentration
Total of at least 50 Engineering Credits is required

ABET Criteria 3	Faculty Coordinator	a	b	c	d	e	f	g	h	i	j	k	l	m	n
EENG 101	Dr. Ebel						X								
EENG 205	Dr. Mitchell	X	X	X		X						X		X	X
EENG 206	Dr. Mitchell	X	X	X	X	X		X				X			X
EENG 210	Dr. Rahman	X	X			X						X			
EENG 211	Dr. Rahman	X				X						X			
EENG 212	Dr. Mitchell	X	X	X	X	X		X				X			
EENG 301	Dr. Ebel	X		X		X		X				X			
EENG 302	Dr. Rahman	X				X	X			X		X			
EENG 303	Dr. Gharabagi	X		X		X			X	X	X		X	X	
EENG 305	Dr. Mitchell	X		X		X								X	X’
EENG 306	Dr. Mitchell	X	X	X	X	X		X			X	X		X	X’
EENG 309	Dr. Gharabagi	X		X		X					X	X		X	
EENG 310	Dr. Gharabagi	X	X	X	X	X		X	X			X	X’	X’	
EENG 311	Dr. Mitchell	X	X	X		X		X			X	X		X	
EENG 419	Dr. Gharabagi	X		X		X		X		X	X	X		X	
EENG 490	Dr. Mallik Dr. Ebel Dr. Mitchell Dr. Gharabagi Dr. Rahman	X	X	X	X	X	X	X	X	X	X	X	X’	X	
EENG 491	Dr. Mallik Dr. Ebel Dr. Mitchell Dr. Gharabagi Dr. Rahman	X	X	X	X	X	X	X	X	X	X	X	X’	X	

Map of program outcomes and required courses (current version-2006)
X’ indicated newly identified outcome

Computer Science Courses required as part of Computer Engineering Concentration:

- CSCI 180 Data Structures.
- CSCI 224 Computer Architecture
- Two CSCI Electives are also required for the senior year

3.4. Process Applied to Assess Program Outcome

The following discussion will highlight the general approach to outcomes assessments. The primary constituencies for outcome assessments are faculty and students of the program. The assessment is carried out at two levels. The first level is at the course level. The second level is at the program level. Assessment tools compatible with each level is identified and employed to evaluate and identify outcomes achievement levels. The primary assessment tools for the academic years 2002-2003, 2003-2004, and 2004-2005 were comprehensive senior students' survey, senior exit interview, and faculty direct observation. For academic year 2005-2006 an additional tool which will be discussed later was incorporated in our assessment process. Year by year assessment is discussed in section 3.5.2.

3.4.1 Course Level Assessment

It is decided that the most compatible tools for course level assessment would be surveys and students class performance. Class performance is evaluated from homework, exams, projects, laboratory experiments and reports which include computer simulations, oral and written reports, team work, and class participation and performance. Faculty may use direct observations as an additional tool for outcomes evaluation.

At this level course coordinators develop a set of learning points or objectives that are mapped to one or more program educational outcomes as shown in the matrices above. At the end of each semester faculty and students complete evaluation forms (Survey) to measure achievements level for each of course objectives and/or program educational outcomes.

3.4.2 Program Level Assessment

The faculty of the department used a variety of tools to assess the effectiveness of our curriculum in achieving the Program Outcomes. These tools provide several different mechanisms for our constituents to provide input, including anonymous surveys, observations from direct discussions, and semi-quantitative evaluations of student work in the review of our program. We continuously review assessment results in terms of the Program Outcomes and Educational Objectives and consider changes when appropriate.

The department tracked the performance of outcomes throughout the curriculum. In particular more detailed assessment was done at the senior level courses. Exit interviews with graduating seniors along with a more comprehensive written anonymous survey were employed to assess overall success of the program in achieving stated programs outcomes. The senior survey solicits students' evaluation of Math and Science, ECE courses, and general education components. The survey also solicits feedback on all of program educational outcomes. In addition to the survey the Dept. Chair carries out in person interview of graduating students. The purpose of this exercise is to ensure program educational outcomes are achieved at the time of graduation.

3.4.3. Evaluation Rubrics

The course evaluation data are accumulated as each class progresses toward graduation. Data from the outcome requirements are compared to the course evaluation data to provide indicators of areas for improvement. Course coordinators are responsible for collecting assessment data and provide feedback for continuous improvement.

Evaluation and continuous improvement process has been established at both course level as well as program level. For outcomes evaluation the following five achievements levels are clearly defined.

- Level 1 (strongly disagree or poor)
- Level 2 (disagree or below average)
- Level 3 (Neutral or average)
- Level 4 (agree or good)
- Level 5 (strongly agree or excellent)

The level of acceptable achievement (Performance Criteria) for the department has been established as level 3 or higher. Following actions are to be taken based on achieved level.

- Level 1 would require a major action and significant attention on behalf of the individual faculty (Course level) and the department (program level). It would require greater emphasis on failed outcome, and serious evaluation of the course content and coverage, textbook, lectures, assignments, and emphasis to identify and rectify deficiencies. At program level it would require review of coverage in more than one course to identify short comings and weaknesses. Then a clear plan is to be formulated to rectify the deficiency in a timely manner.
- Level 2 would require a clear action on behalf of individual faculty. At course level it may require more emphasis in lectures, more relevant examples solved in class, and more assignments. More emphasis in more than one course may be required to improve and raise the satisfaction level.
- Level 3 is minimum acceptable level for both at the course level and program level. Faculty and department may need to recommend some action (s) to ensure better coverage and emphasis at both course level (more coverage in lectures, problem session hours, homework, and project (s)) and program level (ensure more coverage in more courses).
- Level 4 is a good level of achievement and no action is needed on behalf of the individual faculty and/or department. We should note that a care must be taken to ensure this level is maintained and possibly improved upon.
- Level 5 is the best possible level of achievement. No action is needed. The lessons learned from this level and level 4 should be used to improve levels 1, 2, and 3.

3.5. Evaluation and Action Phase:

3.5.1. Assessment of Achievements of Outcomes

Data from various assessment tools are collected regularly by the department. These data are reviewed and assessed by the faculty to make recommendation for possible actions both at the course level and program level. The faculty meets at the end of each semester to discuss and assess the overall outcomes and then identify the strength and weakness for each outcome. Then faculty provides action items to improve identified weaknesses in outcomes.

3.5.2. Action Items and Closing of the Loop at the Program Level

The following table provides a summary of outcomes assessment for the period of 2002-2003 till 2005-2006. It is clear that prior to academic year 2005-2006 program specific outcomes (outcomes l, m, and n) were not included in the assessment process

Academic Year	Outcome identified in need of continuous improvement	Changes Recommended	
2002-2003 2003-2004	No Action	No Action	
2004-2005	Outcome "i" Outcome "d" Outcome "k"	- Classroom discussion & Indirect research - One major team in senior design courses	
2005-2006	- Improve outcomes b and c - Improve Probability and Statistic for Computer Engineering Concentration	- Implement junior design course - More Probability and Statistic application in CpE required courses - Possibility of teaching Prob. and Stat. course by Engineering Faculty.	
2006-2007	See discussion below for years 2007 and beyond		

The summary results for academic years 2002 till 2006 is given in the following table. For 2002-2003 to 2004-2005 results were primarily obtained from senior students' survey and faculty observations. For academic year 2005-2006 an additional assessment tool which is discussed in section 3.5.5. was employed. The following table presents a summary of outcomes assessments for the past four years.

Outcomes	2002-2003 Average	2003-2004 Average	2004-2005 Average	2005-2006 Average	
a	4.4	4.1	4.375	4.4	
b	4.2	4.0	4.375	4.3	
c	4.3	3.7	3.875	4.1	
b	4.6	4.2	4.0	4.3	
e	4.5	3.9	4.125	4.7	
f	4.4	4.3	4.375	4.6	
g	4.3	4.3	4.125	4.3	
h	4.2	3.7	4.375	4.3	
i	4.4	4.1	4.375	4.8	
j	4.1	3.1	3.375	4.4	
k	4.4	3.8	4.125	4.2	
l	NA	NA	NA	4.5	
m	NA	NA	NA	4.8	
n	NA	NA	NA	4.5	

Outcomes assessment data from 2003 till 2006
NA: Not Assessed
(The acceptable level of achievement is level 3 or above)

3.5.3. Academic Years 2002-2003 and 2003-2004:

During the academic years 2002-2003 and 2003-2004 several department meetings were devoted to discussing and understanding the ABET assessment process. Various assessment tools were discussed. The importance of mapping a course learning objectives to Outcomes was discussed. The primary assessment tools for the academic year 2002-2003 and 2003-2004 were comprehensive senior survey, graduating students exit interviews, and direct faculty observations. Program specific outcomes (l, m, and n) were not included in the survey for these periods.
The collected data were summarized and discussed in departmental meetings. Overall senior survey, senior exit interview, and direct faculty observation showed satisfactory achievement for program outcomes. Hence no action to correct was recommended.

3.5.4. Academic Year 2004-2005:

In July of 2005 a group of ECE Department faculty met to review collected assessment data and provide possible actions to correct possible deficiencies and close the loop at the program level. Faculty used the senior exit interview, senior comprehensive survey, and direct observation assessment tools to close the loop at the program level. The following provides the result of the meeting with recommended actions for the upcoming academic year 2005-2006.

The department is using a benchmark of 3 (Neutral or Average) as an acceptable level of achievements for outcomes as well as objectives.

Actions are recommended for an outcome evaluated to be in greatest need for improvement. The item may not be below recommended acceptable level of 3. But the goal is to provide continuous improvements.

The following table provides the summary of the assessment and recommended actions based on senior survey, senior exit interview, and faculty observations in the Senior Design I & II courses.

Typical Evaluation and Actions Sheet

Fall 2005 Program Outcomes	Improvement Required?	Benchmark Of 3 out of 5 is used	Action (s) Recommended	Additional Comments
a	No	Exceeded		
b	No	Exceeded		
c	No	Exceeded		
d	Yes	Exceeded	More emphasis on team work and importance of accepting decision making (leadership) role in design course is recommended.	Students are not willing to accept leadership roles. They are good in following a given directive. Marginal improvement is needed.
e	No	Exceeded		
f	No	Exceeded		
g	No	Exceeded		
h	Yes	Exceeded	More coverage in freshman EE course as well as senior design courses.	
i	Yes	Exceeded	Make the definition clear to students and provide examples in more than one EE course (such as intro to EE, and senior design sequence). Use the terminology more often in our lectures in an appropriate context.	Students are not clear about the meaning of the life long learning.
j	No	Exceeded		
k	Yes	Exceeded	In EE laboratory courses such as EENG 212, P206, P310, and 490-491, emphasis the importance of simulation tools such as PSPICE in testing potential solution in engineering problems.	Marginal improvement is needed. Students lack the appreciation of the value of applying modern engineering tools such as circuit simulation environment to test potential solution to engineering problems.
l	No	Exceeded		
m	No	Exceeded		
n	No	Exceeded		

3.5.5. Academic Year 2005-2006

The process used for this academic year is explained in **Part 1** and the resulting action items for continuous quality improvement of the program are discussed in **Part 2**.

Part 1: The Process

For the academic year 2005-2006 better assessment tools were developed and adopted. This is as a consequence of some faculty attending ABET workshops and clarification of the language on outcomes and objectives by the ABET.

For the **Fall semester** of academic year 2005-2006 faculty course coordinators were asked to develop a set of learning points for each of their courses. A survey was developed based on these learning points. Each learning point was then mapped to one or more relevant Program Educational Outcomes. At the end of the fall semester these surveys were completed both by students as well as course coordinator or course instructor. For each course a table (as shown below or refer to Appendix I section D) was prepared mapping the course learning points to applied outcomes.

Outcomes Vs. Learning Points	a	b	c	d	e	f	g	h	i	j	k	l	m	n	
L.P.#1	3				4				4				5		
L.P.#2	4		4		5			4					4		
L.P.#3	4		3					5	3						
L.P.#4				4			4						3		
L.P.#5	5		5	3	3					4					
Average	4		4	3.5	4		4	4.5	3.5	4			4		

The results of the assessment for each course were used by course coordinators to recommend appropriate action(s) to provide continuous improvement at the course level.

To assess achievement at the program level the averages for relevant outcomes (from a table similar to the one shown above) for each of the fall courses were then entered into a larger table (see **Table A0** page 41). The results of these surveys presented in the **Table A0** were used as one of the assessment tools to evaluate/assess the achievement of program educational outcomes. Utilizing this and other assessment tools, and considering acceptable achievement level, a set of possible actions were then recommended by faculty of the department to provide continuous improvement at the program level.

A departmental meeting was held on January 24, 2006 to consider collected data from the surveys as well as faculty observations. At the meeting the faculty discussed the evaluation data of all courses for the program. Although no program educational outcome was below acceptable achievement level, faculty of department recommended actions for outcomes to provide continuous improvement. Key courses with greatest impact on identified outcomes in need of improvement were discussed. Several possible action items and their possible impacts were considered. Action items with measurable impact were recommended for adoption (See Part 2: The recommended Actions).

For the spring semester of 2006 additional surveys were developed which directly mapped spring semester courses to one or more Program Educational Outcomes (a-k, l, m, and n) (Please refer to Appendix I section D). These surveys were completed both by students and course coordinator or course instructor at the end of the spring semester. The results of these surveys were collected and entered in a larger table (refer to **Table A1).** A meeting was held at the end of the academic year 2005-2006 to evaluate collected data and recommend actions for continuous improvement and achievements of program educational outcomes.

Table A0: Fall semester (Academic year 2005-2006)
Evaluation data (out of five) for outcomes
(The acceptable level of achievement is level 3 or above)

ABET Outcomes Vs. Fall 2005 Courses	a	b	c	d	e	f	g	h	i	j	k	l	m	n	
EENG 101															
EENG 205	4.54	4.30	4.30		4.42					3.69	5		4.34	4.49	
EENG 206	4.22	4.12	4.2	X	4.55		4.37				4.59			4.61	
EENG 210															
EENG 301															
EENG 303	3.8		3.8		3.78			4.03	3.5	3.8		3.8	3.8		
EENG 305	4.13		4.13		4.13	3.77			3.77				4.33	X’	
EENG 306	4.4	4.5	4.53	4.8	4.36		4.25			3.55	4.16		4.36	X’	
EENG 307	4.5		5		4.5	4.5	4.5	4.5	4.5	4.5	X		4.5		
EENG 311	3.56	3.56	3.56		3.2		2.39		1.85	3.37	2.39		2.96		
EENG 407	4.43		4.37		4.3			4.63	X		X	4.16	4.16		
EENG 419	3.67	4.08	3.94		3.68		4.08		4.04	3.91	4.08		3.67	X’	
EENG 490	X	X	X	X	X	X	X	X	X	X	X	X	X		
Total Average	4.14	4.16	4.20	4.8	4.10	4.13	3.92	4.39	3.53	3.8	4.04	3.98	4.01	4.55	
Comments	C1	C1	C1	C2	C1	C1	C1	C1	C2	C1	C1	C1	C1	C1	

C1: No Action is needed.
C2: Some action is recommended.
X indicates data not available or not evaluated
X’ indicates outcomes to be included for the next evaluation cycle.
Scores with underline are outcomes to be considered for removal for lack of strong evidence.

Considering results presented in Table A0 and program's acceptable achievement level it was clear that there is no need for a major action to correct. The suggested recommendations are to provide continuous improvement for two of the fourteen outcomes as discussed in **Part 2**.

Part 2: The Recommended actions

Based on mid year outcome assessment the ECE faculty suggest following actions to further improve outcomes d and i.

Outcome d: Ability to function in a multidisciplinary team.

Limited coverage of outcome d is noted. Action (s) recommended to further improvement is (are):

Short term action: In spring 2006 ECE courses that have mix of students with EE and CpE concentrations suggested to have a multidisciplinary projects. It should be noted that current senior design students are carrying out a multidisciplinary projects which includes students from Aerospace Engineering and Mechanical Engineering programs. Design students were not surveyed for the mid-year assessment.

Long Term Actions: In academic year 2006-2007 senior design students will be encouraged to carry out multidisciplinary projects. Faculty envisions collaboration between AE, ME, BME, and ECE senior design students.

Outcome i: Recognition of the need for, and ability to engage in life-long learning.

The outcome "i" received average of 3.53. Action (s) recommended for further improvement are:

Short and Long Term Actions: Faculty are to discuss the importance of life long learning in class. It is recommended that faculty assign homework and/or projects that involve library/internet research. It is also recommended that speakers to be invited to further emphasis the importance and the need for life long learning and related issues.

Additional suggestion is to provide assignments to senior design students to further improve on this outcome. Spring 2006 outcomes survey would provide a better measure of the outcome.

For the fall 2005, some homework assignments in semiconductor (EENG 303) course emphasized the importance of continuous education and life long learning. Students were asked to search the web for up-to-date research materials related to semiconductor technology.

3.5.6. Faculty Evaluation of Program Outcomes – May 2006:

The Faculty retreat was held to consider assessment data collected for the academic year 2005-2006. The retreat was also used to consider the result of actions taken to correct few areas of weaknesses identified by the faculty during the July of 2005 and January of 2006 meetings.

At the **July of 2005** meeting faculty considered the data from the senior exit interview, senior survey, and direct observation. The faculty concluded that outcomes d, i, and k would require additional attention.

At the **January 2006** meeting faculty considered collected data from surveys of course learning points mapped to outcomes results shown in Table A0. Outcomes d and i were identified/adopted for continuous improvement.

Actions on Outcome d: "The ability to function on multidisciplinary teams"

Senior Design coordinator presented lectures on team work and the importance of accepting leadership role. During academic year 2005-2006 a group of students in ECE program joined the multidisciplinary project named "BillikenSat". The project was carried out by a group of more than 20 students from various disciplines, Aerospace, Electrical and Computer, Mechanical engineering as well as Computer Science at the Saint Louis University. Instructors from Aerospace and Electrical Engineering Departments collaborated closely to lead students through such a challenging project. Several sub groups were formed to carry out parts of the project. Each group was able to elect group leaders who were willing and able to accept the leadership role. Faculty assessed that students are stepping forward to take charge and make sure the project progresses at an acceptable pace.

In addition to "BillikenSat" project electrical and computer engineering students selected to carry out two additional projects. Department Faculties were mentors for two groups of electrical and computer engineering students working on "RFID" and "Local Positioning System" projects. Both of these projects provided ample opportunity for students in EE and CpE concentrations to interact in implementing interdisciplinary projects.

In a recent town hall meeting, March 29, 2006, some issues regarding the multi-disciplinary team were discussed. The importance of communication and leadership was discussed.

The survey results and department faculty direct observation of senior design students has resulted in concluding that students are able to function in multi-disciplinary teams and accept leadership roles.

It should also be noted that Electrical and Computer Engineering and Biomedical Engineering departments have agreed on working in collaboration to offer joint projects in 2007-2008 academic year and beyond.

Action on outcome "i": "a recognition of the need for, and an ability to engage in life-long learning"

As an assignment for semiconductor devices, ECE 303, students were asked to search the web and find a news article (s) related to advances in semiconductor industry. Assignment was evaluated by the instructor and a brief history of progress in semiconductor industry was

presented to the class. This is one of several examples illustrating to the students the importance of the life long learning.

In a recent **town hall** meeting, March 29, 2006, there was presentation on globalization and the importance of life long learning. It was stated that the current ECE knowledge half life is 5 years. It is expected the half life to reduce even further. Hence for an Electrical and Computer Engineering major it is very important to keep up with current knowledge through continuous learning.

Department faculty presented a talk to senior students about importance of life long learning and the global competition.

The department faculty indicated that students have received enough information to recognize the need for, and ability to engage in life-long learning. Hence outcome "i" may no longer be of concern.

The following tables present the summary of the 2005-2006 outcome assessment for combined fall and spring semesters. Various ECE course assessments were carried out by faculty coordinators. The results of both students as well as faculty evaluations are presented in the following tables. Table A1 presents a summary of students' evaluations of ECE courses. Table A2 presents summary of faculty evaluations of ECE courses. The Table A3 presents an average of Table A1 and Table A2 results.

Action on outcome "k" an ability to use the technique, skills, and modern tools necessary for engineering practice.

Actions adopted by the faculty of the department in such courses as Digital Design Lab (EENG 206), Microprocessors Lab (EENG 306) and Electronics Lab (EENG 310) has improved the ECE students ability to use modern engineering tools such as test equipments and modern simulation environments necessary for engineering practice. Hence no further action is recommended for improving outcome "k".

Table A1: Annual Students Outcomes Evaluation
Academic Year 2005-2006
(The acceptable level of achievement is level 3 or above)

Outcomes Vs. Courses	a	b	c	d	e	f	g	h	i	j	k	l	m	n	
101						X									
205	4.6	4.25	4.25		4.4						4.65		4.36	4.2	
206	4.4	4.35	4.25	4.3	4.3		4.24				4.45			4.35	
210	X	X			X						X				
211	4.4				4.4						4.2				
212	4.3	4.8	3.9	4	4.3		4.1				4.7				
301	4.15		4.15		4.15		2.8				4.15				
302	4.3				4.1	3.8			4.1		4.3				
303	3.8		3.8		3.78			4.03	3.5	3.8		3.8	3.8		
305	4.13		4.13		4.13								4.33	X’	
306	4.4	4.5	4.53	4.8	4.36		4.25			3.55	4.16		4.36	X’	
307	4.5		5			4.5	X’	4.5	4.5	4.5	4.5				
309	4.6		4.4		4.2					3.8	4.4		4.3		
310	4.6	4.6	4.5	4.2	4.4		4.4	4.1	4.5	4.4	X’		X’		
311	3.56	3.56	3.56		3.8		2.39			3.37	2.39		2.96		
403	4.6	3.5	3.7		4.4				4.6		4.2	4.7			
404	X		X		X						X				
407	4.43		4.37		4.3			4.63			X’				
419	3.67		3.94		3.68		4.08		4.04	3.91	4.08		3.67	X’	
490/491	4.4	4.3	4.1	4.3	4.7	4.6	4.3	4.3	4.8	4.4	4.2	4.5	4.8	4.5	
Average	4.28	4.23	4.17	4.32	4.21	4.3	3.82	4.31	4.29	3.96	4.18	4.33	4.07	4.35	

Outcome Data (out of 5) for the end of academic year 2005-2006
(Student surveys)

Note: The Department’s retreat resulted in updating the super-matrix to better reflect coverage of outcomes in ECE courses. X’ is an indication that faculty feel that there is enough coverage within the course that the outcome needs to be included. Outcomes with underlined scores are to be considered for removal for lack of strong supporting evidence.

Table A2: Annual Faculty Outcomes Evaluation
Academic Year 2005-2006
(The acceptable level of achievement is level 3 or above)

Outcomes Vs. Courses	a	b	c	d	e	f	g	h	i	j	k	l	m	n	
101						5									
205	5	4	4		5						5		5	5	
206	5	5	4	4	5		5				5			5	
210	4	3			3						4				
211	4				4						4				
212	5	5	5	4	5		5				5				
301	5	3	4		4		5				2				
302	5				5	4			4		5				
303	5		4		5			4.	4	4		4	5		
305	4		3.5		4								4	5	
306	4	5	3.5	4	4		4			4	5		4	5	
307	5		5			4	4	4	4	4	4			3	
309	5		5		5					4	5		5		
310	5	5	5	4	5		4	4	4		5		5		
311	X	X	X		X		X			X	X		X		
403	5	3	4		5				5		4	5			
404	X		X		X						X				
407	5		4		4				4		5				
419	5		4		4		4		4	4	4		5	5	
490/491	5	4	4	5	4	4	5	4	4	4	4	X	4		
Average	4.76	4.11	4.21	4.2	4.43	4.25	4.5	4	4.125	4	4.4	4.5	4.71	4.66	

Outcome Data (out of 5) for the end of academic year 2005-2006
(Faculty surveys)

Note: For the academic years 2003 to 2005 not all courses were offered every year. Although it had achieved stated efficiencies but it resulted in problems with advising and problems with transfer students. Starting academic year 2005-2006 it was decided that all required ECE courses will be offered at least once every academic year. The ECE 404 was not taught during the academic year 2005-2006. All ECE students requiring the course had taken the course during the academic year 2004-2005.

Table A3: Annual Outcomes Assessment
Data from Combined Student and Faculty Evaluation
(The acceptable level of achievement is level 3 or above)
2005-2006

Outcomes	Faculty Evaluation	Students Evaluation	Averages	Recommended Action
a	4.76	4.28	4.52	No Action Needed
b	4.11	4.23	4.17	Need to increase students exposure to open ended problems
c	4.21	4.17	4.14	Need to increase students exposure to open ended problems
d	4.2	4.32	4.26	Continue emphasis on multidisciplinary team
e	4.43	4.21	4.32	No Action Needed
f	4.25	4.3	4.275	No Action Needed
g	4.5	3.82	4.16	No Action Needed
h	4	4.31	4.15	No Action Needed
i	4.125	4.29	4.20	No Action Needed
j	4	3.96	3.98	No Action Needed
k	4.4	4.18	4.29	No Action Needed
l	4.5	4.33	4.415	No Action Needed
m	4.71	4.07	4.39	No Action Needed
n	4.66	4.35	4.5	No Action Needed

3.5.7. Action Items Recommended for Academic Year 2006-2007 (Student Outcomes)

The ECE faculty met and assessed the input from various assessment tools. This provided a feedback for outcomes skill set. The faculty then concluded that there is no need for major actions. But faculty discussed the need to increase students exposure to open ended problems that consider outcome "b" (…..design and conduct experiments, as well as analyze and interpret data) and outcome "c" (design system, component, or process to meet desired needs within realistic constraints such as …..) in applicable courses. Faculty also reiterated the importance of continuous emphasis on outcome "d" (….. functioning in multidisciplinary teams).

The faculty also acknowledged the need to increase the coverage of application of the Probability and Statistics for Computer Engineering concentration (track) students. The following actions will strengthen the outcome "l".
In a recent College Faculty Assembly Meeting, the ECE department proposed and received approval for a one credit course as junior design course as a part of a new curriculum to be presented to the University Board of Trustees in time for academic year 2007-2008. Faculty agreed to use portion of this course to provide application of the probability and statistics.
In addition there will be more examples of application of probability and statistics in Semiconductor Devices, EENG 303, in future.

The faculty of ECE and BME met and discussed the possibility of introducing a new course for engineering students in both the programs called Probability and Statistics for Engineers in place

of existing Prob. and Statistics (MATH 403) delivered by math department. The goal of the course is to expose students in both departments to engineering applications using Probability and Statistics. This course will be taught by ECE/BME faculty.

3.5.8. Action Items for Criterion 3 for 2006-2007 and Beyond (Faculty)

- Re-evaluate course level outcomes
- Obtain documentary evidence in support of stated outcomes for each course. For example at present there may be oral discussion but no written material to show as documentary evidence for some outcomes.
- Collection of assessment data at course level needs to take place in a timely manner by course coordinators.
- Consider assessment tools in addition to the ones currently used.
- More time is required for faculty to get familiar with new assessment process and tools. As a result, the department plans to send faculty to ABET workshops.
- Another assessment tool as discussed below to be considered for adoption.

At the course level the assessment of students' performance on homework, exams, projects, laboratory experiments and reports which include circuit and system simulations, oral and written reports, team work, and class participation and performance is to be carried out using the following evaluation process.

Level-1	Greater than 80% of students received a passing grade (>60%). Strong Indication that outcome is sufficiently addressed.
Level-2	Greater than 60% of students received a passing grade (>60%). Outcome is addressed but faculty should monitor closely during next cycle.
Level-3	Less than 60% of students received a passing grade (>60%). Marginal indication that outcome is addressed. Faculty should review before next cycle.

3.5.9. Materials Available for Program Evaluator

The following assessment tools will be available for review during the visit to demonstrate achievement of the Program Outcomes and Assessment.

- Portfolios (Exams, Homework, Lab Books, Lab reports, Projects)
- Surveys from various constituents
- Video Recordings of student project presentations
- Senior Design Logbooks and Project reports.

The materials stated above will be available for program evaluator. Materials will be organized to provide evidence of achieving stated program educational outcomes. Additional material will be provided upon the request by the program evaluator.

4. Professional Component

The basic level curriculum for the Electrical Engineering program is listed in Table I-1 of Appendix I. This table lists the courses in the order in which they are offered in the curriculum and classified in appropriate categories to clearly indicate how the program meets the Professional Component (Criterion 4) as well as Program Criteria (Criterion 8).

4.1. Math and Basic Science:

The curriculum requires 36 hours of Mathematics and Basic Sciences which exceeds the ABET requirement of 32 hours (1 year). The math requirements are Calculus I (4 cr.), II (4 cr.), III (differential and integral calculus – 4 cr.), differential equations (3 cr.), Elementary Discrete Structures (3 cr.), Linear Algebra (3 cr.), and a formal course in probability and statistics (3 cr.). The basic science sequence starting from Engineering Chemistry with associated laboratory (3 + 1 hours), Engineering Physics I and II with associate laboratories (6 + 2 hours) total 12 hours.

For students in EE concentration further 10 credits in science and math are obtained from CS 150 (4 cr.), science and math elective (3 cr.), and technical elective (3 cr.). Thus the total credits in Science and Math will add to 46 (36 + 10) credits as indicated in Table I-1 EE Concentration.

For students in CpE concentration a further 20 credits in science and math are obtained from CS 150 (4 cr.), CS 180 (4 cr.), CS 224 (3 cr.), two CS electives (6 cr.), and a technical elective (3 cr.). Thus total credits in Science and Math will add up to 56 (36 + 20) credits as indicated in Table I-1 CpE Concentration.

4.2. Engineering Topics:

The curriculum requires 59 hours of Engineering Topics for Electrical Engineering Concentration and 50 hours for Computer Engineering Concentration exceeding ABET requirement of 48 hours (one and half years).

4.3. Computer Experience:

Computers are heavily integrated into the Electrical Engineering curriculum. All electrical engineering students are required to take CSCI-150 **Introduction to Object Oriented Programming**. MathCAD software package is used in Physics, Math and freshman engineering courses. Within the Electrical Engineering curriculum, in the EE –P101 Introduction to electrical engineering course, students are exposed to software packages like circuit simulation software (ORCAD and/or Multisim) and MATLAB. The students develop further skills in using these software packages as they progress to higher level courses like circuits and electronics. The students also learn assembly language programming when they take the required courses Microprocessors and the lab (EENG 305 and EENG 306). The software package Quickfield is used by the students in Electromagnetic Fields (EENG 302). Microsoft Project 2003 is used in tracking the progress of design projects. The students are required to be proficient in (1) Microsoft Word, (2) Microsoft Excel, (3) Microsoft PowerPoint, (4) Microsoft Project 2003, (5)

MathCAD, (6) MATLAB, (7) SPICE, the simulation packages (ORCAD, Multisim, Xilinx) for analog and digital circuits. The students are proficient in C programming and assembly language programming. The students learn high level languages like VHDL, C++ if they opt for certain elective courses.
Computer based assignments and projects are given to the students in most of the required courses in the Electrical Engineering curriculum. These are graded and returned to students with comments for further improvement.

4.4. Laboratory Experience:

The Electrical Engineering curriculum introduces the student to a variety of laboratory experiences for hand on experience. Students are required to take the following labs for total of 11 credits.

Chemistry Laboratory - (1 Credit)
Introduction to Electrical Engineering – (1 Credit)
Engineering Physics I and Engineering Physics II with labs – (2 Credit)
Electrical Science Lab – (1 Credit)
Electronics Lab – (1 Credit)
Digital Design Lab – (1 Credit)
Microprocessors Lab – (1 Credit)
Senior Design I and II with labs (3 Credits)

The laboratory courses strengthen the understanding of the physical concepts of engineering analysis and design as well as safety considerations. Handouts describing general laboratory safety procedures are provided with explanation to the students. The students are exposed to safety issues right from the beginning when they take freshman engineering course where they are given a formal lecture on safety issues. Safety concerns are of foremost consideration and are continually stressed by the lab instructors. In addition to this, the laboratory instructor in charge ensures that associated safety rules and procedures are maintained and implemented. In many instances, experimental set-up must be verified by the instructor before the student proceeds with the experiment. First aid boxes are located in all labs in case of emergency.

4.5. Engineering Design Experience

Engineering design is well integrated into the Electrical Engineering curriculum. The design experience starts with **Introduction to Electrical Engineering**, continues at the sophomore level in the courses **Engineering Circuits I, II,** and **Digital Design**. Design is further reinforced the junior year in **Electronics Circuit Design** and **Automatic Control Systems** among others. Open-ended design tasks in the form of projects are integrated into these courses. Design projects are assigned to teams of students to provide an opportunity to work in a team environment, and also develop effective communication skills.

4.5.1. Major Design Experience

Electrical Engineering curriculum requires students to complete major design experience in two

course sequence of Senior Design I (EENG 490) and Senior Design II (EENG 491) (Capstone Design Courses totaling six credits). The design courses are based on experiences gained throughout the curriculum. Students are expected to work in a team environment. The teams consist of students of multidisciplinary backgrounds such as programming, hardware design, and theoretical skills.

In the first course (Senior Design I) students are grouped together based on their interests, background, and educational strengths. Projects (industry sponsored or internally generated) are presented to students by faculty of the department. Upon selecting a project students are guided by faculty advisor (s) and /or industry representative (s). At the end of the design I the students write a detailed proposal and orally present to the faculty, industry representative, and students. Proposal consists of detailed specs, design methodologies, the budget, timeline, task distribution within a group, and related information. Faculty of the Department provides suggestions to improve the design proposal. The approved projects are funded by the Electrical Engineering Department or funds are provided by the industry sponsor.

Students in Design II develop a working proto type of the proposed design project. Upon successful demonstration of a working proto type the project enters the final phase of the design. In the final phase of the design students are expected to build and package a copy of the working model, prepare a detailed final written report, and along with a detailed presentation material. Final presentation (oral presentation followed by hardware and software demonstration of final project) is open to students and faculty of Parks College as well as industry partners.

The students enrolled in the senior design course learn and implement concepts of an engineering design, which includes constraints such as economic factors, reliability, realistic constraints, aesthetics, legal, environmental, ethics, and social impact. These are discussed in detail as an integral part of the various design experiences. Specifically, students consider how these factors enter into the decision-making process while considering design alternatives. All these factors are taken into consideration in the two electrical engineering capstone design courses taken in the senior year. EE Design I consists of two hour lecture and two hour lab. EE Design II consists of one hour lecture and four hour lab.

4.6. Identify the Part(s) of the Curriculum in which Probability and Statistics are Applied to Engineering Problems.

The curriculum includes a required formal three-credit course in probability and statistics (Math 403). This course is a co-requisite for Semiconductor Devices (EENG 303) and pre-requisite for Communication System (EENG 403). The concepts of probability and statistics are applied to random noise analysis in the study of continuous wave modulations in the communication system course. Application of probability is important in introduction to quantum mechanics as a part of the Semiconductor Devices (EENG 303). Statistical analysis is used in analyzing experimental results in many electrical engineering labs and the results are interpreted in conclusions part of the lab reports.

4.7. Oral and Written Communication:

Electrical Engineering curriculum requires that all students take the course ENGL192, Advanced Writing for Professionals. Students needing prerequisite work in writing skills, as determined by scores in placement exam will be required to take ENGL150 "The Process of Composition (3 cr.) and perhaps ENGL100 Introductory Writing. English courses are offered by the Department of English in the College of Arts and Sciences.
Written reports are required in all experimental laboratory courses. Those courses which include elements of design require a written report (see Appendix I Table I-1 for list of these courses). The two-semester capstone design course has several oral and written status reports, as well as the formal design report. Oral presentations are made by each member of the senior capstone design team several times during the senior year.

As part of the Parks College of Engineering, Aviation, and Technology core-curriculum requirements, a one-credit hour course in Small Group Presentations (CMM 293) is being taught by faculty of Communications department in the School of Arts and Sciences. All students enrolled in the program are required to take this course. Each student is required to do oral presentation as well as written report.

In many courses, such as Digital Design, Microprocessors, and Electronic Circuits opportunities are provided in the form of a design project for the development of competence in oral and written communications. The written reports are typed using standard word processors and oral presentations are made to the entire class using software like Power-point along with data projectors (Computers).

Instructors grading lab reports, progress reports and design proposals periodically provide feedback to students and offer suggestions to improve the grammar, layout and writing skills. Instructors and fellow students also offer constructive suggestions to improve oral presentations and sometimes these oral presentations are recorded on a video tape for later viewing and discussions for improvement.

The students who are deficient in oral and written communication skills seek help from Student Educational Services Center (SESC) and Writing Center (SESC).

4.8. General Education Component:

The General Education component is well focused and complements the technical component to achieve the program educational outcomes and program educational objectives of Electrical Engineering program, and to be consistent with the mission of the Saint Louis University.

The electrical engineering curriculum includes a general education component of 22credits as indicated in Table I-1 of Appendix I. The humanities/social science sequence is designed to satisfy the ABET general education component requirements. The humanities/social sciences include the following disciplines: fine arts, history, humanities, literature, philosophy, political

science, psychology, sociology, theology, and languages other than English or a student's native language. One three-credit course in economics may be included in the general minimum requirement of 18 credit hours of humanities/social sciences.

The humanities and social science core curriculum required for graduation are:

1. Philosophy and Theology (6 hours)
   Theological Foundations (3)
   and PHIL 205 Ethics (3)

2. Social and Behavioral Sciences (3 hours)
   A course in Anthropology, Communications, Communication Disorders, Economics, Education, Political Science, Psychology, Sociology, Social Work, or Public Policy Studies.

3. Humanities (3 hours)
   Courses in the Fine Arts, Literature, History, or Foreign Language.

4. General Electives (3 hours)
   An additional course from Philosophy and Theology, Social and Behavioral Sciences, or Humanities.

5. Cultural Diversity (3 hours)
   This requirement may be met by a course which also satisfies another core curriculum requirement.
   (There are specific courses which meet core curriculum requirements. The list of courses is available in the Dean's office).

Further, the Electrical Engineering program will require an additional 3 hours of General Electives if the Cultural Diversity core is met by a course which also satisfies another core curriculum requirement.

5. Faculty

Section 5.1 provides background information since last visit and section 5.2 provides information on faculty resources.

5.1 Background Information: Departmental Changes and Updates since Last ABET Visit

In response to the needs of our constituencies a new concentration in Computer Engineering was established in 2004. In the same year the name of the department was changed from Electrical Engineering to Electrical and Computer Engineering Department. This change is to reflect the newly established concentration within the program. It is also to attract students interested in pursuing Computer Engineering at the Saint Louis University. One of the departmental future goals is to establish and seek a separate accreditation of Computer Engineering Program along side the Electrical Engineering Program in the next ABET cycle. Department in consultation with its various constituencies has established a process to meet the requirements of ongoing program assessment and improvement.

Personnel Changes are as follow:

2. Dr. William Ebel Joined the department in July 1, 2000.
3. Dr. Thomas Bush left the department in 2001.
4. In 2002 Dr. David Barnett accepted a position in the newly established Biomedical Engineering Department as Chair.
5. Dr. Kyle Mitchell joined the department as a tenure track assistant professor in July 1, 2004.
6. Computer Science Department at Parks College was closed in 2003.
7. In 2003 Drs. Dennis Bouvier and Ann McNamara, CS faculty, joined the Electrical and Computer Engineering Department.
8. Dr. Bouvier left the University in June of 2005.
9. In July 1, 2005 Dr. McNamara Joined the Engineering Technology Department at Parks College.
10. In June 2005 Mr. James Tucker, technician, resigned from his position.
11. In September 2005 the College hired Mr. Emile Damatte to oversee safety across all labs, compliance with OSHA rules, machine shop instructions, etc.

5.2 Faculty Resources

The Department of Electrical Engineering has the services of 5 full time dedicated, highly qualified, and motivated Faculty with diverse backgrounds (refer to Table 5A). The faculty consists of following ranks:

Professor: Dr. Habib Rahman
Associate Professor: Drs. William Ebel, Roobik Gharabagi, and Huliyar Mallikarjuna
Assistant Professor (tenure track): Dr. Kyle Mitchell

The faculty of the department with their diverse backgrounds has been effective in delivering a quality instruction to students.

Faculty is involved in all aspects of the operation of the department. The faculty have received financial support to attend ABET workshops to be educated about the ABET processes. The ECE faculty understands the importance of developing and implementing an effective process for evaluation, assessment, and continuous quality improvement of the program, its educational objectives and outcomes. The department with faculty cooperation has been successful in establishing an effective evaluation, assessment and continuous quality improvement processes.

The department encourages and supports faculty development by providing funds to participate in professional societies and travel to professional meetings and conferences. The department pays for the membership of professional societies (IEEE and ASEE) and also pays for the subscription of relevant journals. Junior faculty continues to receive support from the department faculty in pursuit of tenure and promotion. Junior faculty is given reduced load for the first three years in order to establish research and scholarly activities. Junior tenure track faculty receives start up funds from the college to establish his/her research infrastructure.
The following table provides expertise of the department faculty and their specialized and general teaching assignments.

Table 5A: ECE Faculty Teaching and Research Expertise and Interests

ECE Faculty	**Teaching (Area of Expertise)** EENG	**Teaching (Common areas)** EENG	**Research Interests**	
William Ebel	Signals and Systems 301 Communication 403 **EE Electives** Digital Signal Processing, Cellular and Digital Communication	101, 210, 211, 212 490, 491 plus electives	Error Codes. Digital and Cellular Communication, Simulation	
Roobik Gharabagi	Semiconductor Devices 303 Electronics Circuit Design 309 Electronics Circuits Lab. 310 Digital IC Design 419 **EE Electives**	101, 210, 211, 212, 205, 206, 305, 306, 490, 491 plus electives	Solid State Electronics, Small Geometry Device Modeling, Integrated Circuits, and Engineering Education	

	Semiconductor Devices, Digital and Analog IC Design			
Huliyar Mallikarjuna	Energy Conversion 307 Control Systems 403 **EE Electives** Power Systems Analysis, Analog and Digital Filter Design	101, 210, 211, 212, 301, 490, 491 plus electives	Modeling and Analysis of Electric Machinery, Power system Analysis, Classical Control Systems	
Kyle Mitchell	Digital Systems 205 Digital Systems Lab 206 Microprocessors 305 Microprocessors Lab 306 Computer Systems Design 311 **EE Electives** Hardware Software Co-Design, Advance Digital Design	101, 210, 211, 212, 490, 491 plus electives	Sensor Arrays, Intelligent Agents, Modeling and Simulation	
Habib Rahman	Electromagnetic 302 Lines and waves 407 **EE Electives** Satellite Communications, Radar	101, 210, 211, 212, 403, 490, 491 plus electives	Electromagnetic Fields and Applications, Radar System Design and Analysis, Satellite Communications, and Engineering Education	

The Faculty of the department is active in professional and scientific societies such as IEEE, ASEE both at the local and national level. Faculty expecting tenure and promotion are highly encouraged and expected to publish papers in reputed international journals, make presentations in reputed conferences.

All Faculties have excellent oral and written communication skills. Students' evaluation of the faculty effectiveness, dedication, and knowledge of one's field reveal a high level of satisfaction. Faculty have shown a strong interest in the student's academic and professional development.

Faculty is involved in students academic advising and their academic activities. Faculty has been very supportive of our students seeking employment or graduate studies upon graduation. Faculty provides valuable service to Department, College, and University by being active members in several academic committees at the college and the university level.

6. Facilities

The Department of Electrical and Computer Engineering is located in the McDonnell Douglass Hall. Almost all classrooms and instructional laboratories are located in McDonnell Douglass Hall. All faculty have their offices located in McDonnell Douglass Hall.

In order to provide a high quality undergraduate instruction, the Electrical and Computer Engineering Department has state of the art test equipment in all teaching labs. All labs have computer hardware with appropriate software. The department faculty is actively involved in equipment purchase decision making. College of Engineering receives adequate funds from Student Laboratory Fee to acquire and maintain the lab facilities.

Major laboratory test equipments are under maintenance agreement. The department purchased the current test equipments in Analog and Digital Circuits Lab and Senior Design Lab in 2002. The department plans to replace or upgrade these equipments every eight to ten years. Major portion of students' laboratory fees are saved in an account controlled by the faculty of the department to allow such major purchases. Smaller or more specialized equipment purchases are made on the need bases. Computer hardware and software in instructional laboratories are under continuous maintenance agreement. Department has continuous hardware upgrade plan. Computer hardware (CPU) is to be replaced every four years. The new hardware was acquired in the summer of 2006. Faculty computer needs are met from the department general expense budget of the department. Every year funds are available to upgrade two faculty computers.

The following table provides the collected lab fees since academic year 2001-2002.

Lab Fees Collected

Year	Fees Collected	Spent
2001/2002	$30,095	$8,574.68
2002/2003	$27,050	$12,400.41
2003/2004	$23,385	$13,171.54
2004/2005	$20,496	$10,114.00
2005/2006	$23,221	$18,144.83
Totals	$124,247	$62,405.46

Balance as of 6-8-06 = $107,032.66

The accumulated lab fee account is sufficient to cover acquisition and maintenance of the lab equipment for the next six years.

6.1. Laboratory Facilities of Electrical Engineering Department

All electrical engineering labs are located in McDonnell Douglas Hall. The first three labs listed below are connected together for easy accessibility to test equipments, computers, parts and other supplies. All computers are connected to internet through high speed LAN. All labs are equipped with first aid boxes. Students have access to these labs at all times through numerical keypad lock. The students can connect their notebook computers to high speed internet through wireless access available from all parts of McDonnell Douglas Hall which includes these labs.

6.1.1. Analog and Digital Circuits Laboratory MDH-1078

This lab is primarily used for conducting experiments in electrical and electronic circuits. The lab houses thirteen stations, each station consisting state of the art test equipment from Agilent (DMM, Scope, Signal generator and DC power supplies). The lab has multiple cabinets which are used to store lab supplies. Lockers in the lab are available for students to store their toolboxes and parts related to their experiments. The test equipments are connected to computers interfacing with LabVIEW running on Windows platform. This lab is capable of handling maximum of twenty six students. The courses offered in this lab are EENG 101, EENG 202, EENG 206, EENG 212 and EENG 310.

6.1.2. Microprocessors and Design Automation Laboratory MDH-1018

This lab houses sixteen computers (Pentium P4 3.4 GHz, 17 inch LCD monitors) running windows platform. All the computers have printing capabilities through dedicated printer. These computers are connected to internet through high speed LAN. The lab has multiple cabinets for storing parts primarily related to Digital Design lab and Microprocessors lab. The list of software installed on these computers that are available to students include:

Microsoft Office 2003
Orcad 9.3
Mulitisim 7.0
MATLAB 2006a
Quickfield
PowerWorld
Femlab (Multiphysics)
IsoPro
LEGO Mindstorms
Microsoft Visual Studio
NI LabView 8.0
TI Code Composer Studio
Microsoft Project Professional
Flowlab
Xilinx ISE 6
ModelSim Xilinx Edition II v5.7g

Currently, there are negotiations with vendors to upgrade some of the software.

6.1.3. Electrical Engineering Senior Design Lab MDH-1074

This lab is dedicated for use by the electrical engineering senior design students. The lab houses five workstations consisting state of art test equipment from Agilent (DMM, Scope, Signal generator and DC power supplies). The lab has multiple cabinets which are used to store lab supplies. The lab has lockers available to students for storing their design projects, parts and other related supplies. Each station has an advanced Pentium P4 computers running Windows platform. The software packages are essentially same as in Lab 6.1.2 listed above. The senior

design students also install their project specific software on these computers. These computers are connected to internet through high speed LAN. The students can print from these computers to the dedicated LAN printer housed in the Lab 6.1.2 listed above.

6.1.4. Sensors and Signals Lab MDH-2093

This is a research lab dedicated to the investigation of remote sensing hardware and the signal processing related to information extraction from sensor signals. This lab is equipped with a high speed Oscilloscope, broad range LCR meter and a surface mount rework station to facilitate assembly and testing of miniature remote sensing hardware. The lab also contains power supplies, function generators, shakers, LVDTs and strain amplifiers to aid in development of sensing equipment. There are several dual processor computers to support the signal processing effort of the researchers.

6.1.5. Printed Circuit etching machine Area

The senior design lab also houses printed circuit etching machine (manufactured by Quick Circuit)

6.1.6. High End Soldering station

The area connecting the Microprocessor lab and senior design lab houses a high end soldering station - PACE MBT 250 system.

6.2. Facilities Maintenance and Upgrade Plan:

Major instructional equipment owned by the Electrical and Computer Engineering Department are under continuous maintenance agreement. Malfunctioning equipments are packed and sent to manufacturer for quick repair and/or replacement. This has allowed the department to eliminate the need for a dedicated technician. Computer Information Specialists from Information Technology Service (ITS) department employed by the University provide software installation and maintenance support for UNIX and Windows environments and network support.

Space needs for all ECE laboratories are reviewed on regular basis. There is currently adequate space for educational laboratory needs of the department. As additional emphasis is placed on research by the university and the college it may be necessary to request additional space for research purposes.

The University Facilities Office handles almost all facility maintenance. Request for routine repairs are performed by University Facilities. Other needs, such as major remodeling projects, must be performed and managed by University Facilities following the submission of formal estimate. The college pays for this type of work.

7. Institutional Support and Financial Resources

7.1 Budget Process

7.1.1 University Level

The annual planning and budgeting process continues throughout each year and is linked to the strategic and operating plans of the University. The fiscal year begins on July 1, and ends on June 30 of the following year. This process systematically:

- reviews and revises the operating plans;
- assesses the achievement of short-range objective;
- evaluates administrative performance and resource management
- define resource needs, including funds, space, and personnel for the next fiscal year; and determines resource allocation priorities in relation to University and College goals, program costs, and availability of resources

This annual planning and budgeting process is based on several fundamental principles.

- The process is an open, shared process that is based on quantitative and qualitative information.
- College planning and budget decisions are based on a realistic assessment of currently available resources and projections of future resources.
- Resource allocation decisions within the College are guided by the strategic and operating plans of the University and the College.

The activities of the annual planning and budget request process involves five phases, with the time frame for those activities indicated:

1. Process Preparation (August-September)
2. Budget Request Preparation (October)
3. Budget Request Review (October-November)
4. Budget Proposal Preparation (January-May)
5. Approved Budget Allocation (June)

The process culminates where the Board of Trustees approves the University's budget proposal. The President announces the approval to the University community. After budget allocations have been made, modifications to the allocated budgets can be made following agreement among the Vice Presidents and the President.

7.1.2 College Level

The Dean of Parks College develops a budget consistent with the aims of the University and the individual needs of each program. The Dean's Executive Committee (DEC) provides input on the budget consistent with goals/objectives of the Programs and the priorities of the College.

Necessary modifications to the budget are made, resulting in a budget request from the College. The dean makes a presentation to the appropriate committee regarding their budget requests, and is responsible for communicating to the Dean's Executive Committee on changes that are made to the request as they undergo further review within the University.

7.1.3 Adequacy of Institutional Support and Financial Resources

Electrical Engineering program has received substantial and sufficient institutional support and funding for the operation and growth of the program. The source has been the SLU 2000 Grant of nearly $233855.00 that the department received during 2000 to upgrade the laboratory facilities. From the amount 205322.79 spend on new equipment and the remaining placed in a reserve equipment fund. In addition, the laboratory fees set up as a result of the previous ABET visit during 2000, provides funding for capital equipment acquisition, repair and upgrades as needed. The activities undertaken include curriculum development, classroom and laboratory teaching, equipment acquisition, laboratory development, interaction and collaboration with industry and other institutions, and student extra-curricular activities. Finally, all five engineering disciplines have cooperated in joint use of common facilities, such as the computer laboratories and manufacturing shops.

The program has also benefited from responsive leadership and support at the university and college level. This leadership not only enables the accomplishment of the above activities, it also encourages and facilitates mutually beneficial collaborations across disciplinary boundaries within the College of Engineering, Aviation and Technology and throughout the university.

7.2 Faculty Professional Development

Faculty members in the department are supported by the allocated annual budget for professional development activities such as attending conferences, attending workshops, and computer hardware/software upgrades. Newly appointed faculty members at the assistant professor rank are given a reduced course load during the first three years. This provides additional time for new faculty members for developing courses and for planning and establishing their research/scholarly activities. Adjustments to the standard course load and departmental obligations are made on a case-by-case basis to facilitate professional development.

In addition to applicable policies, there is also the Faculty Center for Excellence in Teaching and Learning. This is a faculty-owned resource that provides opportunities for professional development; support for innovation/experimentation in teaching; and assistance in renewal and change as faculty work on institutional, college, departmental and personal goals. The Center's range of services is designed for the induction of new faculty and the ongoing professional development of mid-career and senior faculty. Its goals are:

- To provide orientation sessions for new faculty to acquaint them with the instructional policies at Saint Louis University, effective teaching practices, and resources available to them.

- To convene workshops/seminars and interest groups for faculty to share their insights on teaching issues to enhance their pedagogical development.

- To disseminate materials on teaching to faculty.

Faculty members in the department have participated in Center activities.

7.3 Acquisition and Maintenance Plan for Equipment and Facilities

The Department of Electrical and Computer Engineering controls its own budget for the acquisition and maintenance of capital equipment necessary to achieve its program objectives via the laboratory fees account. Any plan for capital acquisition is discussed in departmental meetings held on regular basis. Group consensus is reached on funds to be expended for acquisition of new equipment or maintenance of existing equipment, and a timeline for the expenditure. An account is maintained to accumulate enough funds to make major re-investment in our main laboratories and for unforeseen needs.

The maintenance of facilities falls under two categories: Those equipments under the control of the College of Engineering, and those under the direct control of the programs. Facilities under College control are maintained by the Dean through College funds. Funds for maintaining facilities under Electrical and Computer Engineering Department come from departmental funds. Major departmental equipments are under a maintenance agreement.

The following table provides the collected lab fees since academic year 2001-2002.

Lab Fees Collected

Year	Fees Collected	Spent
2001/2002	$30,095	$8,574.68
2002/2003	$27,050	$12,400.41
2003/2004	$23,385	$13,171.54
2004/2005	$20,496	$10,114.00
2005/2006	$23,221	$18,144.83
Totals	$124,247	$62,405.46

Balance as of 6-8-06 = $107,032.66

7.4 Support Personnel and Institutional Services

7.4.1 Secretarial and Clerical Support

There is one (1) secretary assigned to the department, whose primary duty is to provide general office support for the department Chair and its faculty. They also perform college-wide duties that include support of the work-study program, student recruiting, faculty recruiting, and student

course registrations as needed. A budget Coordinator is responsible for tracking the budgets and expenditures in the College. S/he interacts with the secretaries in each Program as necessary.

7.4.2 Technician Support

There is one technician in the College of Engineering, Aviation and Technology. The technician assists the engineering programs (primarily Aerospace and Mechanical Engineering) by maintaining and upgrading student laboratory facilities.

The laboratory director at the college level provides help to the engineering programs by supporting in a wide range of areas. S/he is charged with the installation, safe operation, maintenance, and repair of equipment. Responsibilities include the development and implementation of a safety program that meets industry standards in all laboratories within the college.

7.4.3 Computer Resources Specialists

There are two computer Resources Specialists (Andy Ascher and Scott Wolosyk) serving the College of Engineering. They are staff members of Information Resources, whose primary functions are supporting the computing facilities and operations for all engineering programs. The range of services includes maintaining, managing, and upgrading the computer network. Other responsibilities include budgeting for hardware and software needs and upgrades.

7.4.4 Academics Records and Internship Manager

The academic Records and Internship Manager is responsible for developing internship opportunities that will enhance the students' educational experience. This position has assumed the added dimension of career placement as well. In addition, the manager is involved in articulation processes and procedures, and graduation checks for students.

This position has allowed additional opportunities for student development. The Internship manager jointly with the career center arranges special seminars as part of the Freshman Engineering course. Students are provided with strategies in seeking co-op and internship opportunities. The students are taught proper interviewing techniques, and are given the opportunity to practice during mock interview sessions.

8. Program Criteria

8.1. Program Criteria

The electrical engineering program satisfies the program criteria through the program outcomes outlined in section 3 and implemented by the curriculum in Table I *Basic Level Curriculum* in Appendix I. The basic electrical engineering curriculum provides breadth across a wide range of basic topics. Breadth is achieved by curricular outcomes covering courses in

- Electrical Circuits
- Electronics
- Digital and Microprocessors
- Electromagnetics
- Energy Conversion
- Controls
- Communication

In addition, each student in EE concentration is required to take select three advanced courses in electrical engineering (as elective courses) to provide depth. Students in CpE concentration are required to take two Electrical Engineering electives as well as two Computer Science Electives to provide depth.

Students gain knowledge of probability and statistics in the required Probability and Statistics (MATH 403). This course is co-requisite for Semiconductor Devices (EENG 303) and pre-requisite for Communication (EENG 403) (required for EE concentration but elective for CpE concentration) where students learn to apply concepts of probability and statistics to solve engineering problems.

Mathematics courses dealing with differential and integral calculus and differential equations are prerequisite to basic circuits' courses. Introductory discrete mathematics is covered in Discrete Math (MATH 135) and is prerequisite to Digital Design (EENG 205). An advance math course Linear Algebra for Engineers (MATH 311) is required by all EE majors.

All EE majors are required to take basic Science courses in physics and chemistry with appropriate laboratory experiences. A computer science course Introduction to Object Oriented Programming (CSCI 150) is also a required course. An Engineering science elective and a Science or Math elective is required of all EE majors in EE Concentration. An Engineering Science Elective is required of all EE majors in CpE Concentration. These engineering science and basic science courses provide the fundamental understanding of physical phenomena needed to design complex electrical and electronic devices, software, and complex systems containing hardware and software components.

Appendix I – Additional Program Information

A. Tabular Data for Program

Table I-1 Basic Level Curriculum
Table I-2 Course and Section Size Summary
Table I-3 Faculty Workload Summary
Table I-4 Faculty Analysis
Table I-5 Support Expenditures

B. Course Syllabi

B.1. ECE Required Course Syllabi

C. Faculty Curriculum Vitae

D. Samples of Assessment Tools

D.1. Program Educational Objectives Survey Forms

D.2. Program Educational Outcomes Assessment Tools

A. Tabular Data for Programs

Table I-1 Basic-Level Curriculum
(Electrical Engineering - EE Concentration)

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics *Check if Contains Significant Design (✓)*	General Education	Other
1-1	CHEM-151 Eng. Chemistry	3	( )		
	CHEM-152 Eng. Chemistry Lab	1	( )		
	ENGL-192 Adv. Writing		( )	3	
	EENG -101 Intro to EE		1 ( )		
	MATH-142 Calculus I	4	( )		
	THEO-100 Theological Found.		( )	3	
1-2	MATH-135 Discrete Math	3	( )		
	MATH-143 Calculus II	4	( )		
	PHYS-161 Eng. Physics I	3	( )		
	PHYS-162 Eng. Physics I Lab	1	( )		
	Social and Behavioral Science		( )	3	
	Humanities		( )	3	
2-1	CMM-293 Small Group Present.		( )	1	
	CSCI-150 Intro to OO Programs	4	( )		
	EENG -210 Circuits I		3 (√)		
	MATH-244 Calculus III	4	( )		
	PHYS-163 Eng. Physics II	3	( )		
	PHYS-164 Eng. Physics II Lab	1	( )		
2-2	EENG -205 Digital Design		3 (√)		
	EENG -206 Digital Design Lab		1 (√)		
	EENG -211 Circuits II		3 (√)		
	EENG -212 El Science Lab		1 (√)		
	MATH-355 Diff. Equations	3	( )		
	MATH-311 Linear Alg. For Eng.	3	( )		
	Science or Math Elective	3	( )		
3-1	EENG -301 Signals & Systems		3 ( )		
	EENG -303 Semi Devices		3 ( )		
	EENG -305 Microprocessors		3 (√)		
	EENG -306 Micro Lab		1 (√)		
	MATH-403 Prob. and Statistics	3	( )		
	EENG -307 Energy Conversion		3 ( )		

Table I-1 Basic-Level Curriculum (continued)
(Electrical Engineering - EE Concentration)

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math, & Basic Science	Engineering Topics *Check if Contains <u>Significant</u> Design (✓)*	General Education	Other
3-2	EENG -302 EM Fields		3 (√)		
	EENG -309Electronic Circuit		3 (√)		
	EENG -310 Electronic Ckt. Lab		1 (√)		
	EENG -404 Auto Control		3 (√)		
	PHIL-205 Ethics		( )	3	
	Cultural Diversity		( )	3	
4-1	EENG -490 EE Design I		3 (√)		
	EENG -407 Lines & Waves		3 (√)		
	EENG Elective		3 ( )		
	ESCI Elective		3 ( )		
	General Elective		( )	3	
4-2	EENG -491 EE Design II		3 (√)		
	EENG -403 Communications		3 (√)		
	Technical Elective	3	( )		
	EENG Elective		3 ( )		
	EENG Elective		3 ( )		
			( )		
			( )		
			( )		
			( )		
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		46	59	22	
OVERALL TOTAL FOR DEGREE	127				
PERCENT OF TOTAL					
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs		
	Minimum percentage	25%	37.5 %		

Table I-1 Basic-Level Curriculum
(Electrical Engineering - CpE Concentration)

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics *Check if Contains <u>Significant</u> Design (✓)*	General Education	Other
1-1	CHEM-151 Eng. Chemistry	3	( )		
	CHEM-152 Eng. Chemistry Lab	1	( )		
	ENGL-192 Adv. Writing		( )	3	
	EENG -101 Intro to EE		1 ( )		
	MATH-142 Calculus I	4	( )		
	THEO-100 Theological Found.		( )	3	
1-2	MATH-135 Discrete Math	3	( )		
	MATH-143 Calculus II	4	( )		
	PHYS-161 Eng. Physics I	3	( )		
	PHYS-162 Eng. Physics I Lab	1	( )		
	Social and Behavioral Science		( )	3	
	Humanities		( )	3	
2-1	CMM-293 Small Group Present.		( )	1	
	CSCI-150 Intro to OO Programs	4	( )		
	EENG -210 Circuits I		3 (√)		
	MATH-244 Calculus III	4	( )		
	PHYS-163 Eng. Physics II	3	( )		
	PHYS-164 Eng. Physics II Lab	1	( )		
2-2	EENG -205 Digital Design		3 (√)		
	EENG -206 Digital Design Lab		1 (√)		
	EENG -211 Circuits II		3 (√)		
	EENG -212 El Science Lab		1 (√)		
	MATH-355 Diff. Equations	3	( )		
	MATH-311 Linear Alg. For Eng.	3	( )		
	CSCI-180 Data Structures	4	( )		
3-1	EENG -301 Signals & Systems		3 ( )		
	EENG -303 Semi Devices		3 ( )		
	EENG -305 Microprocessors		3 (√)		
	EENG -306 Micro Lab		1 (√)		
	MATH-403 Prob and Statistics	3	( )		
	EENG -311 Comp. Sys Design		3 (√)		

(Continued on next page)

Table I-1 Basic-Level Curriculum (continued)
(Electrical Engineering - CpE Concentration)

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Science	Engineering Topics *Check if Contains <u>Significant</u> Design (✓)*	General Education	Other
3-2	EENG -302 EM Fields		3 (√)		
	EENG -309Electronic Circuit		3 (√)		
	EENG -310 Electronic Ckt. Lab		1 (√)		
	CSCI-224 Comp. Architecture	3	( )		
	PHIL-205 Ethics		( )	3	
	Cultural Diversity		( )	3	
4-1	EENG -490 EE Design I		3 (√)		
	EENG -419 Digital IC Design		3 (√)		
	CSCI Elective	3	( )		
	ESCI Elective		3 ( )		
	General Elective		( )	3	
4-2	EENG -491 EE Design II		3 (√)		
	CSCI Elective II	3	( )		
	Technical Elective	3	( )		
	EENG Elective		3 ( )		
	EENG Elective		3 ( )		
			( )		
			( )		
			( )		
			( )		
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		56	50	22	
OVERALL TOTAL FOR DEGREE	128				
PERCENT OF TOTAL					
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs		
	Minimum percentage	25%	37.5 %		

Table I-2 Course and Section Size Summary
(Electrical Engineering)

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class[1]			
				Lecture	Laboratory	Recitation	Other
EENG -101	Intro to EE	1	17	70%	30%		
EENG -205	Digital Design	2	5	100%			
EENG -206	Digital Design Lab	2	5		100%		
EENG -210	Circuits I	1	7	100%			
EENG -211	Circuits II	1	12	100%			
EENG -212	Electrical Science Lab	1	11		100%		
EENG -301	Signals & Systems	1	20	100%			
EENG -302	EM Fields	1	18	100%			
EENG -303	Semiconductor Devices	1	20	100%			
EENG -305	Microprocessors	1	19	100%			
EENG -306	Microprocessors Lab	1	19		100%		
EENG -307	Energy Conversion	1	12	100%			
EENG -309	Electronic Circuits	1	17	100%			
EENG -310	Electronic Circuits Lab	1	17		100%		
EENG -311	Computer Systems Design	1	14	80%	20%		
EENG -403	Communications	1	23	100%			
EENG -404	Auto Control			100%			
EENG -407	Lines & Waves	1	12	100%			
EENG -409	Radar	1	10	100%			
EENG -419	Digital IC Design	1	3	100%			
EENG -490	EE Design I	1	13	50%	50%		
EENG -491	EE Design II	1	13	25%	75%		

Table I-3 Faculty Workload Summary
(Electrical Engineering)

Faculty Member (Name)	FT or PT (%)	Classes Taught (Course No./Credit Hrs.) Term and Year	Total Activity Distribution[2]		
			Teaching	Research	Other[3]
		Fall 2005			
William J. Ebel	FT	Intro to EE (EENG -101 [1])	65%	20%	15%
		Engineering Circuits I (EENG -210 [3])			
		Signals & Systems (EENG -301 [3])			
Roobik Gharabagi	FT	Semiconductor Devices (EENG -303 [3]	50%	20%	30%
		Digital IC Design (EENG -419 [3])			
H.S. Mallikarjuna	FT	Energy Conversion (EENG -307 [3])	65%	20%	15%
		EE Design I (EENG -490 [3])			
Kyle Mitchell	FT	Digital Design (EENG -205 [3])	50%	35%	15%
		Digital Design Lab (EENG -206 [1])			
		Computer System Design (EENG -311			
Habib Rahman	FT	Lines & Waves (EENG -407 [3])	65%	20%	15%
		Radar (EENG -409 [3])			
		Spring 2005			
William J. Ebel	FT	Electrical Engineering (EENG -210 [3])	65%	20%	15%
		Communication Systems(EENG -403 [3]			
		Dig. Signal Processing (EENG -493 [3])			
Roobik Gharabagi	FT	Electrical Eng. Lab (EENG -202 [1])	50%	20%	30%
		Electronic Ckts. Design (EENG -309 [3])			
		Elect. Ckts. Design Lab (EENG -310 [1])			
H.S. Mallikarjuna	FT	Electrical Engineering (EENG -201 [3])	65%	20%	15%
		EE Design II (EENG -491 [3])			

		Power Sys. Analysis (EENG -493 [3])			
Kyle Mitchell	FT	Digital Design (EENG -205 [3])	50%	35%	15%
		Digital Design Lab (EENG -206 [1])			
		El Science Lab (EENG -212 [1])			
Habib Rahman	FT	Electrical Eng. Lab (EENG -202 [1])	65%	20%	15%
		Electrical Eng. Lab (EENG -202 [1})			
		Engineering Circuits II (EENG -211 [3])			
		Electromagnetic Fields (EENG -302 [3])			

Table I-4 Faculty Analysis

(Electrical Engineering)

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience			State in which Registered	Level of Activity (high, med, low, none)		
					Govt./ Industry Practice	Total Faculty	This Institution		Professional Society (Indicate Society)	Research	Consulting /Summer Work in Industry
William J. Ebel	Asso	FT	PhD	U. of MO-Rolla	5	14	5	N/A	IEEE	Med	Low
Roobik Gharabagi	Asso	FT	PhD	U. of Pittsburgh	-	18	18	N/A	IEEE/ASEE	Low	Low
H.S. Mallikarjuna	Asso	FT	Ph.D.	U. of Pittsburgh	-	16	16	N/A	IEEE/ASEE	Low	Low
Kyle Mitchell	Asst	FT	Ph.D.	U. of MO-Rolla	1	3	3	N/A	IEEE	Med	Low
Habib Rahman	Prof	FT	Ph.D.	Syracuse Univ.	-	21	21	N/A	IEEE/ASEE	Med	Low

Table I-5 Support Expenditures

(Electrical Engineering)

Fiscal Year	1	2	3	4
	2003-2004	2004-2005	2005-2006	2006-2007
Expenditure Category				
Operations (not including staff)	29,328	21,300	22,084	30084
Travel	4,244	6,700	7,527	10000
Equipment	23,385	20,496	23,221	TBD
Institutional Funds	0	0	0	0
Grants and Gifts	0	0	0	0
Graduate Teaching Assistants/ Undergraduate Assistants	5,514	4,367	5,672	TBD
*				

* Additional financial data is provided in section 7.3.

Course Syllabi

B.1. ECE Required Course Syllabi

EENG -101: Intro to Electrical Engineering

==========

Required for the EE Concentration Required for the CpE Concentration

2005 - 2007 Catalog Data:

Electrical Devices, magnetic devices, electronic devices, digital logic, computer organization, communication systems. Design concepts in electrical and computer engineering. Hands-on experience on familiar pieces of electronic gear. Introduction to software packages applicable to electrical engineering.

Prerequisites: MT-A152 or equivalent

Class/Lab Schedule: One two-hour class session per week

Course Objectives:

The purpose of this course is to introduce students to the field of Electrical Engineering and to the Department, College, and University.

Textbook: Electrical Engineering Uncovered, by D. White & R. Doering, 2nd Ed.

Topics Covered:

Fundamentals concepts of engineering design
Engineering Ethics
The definition of an Electrical Engineer
Learning styles
The field of Electrical Engineering
The Electrical Engineering degree curriculum
Brief introduction to the frequency domain
The internet and Google
Brief introduction to electrical circuits
Brief introduction to logic gates

Course Educational Outcomes:

1. Appreciation of ethics in the practice of engineering
2. Appreciation of engineering design principles
3. Appreciation of the field of Electrical Engineering

Contribution of the Course to Meeting the Professional Component:

Mathematics and Basic	Engineering Topics	General Education
	X	

Relationship of Course to the Program Educational Outcomes (PEO's): f

Person(s) Who Prepared this Description and Date of Preparation:

William J. Ebel 8/30/2005

EENG -201: Electrical Engineering

==========

Service Course (Required for AE, ME and BME majors)

2005-2007 Catalog Data	**Basic DC circuit analysis techniques including current, voltage and power concepts, mesh analysis, node analysis and circuit reduction techniques. Basic AC circuit analysis including impedance concepts, phasor notation, power principles, principles of circuit frequency response and filter concepts. Transient analysis of simple inductive and capacitive networks. Principles of operational amplifier circuits and analog computers. Introduction to transformers, power supplies and motors.**
Prerequisites	**PHYS163 and MATH-244 or equivalent.**
Class Schedule	**Two 75 minutes class sessions per week.**
Course Objectives	**Learn how to approach and solve electric circuits problems by applying the mathematics and physics concepts to practical applications.**
Textbooks	**"Intro to Electric Circuits" by Dorf, Sixth edition, John Wiley, 2004.**
Topics Covered	**DC Circuits, Analysis of resistive circuits, Circuit theorems, Energy storage elements (L, C), Response of RL and RC circuits, AC circuits – impedance and power concepts, Op-Amps.**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, c, e, k

Person(s) Who Prepared This Description and Date of Preparation: Dr. H. S. Mallik 1-19-2006

EENG -202: Electrical Engineering Laboratory

==========

Service Course (Required for AE, ME and BME majors)

2005-2007 Catalog Data **Laboratory experiments to emphasize materials covered in EENG -201. Not for EE majors.**

Prerequisites/ Corequisite **EENG -201.**

Class/Lab Schedule **One two-hour lab session per week. A total of 12 sessions (approx)**

Course Objectives **To teach the use of basic electrical engineering instrumentation and test equipment including analog and digital multimeters, oscilloscopes, power supplies and function generators to develop the skills needed to build, test and analyze simple active and passive networks using resistors, inductors, capacitor and operational amplifiers. This course complements the theoretical work in the EENG 201 Electrical Engineering class.**

Textbooks **No textbook.**

Topics Covered

1. Test Equipment familiarization
2. Current and voltage Dividers and Kirchoff's Laws
3. Thevinin's theorem and power transfer
4. Transient circuits
5. AC impedance
6. Resonant circuits
7. Low pass/high pass filters
8. Op-Amp circuits – Analog computers

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, b, c, d, e, g, k

Person(s) Who Prepared This Description and Date of Preparation: Dr. H. S. Mallik 1-19-2006

EENG -205: Digital Design

==========

Required Course

2005-2007 Catalog Data **Number systems. Boolean algebra. Logical function. Combinational circuits. Flip-flops, registers and counters. Arithmetic, memories. Introduction to digital computers and microprocessors.**

Prerequisites **CSCI-115.**

Class/Lab Schedule **Three one-hour class sessions per week.**

Course Objectives **The primary objective is to provide a foundation in number systems, Boolean algebra, logical function, combinational and sequential circuits. The students are introduced to TTL chips, Flip-flops, registers, counters, memories, State Machines, PLDs, CPLD/FPGA, and HDL tools to use in design. They are given an introduction to digital arithmetic, and digital computers and microprocessors.**

Textbooks **"Logic + Computer Design Fundamentals" by Mano, Pearson Publisher 2004.**

Topics Covered

1. Understand how to work with numbers in bases related to digital electronics and computers.
2. Understand how to formulate a question in Boolean algebra.
3. Understand how to minimize a Boolean algebra equation
4. Understand how to map a Boolean algebra equation into discrete TTL blocks.
5. Understand how to formulate a Boolean algebra system whose solution is dependant on past results.
6. Understand how to realize result dependant systems using flip-flops and registers.
7. Understand how to design digital system to perform arithmetic functions.
8. Understand how digital systems store information.
9. Design digital system with programmable logic devices.
10. Use CAE tools to design digital systems.

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
X	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, c, e, k. m. n

Person(s) Who Prepared This Description and Date of Preparation:

Dr. Kyle Mitchell 4-19-2006

EENG -206: Digital Design Laboratory

==========

Required Course

2005-2007 Catalog Data **Laboratory experiments to emphasize materials covered in EENG -205.**

Prerequisites **Co-requisite: EENG -205.**

Class/Lab Schedule **One two-hour lab session per week.**

Course Objectives **The primary objective is to provide hands-on experience for the topics discussed in ECE-P205 Digital Design. Topics include building TTL circuits, designing CPLD based circuits using schematic capture and HDL, designing system from natural language descriptions, and a capstone project.**

Textbooks **"Student's Guide to VHDL" by Ashenden, Elsevier Publisher, 1998.**

Topics Covered

1. **Understanding how to use TTL ICs to realize a digital circuit.**
2. **Understanding how to enter designs into a schematic based CAE environment.**
3. **Understanding how to use an HDL based CAE to design digital systems.**
4. **Understanding how to design in a modular fashion in both schematic and HDL environments.**
5. **Understanding how to use simulation as a verification tool in design.**
6. **Understanding the effects of timing delays on digital circuits.**
7. **Develop a capstone system.**
8. **Present capstone design in oral and written form**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
X	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, c, d, e, g, k, n

Person(s) Who Prepared This Description and Date of Preparation:

Dr. Kyle Mitchell 4-16-2006

EENG -210: Engineering Circuits I

==========

Required Course

2005-2007 Catalog Data	**Physical foundations of electrical circuits. Ohm's law, Kirchhoff's law, node and mesh analysis, Thevenin's/Norton's equivalents, and the principle of superposition. Transient analysis of simple RL, RC and RLC circuits. Operational amplifier circuits.**
Prerequisites	**EENG -101, MATH-143, and PHYS-161 or equivalent.**
Class/Lab Schedule	**Three one-hour class sessions per week.**
Course Objectives	**The purpose of the course is to introduce the traditional topics of circuit analysis for resistive and transient circuits. Much attention is paid to helping students recognize how new concept and ideas fit together with those previously learned especially in physics courses. It emphasizes the relationship between conceptual understanding and problem-solving approaches, and provides students with a strong foundation of engineering practices.**
Textbooks	**"Electric Circuits-w/PSPICE Manual" by Nilsson and Riedel, Seventh Edition, Pearson Publisher, 2005.**
Topics Covered	**Circuit variables and Elements** **Simple Resistive Circuits** **Techniques of Circuit Analysis** **The Operational Amplifiers** **Natural Response of RL and RC Circuits** **Step Response of RL and RC Circuits** **Natural and Step Responses of RLC Circuits**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, e, k

Person(s) Who Prepared This Description and Date of Preparation:
Dr. Habib Rahman, Professor of Electrical and Computer Engineering
02/25/2006

EENG -211: Engineering Circuit II

==========

Required Course

2005-2007 Catalog Data **Sinusoidal steady-state analysis, sinusoidal steady-state power calculation, balanced 3-phase systems. Mutual inductance and transformers, series and parallel resonance. Applications of Laplace and Fourier transforms to circuit analysis.**

Prerequisites **EENG -210.**

Class/Lab Schedule **Three one-hour class sessions per week.**

Course Objectives: The course provides concepts on circuits energized by time-varying voltage and current sources. It provides underlying principles to understand the ac power concepts, their relationship to one another and how to calculate them in an ac circuit. It introduces the applications of Laplace's and Fourier transforms to ac circuit analysis, and introduces balanced three phase circuits and frequency selective circuits

Textbooks **"Electric Circuits-w/PSPICE Manual" by Nilsson and Riedel, Seventh Edition, Pearson Publisher, 2005.**

Topics Covered

Sinusoidal Steady-State Analysis
AC Steady-State Power
Three phase Circuits
Mutual Inductance & Transformers
Frequency Response
Applications of Laplace and Fourier Transforms to Circuit Analysis

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, e, k

Person(s) Who Prepared This Description and Date of Preparation:
Dr. Habib Rahman, Professor of Electrical and Computer Engineering
02/25/2006

EENG -212: Electrical Science Laboratory

==========

Required Course

2005-2007 Catalog Data **Laboratory experiments to emphasize materials covered in EENG -210 and EENG -211.**

Prerequisites **Co-requisite: EENG -211.**

Class/Lab Schedule **One two-hour lab session per week.**

Course Objectives

Textbooks **"Intro to PSPICE Manual w/CD" by Nilsson, Pearson Publisher.**

Topics Covered

1. Gain a familiarity with Test Equipment
2. Use test equipment to verify current and voltage Dividers and Kirchoff's Laws
3. Use test equipment to verify Thevenin's theorem and power transfer
4. Construct circuit to understand Wheatstone Bridge Circuit
5. Use test equipment to gain an understanding of RC time constants
6. Use test equipment to measure circuit transient
7. Use test equipment to measure AC impedance
8. Construct resonant circuits and use test equipment to measure their response
9. Use spice based simulation to design circuit and verify lab results
10. Complete open ended design project
11. Present design results in oral and written media

Course Outcomes

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, c, d, e, g, k

Person(s) Who Prepared This Description and Date of Preparation:

Dr. Kyle Mitchell **4-16-2006**

EENG -301: Signals and Systems

Required Course for the EE
Concentration Required Course for the
CpE Concentration

2005 - 2007 Catalog Data:

Introduction to signals and systems. Linear time-invariant systems. Fourier analysis of continuous-time signals and systems. Fourier analysis of discrete-time signals and systems. The Laplace transforms, Z-transforms. Prerequisites:

Prerequisites: **EENG -211 and MATH-354, or equivalent.**

Class/Lab Schedule**: Three one-hour class sessions per**

week

Course Objectives: **The purpose of this course is to introduce students to the area of Linear systems. Both time-domain and frequency-domain analysis techniques are introduced.**

Textbook: **Signals & Systems: Continuous and Discrete, by Ziemer, Tranter, and Fannin, 4th Edition,**

Topics Covered:

Singularity functions
System properties
System stability
The convolution integral
Impulse response of the LT1 system
Fourier Series
The Fourier, Laplace, and Z Transforms
System analysis using transforms
Sampling, ideal reconstruction, and aliasing

Course Educational Outcomes:

1. **Understand the basic mathematical representation of signals and systems.**
2. **Understand and apply convolution integrals.**
3. **Understand the representation of periodic signals using the exponential Fourier Series and energy signals using the Fourier Transform.**
4. **Understand how to analyze periodic and non-periodic signals and systems using the Fourier Transform methods.**
5. **Understand how to analyze continuous-time, linear, time-invariant systems using the Laplace transform.**

6. **Understand sampling theory.**
7. **Analyze discrete-time, linear, time-invariant systems using the Z-transform.**
8. **Understand the stability of continuous-time and discrete-time, linear, time-invariant systems.**
9. **Develop expertise with simulation software.**

Contribution of the Course to Meeting the Professional Component:

Mathematics and Basic	Engineering Topics	General Education
	X	

Relationship of Course to the Program Educational Outcomes (PEO's):

a, c, e, g, k

Person(s) Who Prepared this Description and Date of Preparation:

William J. Ebel 8/30/2005

EENG -302: Electromagnetic Fields

==========

Required Course

2005-2007 Catalog Data	**The electromagnetic model. Vector analysis. Static electric fields, static magnetic fields. Time-varying fields and Maxwell's equations. Plane electromagnetic waves.**
Prerequisites	**EENG -211 and MATH-355 or equivalent.**
Class/Lab Schedule	**Three one-hour class sessions per week.**
Course Objectives	**The purpose of the course is to introduce fundamental physical insight and understanding of basic principles of electromagnetic fields, and to integrate computer applications to solve electromagnetic problems. The course provides students with a solid grasp of electromagnetic fundamentals by emphasizing physical understanding and practical applications. The course is designed to maintain a constant link with established as well as new and emerging applications, while at the same time emphasizing fundamental physical insight and solid understanding of basic principles.**
Textbooks	**"Engineering Electromagnetics" by Inan and Inan, Pearson Publisher, 1999.**
Topics Covered	**Review of Vector Analysis** Static Electric Fields Steady Electric Currents Static Magnetic Fields Time-Varying Fields and Maxwell's Equations

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, e, f, i, k

Person(s) Who Prepared This Description and Date of Preparation:
Dr. Habib Rahman, Professor of Electrical and Computer Engineering
02/25/2006

EENG -303: Semiconductor Devices

==========

Required Course

2005-2007 Catalog Data	**An introduction to fundamentals of semiconductors and semiconductor devices. Electrical properties of solids, energy band diagrams, semiconductor theory. Introduction to workings of devices such as p-n junctions, bipolar junction transistors, field effect transistors (JFETs, MOSFETs, MODFETs).**
Prerequisites	**EENG -211, MATH-355, Co-requisite: MATH-403 or equivalent.**
Class/Lab Schedule	**Three one-hour class sessions per week.**
Course Objectives:	**The purpose of this course is to introduce students to the physics of electronic devices. Introduce students to fundamentals of quantum mechanics. Introduce students to various types of devices and their characteristics. Introduce materials in area of device fabrication.**
Textbooks	**"Solid State Electronic Devices" by Streetman, Pearson Publisher, latest edition.**
Topics Covered:	**Intro to Crystal growth and fundamentals of IC Fabrication** **Intro to Quantum mechanics** **Energy band diagram and charge carriers in semiconductors** **Excess carriers in semiconductors** **Junctions: p-n junctions, metal-semiconductor junctions** **Operation and characteristics of Bipolar Junction Transistors** **Operation and characteristics of Field Effect Transistors** **Some contemporary issues in semiconductor devices**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, c, e, h, i, j, l, m

Person(s) Who Prepared This Description and Date of Preparation: Dr. R. Gharabagi 1/30/2006

EENG -305: Microprocessors

==========

Required Course

2005-2007 Catalog Data	**Review of number systems. Microprocessors/microcomputer structure, input/output. Signals and devices. Computer arithmetic, programming, interfacing and data acquisition.**
Prerequisites	**EENG -205. Co-requisite: EENG -306.**
Class/Lab Schedule	**Three one-hour class sessions per week.**
Course Objectives	**The primary objective is to provide a foundation of understanding of the structure, input/output, control signals and device attachment of a modern microprocessor. Additional topics include computer arithmetic, programming in assembler and machine code and data acquisition.**
Textbooks	**"68000 Microprocessor-w/3" disk" by Mackenzie, Pearson Publisher, 1995.**

Topics Covered

1. Understand number representation in digital computers.
2. Understand how physical attachment of memory relates to memory space mapping.
3. Understand the different ways memory can be addressed by a microprocessor.
4. Understand the signal timing involved in memory accesses.
5. Understand how assembler instructions map in to machine code.
6. Understand how to formulate a program in an assembler language.
7. Understand interrupt, exception, and privilege state command execution.
8. Understand basic input/output operations in a microprocessor system.
9. Understand the design differences between microprocessor families.

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, c, e, m, n

Person(s) Who Prepared This Description and Date of Preparation:

Dr. Kyle Mitchell 4-16-2006

EENG -306: Microprocessor Laboratory

==========

Required Course

2005-2007 Catalog Data **Laboratory experiments to emphasize materials covered in EENG -305.**

Prerequisites **Co-requisite: EENG -305.**

Class/Lab Schedule **One two-hour class session per week.**

Course Objectives **The primary objective is to provide hands-on experience for the topics discussed in ECE-P305 Microprocessors. Topics include direct entry of machine code, writing and testing of assembler based programs, interfacing to peripheral devices, polling based IO, interrupt based IO, and a capstone project.**

Textbooks **No textbook.**

Topics Covered

1. Understanding how to use a debug monitor as a design verification tool.
2. Understanding the process of converting source code into machine code.
3. Understanding how software interacts with IO devices.
4. Understanding how to convert machine data into usable output.
5. Understanding how to convert input into usable machine data.
6. Understanding the implications of interrupt vs. polled IO.
7. Develop a capstone system.
8. Present capstone design in oral and written form.

Course Outcomes

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, b, c, d, e, g, j, k, m, n

Person(s) Who Prepared This Description and Date of Preparation:

Dr. Kyle Mitchell **4-16-2006**

EENG -307: Electric Energy Conversion

==========

Required Course for students with EE concentration

2005-2007 Catalog Data **Magnetic theory and circuits. Transformers. Electromechanical energy conversion. Induction motors. Direct current machines. Electromechanical components of control systems. Direct energy conversion methods.**

Prerequisites **EENG -211 and MATH-355 or equivalent.**

Class/Lab Schedule **Three one-hour class sessions per week.**

Course Objectives **The purpose of this course is to introduce junior level students to electromagnetic circuits, power transformers, rotating machines that include AC, DC and stepper motors**

Textbooks **"Electric Machinery Fundamentals" by Chapman, Stephen J, 4th Edition, McGraw Hill Publisher, 2005.**

Topics Covered

Electromagnetic circuits
Transformers (single phase and three phase)
DC motors (types, load characteristics and speed control)
DC generators (types, voltage regulation and efficiency)
Alternators (power, voltage regulation and parallel operation)
Synchronous motors (operation and power factor correction)
Induction motors (operation, efficiency, and speed control)
Single phase Mac motors (types, analysis, and applications)
Stepper motors (types, analysis, microstepping, and applications)

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, c, e, f, g, h, i, j
Person(s) Who Prepared This Description and Date of Preparation: Dr. H. S. Mallik 1/30/2006

EENG -309: Electronic Circuit Design

==========

Required Course

2005-2007 Catalog Data **Introduction to semiconductor materials and their electronic properties and applications to electronic devices. Introduction to P-N junction (diodes), bipolar junction transistors (BJTs), field effect transistors (FET). Analysis and design of analog circuits using diodes and transistors.**

Prerequisites **EENG -303.**

Class/Lab Schedule **Three one-hour class sessions per week.**

Course Objectives

Introduce students to topics in Analog Electronics Circuit Design
Further integrate computer assisted design (PSPICE)
Enhance design experience by combining lectures and laboratory

Textbooks **"Electronic Design: M.S. Roden, G.L. Carpenter, W.R. Wieserman, 4th Edition, Discovery press, 2002.**

Topics Covered

Diode Applications
Bipolar Junction Transistor Application: Amplifier Design
Field Effect Transistor Application: Amplifier Design
Frequency response: Effect of intrinsic and extrinsic capacitors
Single and multi-stage amplifier design issues
Operational Amplifiers and their applications

Course Outcomes

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, c, e, j, k, m

Person(s) Who Prepared This Description and Date of Preparation: Dr. R. Gharabagi 1/30/2006

EENG -310: Electronics Laboratory

==========

Required Course

2005-2007 Catalog Data **Laboratory experiments to emphasize materials covered in EENG -309.**

Prerequisites **Co-requisite: EENG -309.**

Class/Lab Schedule **One two-hour lab session per week.**

Course Objectives

To bring about an understanding of the relation between theory and practice
Carry out 10-12 experiments with formal written reports
To carry out hardware and software design (Use of PSPICE)
To carry out a design project (2 weeks equivalent) in preparation for the major senior design experience

Textbooks **No textbook**

Topics Covered

Diode Applications (Half-wave and full wave rectifiers, Zener Diode application: AC to DC Converters)
BJT amplifier biasing
BJT amplifiers (Class A: Common Emitter, Common Collector, ..)
Two stage amplifier design
FET amplifier design (Common Source, Common Drain, ..)
Frequency response: Capacitive effects

Course Outcomes

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, b, c, d, e, g, h, k, m

Person(s) Who Prepared This Description and Date of Preparation: Dr. R. Gharabagi 1/30/2006

EENG -311: Computer System Design

Elective Course for EE **Required for CpE concentration**

2005-2007 Catalog Data **Organization and design considerations of the computer; performance and cost analysis, representation of data and instructions; register transfer operations, instruction set format and design and its' effect on the internal microengine, computer arithmetic; hardware implementation of processors and ALUs, hardware and microprogrammed control design, comparative architectures.**

Prerequisites **EENG -205.**

Class/Lab Schedule **Three one-hour class sessions per week.**

Course Objectives **The primary objective is to provide a foundation of understanding in designing systems for getting information into and out of modern computers using modern communications interfaces. Topic areas include bus timing, control, and arbitration, data packet structures survey of available IO devices.**

Textbooks **"PCI System Architecture" by Mindshare, Inc., Pearson Publisher, 1999 and "ISA System Architecture" by Shanley, Pearson Publisher, 1995.**

Topics Covered

1. Understand the data and control signal timing of an RS232 port.
2. Understand handshaking and flow control possible in an RS232 channel.
3. Understand the data and control signal structure of the IBM PC Parallel Port.
4. Understand the timing and coding for the signals in a USB signal.
5. Understand the theoretical and actual transmission throughput possible in digital communications channels.
6. Understand memory mapped and IO mapped data transfers possible in an ISA system.
7. Understand bus mastering and DMA data transfers possible in a PCI system.
8. Develop an ISA system capable of sampling an analog signal.
9. Develop a PCI system capable of sampling, filtering, and recreating an analog signal.

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, b, c, e, g, j, k, m
Person(s) Who Prepared This Description and Date of Preparation:
Dr. Kyle Mitchell 4-19-2006

EENG -401: Spacecraft Communications

==========

Elective Course

2005-2007 Catalog Data **Overview of satellite systems. Orbits and launching methods. The space segment and the earth segment. Base-band signals and modulation, the space link. Satellite access: single access, pre-assigned FDMA, demand-assigned FDMA, spade system, TDMA, CDMA.**

Prerequisites **Permission of the instructor.**

Class/Lab Schedule **Three one-hour class sessions per week.**

Course Objectives **This course is intended to introduce students to the field of electronic communications and its potential for communications in space via satellites, and provides broad coverage satellite communication systems**

Textbooks **"Satellite Communications" by Roddy, McGraw Hill Publisher, 2001.**

Topics Covered

Overview of satellite systems
Orbits and launching methods
Space and earth segments
Base-band signals and modulation
Space link
Frequency-division-multiple-access (FDMA) and time- division-multiple-access (TDMA)
Various types of multiple access

Course Outcomes

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, b, c, e, h

Person(s) Who Prepared This Description and Date of Preparation:
Dr. Habib Rahman, Professor of Electrical and Computer Engineering
02/25/2006

EENG -402: Filter Design

==========

Elective Course (Optional)

2005-2007 Catalog Data	**Transfer functions. Op-amp RC circuits. Design of Butterworth, Chebyshev, elliptic and delay filters. Frequency transformation and switched capacitor filters.**
Prerequisites	**EENG -309 and MATH-355 or equivalent.**
Class/Lab Schedule	**Three one-hour class sessions per week.**
Course Objectives	**Introduce senior EE students to analysis and design of analog and digital filters**
Textbooks	**Design of Analog Filters, Rolf Schaumann and Van Valkenburg, 2001, Oxford University Press Multisin – Simulation software.**
Topics Covered	**Op-Amps, first and second order filter circuits, Butterworth Filters, Chebyshev Filters, Inverse Chebyshev and Cauer filters. Frequency Transformation, and Delay filters. Z-transforms and Bilinear transformation. Pole-zero mapping from s-domain to z-domain.**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, i, j, k , l

Person(s) Who Prepared This Description and Date of Preparation: Dr. H. S. Mallik FEB-8-2006

EENG -403: Communication Systems

Required for the EE Concentration
Elective Course for the CpE Concentration

2005 - 2007 Catalog Data:

Review of signal analysis and probability theory. Amplitude modulation systems. Frequency and phase modulation systems. Pulse modulation systems.

Prerequisites: EENG -301 and MT-A403

Class/Lab Schedule: Three one-hour class sessions per week

Course Objectives:

The purpose of this course is to introduce students to the area of analog and digital communications. Both analog and digital modulation schemes will be introduced as well as an introduction to the relationship between important system resources such as bandwidth, transmitter power, reliability, and complexity.

Textbook: **Principles of Communications, by Ziemer & Tranter, 5th Edition, Wiley**

Topics Covered:

Review of Linear Systems Theory
Brief introduction to the Hilbert Transform
Linear Modulation and Demodulation (AM, DSB, SSB)
Angle Modulation and Demodulation (FM, PM)
Analog Pulse Modulation techniques
Delta Modulation and Pulse Code Modulation
Brief introduction to Random Processes
Baseband Binary Data Transmission
Binary Data Transmission techniques (PSK, ASK, QPSK)

Course Educational Outcomes:

1. **Understand the operation of analog modulation schemes**
2. **Understand the operation of analog demodulation schemes**
3. **Understand how to perform parametric tradeoffs of modulation schemes**
4. **Understand how to select modulators and demodulators for applications with constraints**
5. **Understand the operation of pulse modulation schemes**
6. **Understand the operation of the baseband digital modulator and demodulator**
7. **Understand the operation and performance of digital modulation schemes expressed using points in a signal space.**

Contribution of the Course to Meeting the Professional Component:

Mathematics and Basic	Engineering Topics	General Education
	X	

Relationship of Course to the Program Educational Outcomes (PEO's):

a, b, c, e, i, k, l

Person(s) Who Prepared this Description and Date of Preparation:

William J. Ebel 1/30/2006

EENG -404: Automatic Control Systems

Required Course for students in EE concentration

2005-2007 Catalog Data	**Linear time-invariant systems. Transfer functions, block diagrams and signal flow graphs. Stability, time and frequency response, and root locus analysis. Compensator design in time and frequency domain.**
Prerequisites	**EENG -301.**
Class/Lab Schedule	**Three one-hour class sessions per week.**
Course Objectives	**Introduce students to feedback principles, modeling of dynamic Systems, stability concepts, transient and steady state performance of feedback systems, design and analysis of feedback systems using root locus and frequency domain concepts.**
Textbooks	**"Automatic Control Systems-w/CD" by Benjamin C. Kuo, 8th Edition, John Wiley Publisher, 2003. MATLAB 7**
Topics Covered	**Concepts of linearity, Use of Laplace transforms in finding transfer functions, block diagrams and signal flow graphs, modeling of physical dynamic systems, stability concepts and Routh-Hurwitz –criterion, time domain analysis- transient and steady state error constants, root locus techniques, frequency domain analysis, Bode and Nyquist plots, PID controller design, and compensator (lead, lag and lead-lag) design.**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, c, e, k

Person(s) Who Prepared This Description and Date of Preparation: Dr. H. S. Mallik

EENG -407: Transmission Lines and Waveguides

Required Course

2005-2007 Catalog Data **Introduction, elementary transmission line concepts. Standing-wave AC configurations. Smith chart and matching problems. Plane waves and wave impedance. Mode theory of rectangular waveguides. Microstrips, stripline and other practical transmission lines.**

Prerequisites **EENG -302.**

Class/Lab Schedule **Three one-hour class sessions per week.**

Course Objectives **The purpose of the course is to provide students with a working knowledge of transmission lines. It also provides students with a solid grasp of electromagnetic waves, by emphasizing physical understanding and practical applications**

Textbooks **"Engineering Electromagnetics" by Inan and Inan, Pearson Publisher, 1999.**

Topics Covered

Time-varying Fields and Maxwell's Equations
Plane Electromagnetic waves
Transient Response of Transmission Lines
Steady-State Waves on Transmission Lines
Guided Waves

Course Outcomes

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, c, e, i, k

Person(s) Who Prepared This Description and Date of Preparation:
Dr. Habib Rahman, Professor of Electrical and Computer Engineering
02/25/2006

EENG -409: Radar Systems

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Elective Course

2005-2007 Catalog Data	**Nature of radar, basic elements of the radar systems. Radar waveforms and applications. Tracking radar techniques and applications, radar electronic counter countermeasures (ECCM).**
Prerequisites	**EENG -403 or Permission of the Instructor.**
Class/Lab Schedule	**Three one-hour class sessions per week.**
Course Objectives	**The course is intended to provide the fundamentals and basic principles of radar systems including the general analytical treatment of radar signals and equations. It provides working knowledge to understand the factors external to the radar including electromagnetic wave reflectivity and propagation processes and the multi-path phenomenon and effects. It also provides an analytical treatment and working knowledge of specific radar topics and types including CW and FM radars, MTI and pulse Doppler radars, tracking radars, pulse compression radar, and synthetic aperture radar.**
Textbooks	**"Introduction to Radar Analysis" by Mahafza, CRC Publisher, 1998.**
Topics Covered	**Nature of Radars** **The Radar Equations** **CW and FM Radars** **MTI and Pulse Doppler Radars** **Tracking Radars** **Radar Transmitters and Receivers** **Pulse Compression and Synthetic Aperture Radars**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, c, e, h, l, m

Person(s) Who Prepared This Description and Date of Preparation:
Dr. Habib Rahman, Professor of Electrical and Computer Engineering
02/25/2006

EENG -419: Digital IC Design

Required for CpE Concentration **Elective Course for EE Concentration**

2005-2007 Catalog Data **Introduction to fundamentals of digital integrated circuit design. CMOS inverters and gate circuits. Circuit design for LSI and VLSI.**

Prerequisites **EENG -205 and EENG -309**

Class/Lab Schedule **Three one-hour class sessions per week**

Course Objectives **The purpose of this course is to introduce students to fundamentals of digital IC design. Semiconductor devices introduced in earlier courses will be used as a switching element. Various NMOS and CMOS based gates and cells are introduced. Interconnect related timing issues and Power delay product is introduced. Challenges and issues related to modern and advanced ICs are discussed.**

Textbooks **"Analysis and Design of Digital Integrated Circuits" by D.A. Hodges, H.G. Jackson, and R.A. Saleh, 3rd Edition, McGraw Hill Publisher, 2004.**

Topics Covered

Review of the progress in IC design technology
Fundamentals of MOSFET fabrication
Fundamentals of MOS inverter static and dynamic characteristics
IC design interconnect issues
Design of many input digital gates such as NAND, NOR, EXOR
Design of combinational and sequential circuits
Understand technology challenges facing future IC manufacturers.

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, c, e, g, i, j, k, m

Person(s) Who Prepared This Description and Date of Preparation: Dr. R. Gharabagi 1/30/2006

EENG -490: Electrical Engineering Design I

==========

Required Course

2005-2007 Catalog Data **Principles of engineering experimentation and design. Development of engineering design proposal.**

Prerequisites **Senior EE standing.**

Class/Lab Schedule **One Two-hour class session per week and one two hour lab session per week.**

Goals: **This course is the first of two semester sequence in electrical engineering senior design. The purpose of this course is to introduce the theory and practice of engineering design and develop a major design proposal that incorporates the electrical engineering skills the students have obtained earlier in the curriculum. The course emphasizes the importance of teamwork and inter-disciplinary projects.**

Textbooks **Design Concepts for Engineers, 2nd Edition, by M.N. Horenstein, Prentice Hall**

Topics Covered

The concept of Design
Engineering Design Tools
Design Methodology
Realistic considerations
Experimental Design
Instrumentation
Design Case study
Design considerations – safety, legal, ethical, social, economical..)
The role of the computers in engineering design
The Human-Machine Interface
Learning from design mistakes
Effective Communication skills
ABET outcomes set by the department and their relation to senior design
Developing the Proposal:
Research – Library and Internet
- Copyrights, patents and trademarks
Preliminary proposal
Format and Planning

Technical Reporting – webpage for each project
Formal presentation

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)
a, b, c, d, e, f, g, h, i, j, k, l, m

Person(s) Who Prepared This Description and Date of Preparation: Dr. H.S. Mallik/Dr. R. Gharabagi/Dr. Kyle Mitchell/Dr. Will Ebel

EENG -491: Electrical Engineering Design II

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Required Course

2005-2007 Catalog Data **Development, analysis and completion of detailed design in electrical engineering. Completion of a project under faculty supervision. Project results are presented in a formal report.**

Prerequisites **EENG -490.**

Class/Lab Schedule **One one-hour class session per week and one four hour lab session per week.**

Textbooks **Design Concepts for Engineers, 2nd Edition, by M.N. Horenstein, Prentice Hall**

Topics Covered

1. **Engineering Method**
   a. **Engineering as a Design Process**
   b. **Specifications and realistic Constraints**
   c. **Rules of Thumb and Order of Magnitude**
   d. **Engineering Heuristics**
   e. **Evolution of Engineering Design Method**
   f. **Comparison of Designs**
   g. **Rules of Judgment and Optimization**
   h. **Impact of Design on society**
   i. **Risks and safety**
   j. **Resource Allocation**
   k. **Prototype and mass production**
   l. **User manual and post market support**
2. **Implementing the Proposal**
3. **Breadboard, PCB, and Prototype construction**
4. **Quality Control and Fault Analysis**
5. **Design Management**
6. **Final Design Presentation**
7. **Product Demonstration**
8. **Lessons learned and suggestions for future design and development**
9. **Relating overall lessons learned to ABET outcomes.**

Contribution of Course to Meeting the Professional Component

Mathematics and Basic Sciences	Engineering Topics	General Education
	X	

Relationship of Course to Program Educational Outcomes (PEO's)

a, b, c, d, e, f, g, h, i, j, k, l, m

Person(s) Who Prepared This Description and Date of Preparation: Dr. H.S. Mallik/Dr. R. Gharabagi/Dr. Kyle Mitchell

B.2. Required Computer Science Courses Syllabi

CSCI 150: Introduction to Object Oriented Programming

Required for both EE and CpE concentrations

Catalog Description: An introduction to computer programming based upon early coverage of object-oriented principles such as classes, methods, inheritance and polymorphism, together with treatment of traditional flow of control structures. Good software development practices will also be established, including issues of design, documentation, and testing. Credit will not be given for both CSCI145 and CSCI150

Prerequisite: College Algebra (MATH 120) or the equivalent.

Class/Lab Schedule Four one-hour class sessions per week

Topic Covered: Please see catalog description

Textbook: The main textbook, *Introduction to Object-Oriented Programming in Python*, is being written by Goldwasser and Letscher of our department. Chapters will be given out, free, well in advance of the time the material is covered. A link to an online reference for Python is provided in the home page of this course.

Person(s) Who Prepared This Description and Date of Preparation
Professor Kim Druschel

CSCI 180: Data Structures

Required for CpE Concentration

- Catalog Description

  "The design, implementation and use of data structures. Principles of abstraction, encapsulation and modularity to guide in the creation of robust, adaptable, reusable and efficient structures. Specific data types to include stacks, queues, lists, priority queues, dictionaries, trees and graphs."

- Prerequisites

  The official prerequisite is one of CSCI 146 or CSCI 150 as well as either one of CSCI 140, MATH 135, or MATH 266.

Class Schedule: **Four hour class sessions per week**

- Course Objectives/goals:

  This is an undergraduate course which is a follow-up to an introductory programming course. The goal of that first course can be viewed as gaining the ability to write computer programs for accomplishing tasks. The key in that course was that programs must work *correctly* for the task at hand. In this course, we will focus on the fact that there are actually many different ways to correctly solve a particular problem and that these different methods may vary greatly in *efficiency* and *adaptability*.

  What we will find is that writing a ``good'' program is not as simple as starting with a correct program and then improving it. Instead, the quality of a program is most determined by key thoughts and decisions which take place long before the first line of code might be written. Relevant issues include the choice of data structures which are used to organize all of the information within a program, and the structure and level of generality which allow components of a program to be better maintained, reused, and adapted.

  In hand with this emphasis on writing good programs and designing useful data structures, the course will reinforce aspects of object-oriented programming and the C++ programming language.

- Textbook

The required textbook for this course is:

Data Structures and Algorithms in C++
Michael T. Goodrich, Roberto Tamassia and David M. Mount
John Wiley & Sons, 2004.
ISBN 0-471-20208-8

Person(s) Who Prepared This Description and Date of Preparation
Professor M. Goldwasser

CSCI-224 Computer Architecture

Required for CpE concentration

Catalog Description: **Introduction to the organization and architecture of computer systems, including aspects of digital logic, data representation, assembly level organization, memory systems and processor architectures. 3.0 credit hours.**

Prerequisite: CSCI 150

Class/Lab Schedule: Three one-hour class sessions per week

Topic Covered: Please see catalog description

Textbook:

***Computer Systems Design and Architecture (2nd Edition)*, Vincent P. Heuring and Harry F. Jordan, Pearson Prentice Hall, 2003**

Person(s) Who Prepared This Description and Date of Preparation
Professor Jason Fritts

B.3. Required Math Courses Syllabi

MT-A135-0l
DISCRETE MATHEMATICS
Spring 2006

Instructor: HEBDA
Office: (206 Ritter Hall)
Office Phone: (977-3146)
Office Hours: Mon 1pm; Tue 1pm; Fri 3:10pm; & by appointment e-Mail: *hebdajj@slu.edu*

Times: MWF 9:00-9:50 a.m. Room: Ritter Hall 30

Prerequisite: College Algebra (MT A120)

Text: Richard Johnsonbaugh, Discrete Mathematics, 6th ed., Pearson/Prentice Hall, 2005

This is a course in discrete mathematics. Topics are designed to provide a mathematical foundation for computer science courses. Topics to be covered include: symbolic logic, sets and functions, counting methods, discrete probability, and graphs. Mathematical reasoning and proof are emphasized throughout the course.

Basis of Grade:
Quizzes 100pts
Exam I1O0pts
Exam II 100pts
Final Exam 200pts

I plan to give 11 quizzes. The lowest quiz score will be dropped. There will be no make-up exams without' a valid documented excuse. The Final Exam is cumulative.

Academic Honesty Statement: "Students are expected to be honest in their academic work. The University reserves the right to penalize any student whose academic conduct is, in its judgment, detrimental to the University. Such conduct shall include cases of plagiarism, collusion, cheating, giving or receiving or offering or soliciting information on examinations, or the use of previously prepared material in examinations or quizzes. Violations should be reported to your course instructor, who will investigate and adjudicate them according to the Policy on Academic Honesty of the College of Arts and Sciences. If the charges are found to be true, the student may be liable for academic or disciplinary probation, suspension, or expulsion from the University."

Disability Services Statement: "Any student who feels that he/she may need academic accommodations in order to meet the requirements of this course, as outlined in the syllabus, due to presence of a disability, should contact the Office of Diversity and Affirmative Action, DuBourg Hall 36. (314-977-8885)"

Revised June 2005

MATH 142 Calculus I (4 hours)

Catalog Description: Functions; continuity; limits; the derivative; differentiation from graphical, numerical and analytical viewpoints; optimization and modeling; the definite integral; antiderivatives from graphical, numerical and analytical viewpoints. Offered fall, spring and summer.

Prerequisite: At least a "C" in MATH 141 or four years of high school math.

Graphing Calculator: Required in calculator sections and strongly recommended in Mathcad sections with a TI-83 or TI-84 being the calculator of choice.

Text: Deborah Hughes-Hallett, Andrew Gleason, William McCallum et al. *Calculus,* Fourth Edition. New York, NY: John Wiley & Sons, Inc., 2005.

Syllabus:

Chapter 1: A Library of Functions
1.1 Functions and Change
1.2 Exponential Functions
1.3 New Functions from Old
1.4 Logarithmic Functions
1.5 Trigonometric Functions
1.6 Powers, Polynomials, and Rational Functions 1.7 Introduction to Continuity
1.8 Limits

Chapter 2: Key Concept: The Derivative
2.1 How Do We Measure Speed?
2.2 The Derivative at a Point
2.3 The Derivative Function\
2.4 Interpretations of the Derivative
2.5 The Second Derivative
2.6 Differentiability

Chapter 3: Short-cuts to Differentiation
3.1 Powers and Polynomials
3.2 The Exponential Function
3.3 The Product and Quotient Rules
3.4 The Chain Rule
3.5 The Trigonometric Functions
3.6 The Chain Rule and Inverse Functions
3.7 Implicit Functions
3.8 Hyperbolic Functions

3.9 Linear Approximation and the Derivative
3.10 Theorems about Differentiable Functions

Chapter 4: Using the Derivative
4.1 Using First and Second Derivatives
4.2 Families of Curves
4.3 Optimization
4.4 Applications to Marginality (optional)
4.5 Optimization and Modeling
4.6 Rates and Related Rates
4.7 L'Hopital's Rule, Growth, and Dominance
4.8 Parametric Equations

Chapter 5: Key Concept: The Definite Integral
5.1 How Do We Measure Distance Travel?
5.2 The Definite Integral
5.3 The Fundamental Theorem and Interpretations
5.4 Theorems about Definite Integrals

Chapter 6: Constructing Antiderivatives
6.1 Antiderivatives Graphically and Numerically
6.2 Constructing Antiderivatives Analytically
6.3 Differential Equations (optional)
6.4 Second Fundamental Theorem of Calculus
6.5 The Equations of Motion (optional)

Revised November 2005

MATH 143 Calculus II (4 hours)

Catalog Description: Symbolic and numerical techniques of integration, applications using the definite integral, sequences and series, power series, Taylor series, differential equations. Fall and spring semesters.

Prerequisite: At least a "C" in MATH 142.

Technology: A graphing calculator with a TI-83 or TI-84 being the calculator of choice is required. In addition, the instructor may use math software such as Maple or Mathcad when appropriate.

Text: Deborah Hughes-Hallett, Andrew Gleason, William McCallum et al. *Calculus,* Fourth Edition. New York, NY: John Wiley & Sons, Inc., 2005.

Syllabus:

Chapter 7: Integration
7.1 Integration by substitution
7.2 Integration by parts
7.3 Tables of integrals
7.4 Algebraic identities and trigonometric substitutions
7.5 Approximating definite integrals
7.6 Approximation errors and Simpson's rule
7.7 Improper integrals
7.8 Comparison of improper integrals

Chapter 8: Using the Definite Integral
8.1 Areas and volumes
8.2 Applications to geometry
8.3 Area and arc length in polar coordinates
8.4 Density and center of mass [see note (a) at end of syllabus]
8.5 Applications to physics [see note (a) at end of syllabus]
8.6 Applications to economics [see note (a) at end of syllabus]
8.7 Distribution functions [see note (a) at end of syllabus]
8.8 Probability, mean, and median [see note (a) at end of syllabus]

Chapter 9: Sequences and Series
9.1 Sequences
9.2 Geometric series
9.3 Convergence o(series
9.4 Tests for convergence
9.5 Power series and interval of convergence

Revised June 2005

MATH 244 Calculus **III** (4 hours)

Catalog Description: Three-dimensional analytic geometry, vector-value functions, partial differentiation, multiple integration, and line integrals. Fall and spring semesters.

Prerequisite: At least a "C" in MATH 143.

Graphing Calculator: Required in calculator sections and strongly recommended in Mathcad sections with a TI-83 or TI-84 being the calculator of choice.

Text: Deborah Hughes-Hallett, Andrew Gleason, William McCallum et al. *Calculus,* Third Edition. New York, NY: John Wiley & Sons, Inc., 2002

or

William McCallum, Deborah Hughes-Hallett, Andrew Gleason, et al. *Multivariable Calculus,* Third Edition. New York, NY: John Wiley & Sons, Inc., 2001.

Syllabus:

Chapter 12: Functions of Several Variables
Chapter 13: A Fundamental Tool: Vectors
Chapter 14: Differentiating Functions of Several Variables Optimization: Local and Global Extrema
Chapter 15: Optimization: Local and Global Extrema
Chapter 16: Integrating Functions of Several Variables (16.6 is optional)
Chapter 17: Parameterization and Vector fields (17.1, 17.2 and 17.5)

Cover 1-4 chapters from the following:

Chapter 17: Parameterization and Vector Fields (17.3 and 17.4)
Chapter 18: Line Integrals
Chapter 19: Flux Integrals
Chapter 20: Calculus of Vector Fields

MT - A 355 Differential Equations (3) 10/14/05

PREREQUISITE: MT - A244.

Text Differential Equations, 3'ded. by Blanchard-Devaney-Hall, Brooks/Cole Pl 2002 Topics (The names in parentheses are the software tools to be used with each topic).

(1) First Order Equations (HPG Solver)
(a) Modeling
(b) Separation of variables
(c) Slope fields
(d) Euler's method (Euler's Method)
(e) Existence and uniqueness of solutions (Target Practice – First Order Examples)
(f) Equilibria and the phase line (Phase Lines)
(g) Bifurcation (Phase Lines)
(h) Linear first order differential equations

(2) First-order systems (HPG System Solver)
(a) Modeling via systems (Predator Prey)
(b) The geometry of systems
(c) Analytic methods

(3) Linear systems (Linear Phase Portraits)
(a) Basic properties
(b) Straight line solutions (Matrix Fields – Matrix Draw – Matrix Sliders)
(c) Real eigen values
(d) Complex eigen values
(e) Repeated and zero eigen values
(f) Second order linear equations
(g) The trace determinant plane (TD Plane Animation)

(4) Forcing and resonance
(a) Forced harmonic oscillators (Mass Spring – RLC Circuits)
(b) Sinusoidal forcing
(c) Beats and resonance (Beats)
(d) Amplitude and phase response (Vibration Amp Phs)

(5) Nonlinear systems (HPG System Linearizer)
(a) Equilibrium (Competing Species)
(b) Qualitative analysis
(c) Hamiltonian systems
(d) Dissipative systems

(6) Laplace transform
(a) Definition and basic properties
(b) Discontinuous functions
(c) Second order equations
(d) Delta function and impulse forcing
(e) Convolutions
(f) The qualitative theory of Laplace transforms

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MT -A403
Probability and Statistics for Engineers

Analyzing and producing data; probability; random variables; probability distributions; expectation; sampling distributions; confidence intervals; hypothesis testing; experimental design; regression and correlation analysis.

There will be a strong emphasis on the application of probability and statistics to the engineering and physical sciences. Credit will not be given for both MT A403 and either of MT A401 or MTA402.

Prerequisite: MT A244.

Credit: 3 hours

Text: Ronald Walpole, Raymond Myers, Sharon Myers and Keying Ye. *Probability & Statistics for Engineers & Scientists,* Seventh Edition. Upper Saddle River, NJ: Prentice-Hall, Inc., 2002.

1. Introduction to Statistics and Data Analysis
1.1. Overview: Statistical Inference, Samples, Populations, and Experimental Design
1.2. The Role of Probability
1.3. Sampling Procedures; Collection of Data
1.4. Measures of Location: The Sample Mean
1.5. Measures of Variability
1.6. Discrete and Continuous Data
1.7. Statistical Modeling, Scientific Inspection, and Graphical Diagnostics
1.8. Graphical Methods and Data Description
2. Probability
2.1. Sample Space
2.2. Events
2.3. Counting Sample Points
2.4. Probability of an Event
2.5. Additive Rules
2.6. Conditional Probability
2.7. Multiplicative Rules
3. Random Variables and Probability Distributions
3.1. Concept of a Random Variable
3.2. Discrete Probability Distributions
3.3. Continuous Probability Distributions
3.4. Joint Probability Distributions
4. Mathematical Expectation
4.1. Mean of a Random Variable
4.2. Variance and Covariance
4.3. Means and Variances of Linear Combinations of Random Variables
5. Some Discrete Probability Distributions

B.4. Required Physics Courses Syllabi

ENGINEERING PHYSICS I - SYLLABUS

Course Number: PH-P161

Course Title:.....Engineering Physics I

Number of Credit Hours:.....3 hours

Number of Lectures per week: .....3 hours

Corequisite: .....PH-P162 Physics I Laboratory

Prerequisites: MT-A142

Text: .....Physics: Volume One, 5th Edition, R. Resnick, D. Halliday, and K. S. Krane.

The calculus approach is used to develop concepts of mechanics, heat and wave motion.

Dates	*Week*	*Description*
sept. 6	3	1) Error Analysis and Simple Harmonic Motion
sept. 13	4	2) Force Table
sept. 20	5	3) Newton's Second Law
sept. 27	6	4) Ballistic Pendulum*
oct. 4	7	7) Centripetal Force
oct. 11	8	8) Impulse and Momentum
oct. 18	9	5) Torque Equilibrium
oct. 25	10	*No Lab, Fall Break*
nov.1	11	6) Torque and Inertia*
nov. 8	12	9) Work and Energy
nov. 15	13	10) Wave Motion on a String
		* = uses work and energy concepts

ENGINEERING PHYSICS-II (WITH CALCULUS) PH-P 163-01 FALL 2005

1. Electric Charge and Coulomb's law

2. Electric Field

3. Lines of Electric force, electric field patterns

4. Electric dipoles, flux of the electric field

5. Gauss' Law

6. Applications of Gauss' Law

7. Electric Potential

8. Capacitors

9. Combinations of capacitors, electrical energy

10. Dielectrics, electric currents

11. Resistance, Ohm's Law

12. Energy in circuits, emf

13. Resistances in series and parallel

14. Kirchoff's rules, circuits

15. Measuring devices

16. RC-circuits

MIDTERM EXAM (2 Hours) WED OCT 19th

17. Magnetic fields and forces on charged particles

18. Circulating charges

19. Magnetic force and torque acting on a current loop

20. Biot-Savart Law

21. Applications

22. Ampere's Law

23. Faraday's Law, Lenz's Law

24. Motional emfs, generators

25. Inductance

Dates	*Week*	*Description*
sept. 7-9	2	3) Electric Field
sept. 14-16	3	5) Mechanical Equivalent of Heat (Electrical Method)
sept. 21-23	4	2) Parallel and Series Circuits
Sept 28-30	5	4) Temperature Coefficient of Resistance
oct. 5-7	6	8) Magnetic Fields and the Magnetic Dipole
oct. 12-14	7	9) Current Balance
oct. 19-21	8	7) Magnetic Fields and induced EMF
oct. 26-28	9	*Fall Break, no labs*
nov. 2-4	10	12) LCR Circuits *and/or* 13) Speed of Light
nov. 9-11	11	10) Refraction and Lenses
nov. 16-18	12	11) and 14) Diffraction

B.5. Required Chemistry Courses Syllabi

Note: Chemistry 161 (lecture + Lab) is a replacement for both Chemistry 151 and 152 (lab)

CHEM 161—Introduction to Chemistry I

Course Lecture Topics

Chapter 1—Keys to the Study of Chemistry

- Matter—states and properties
- History of Chemistry
- Scientific Method
- Measurement, Uncertainty and Units

Chapter 2—The Components of Matter

- Elements, Compounds and Mixtures
- Dalton's Atomic Theory
- Modern Atomic Theory
- Compounds and Bonding
- Formulas, Names, and Masses

Chapter 3—Stoichiometry

- Mole Concept
- Determining Chemical Formulas
- Balancing Chemical Reactions
- Yields
- Solution Stoichiometry

Chapter 4—Classes of Chemical Reactions

- Water as a Solvent
- Aqueous Ionic Reactions
- Precipitation Reactions
- Acid-Base Reactions
- Redox Reactions
- Introduction to Chemical Equilibrium

Chapter 5—Gases and Kinetic-Molecular Theory

- Pressure
- Gas Laws
- Applications of Gas Laws
- Gases and Reaction Stoichiometry
- Kinetic-Molecular Theory
- Real Gases

Chapter 6—Thermochemistry

- Forms of Energy—Heat and Work
- Enthalpy Changes in a Chemical Reaction
- Calorimetry
- Thermochemical Equations and Stoichiometry
- Hess's Law
- Heats of Formation

Chapter 7—Quantum Theory and Atomic Structure

- Nature of Light—Wave and Particle Theories
- Atomic Spectra
- Bohr Model of the Atom
- Wave-Particle Duality
- Quantum-Mechanical Model

Chapter 8—Electron Configuration and Chemical Periodicity

- Periodic Table
- Many-Electron Atom
- Quantum-Mechanics and the Periodic Table
- Trends in Atomic Properties—Size, Ionization Energy, Electron Affinity
- Electronic Structure and Chemical Reactivity

Chapter 9—Models of Chemical Bonding

- Ionic Bonding—Energy Considerations
- Covalent Bonding—Energy Considerations, Chemical Change
- Metallic Bonding

Chapter 10—Shapes of Molecules

- Lewis Structures
- VSEPR Theory
- Molecular Polarity

Chapter 11—Theories of Covalent Bonding

- Valence Bond Theory
- Orbital Overlap—Sigma and Pi Bonding
- Molecular Orbital Theory

Chapter 12—Intermolecular Forces

- Physical States of Matter
- Energy Changes in Phase Changes
- Phase Diagrams
- Types of Intermolecular Forces
- Properties of Liquids
- Water

- Solid State Structures
- Advanced Materials

Chapter 13—Properties of Mixtures

- Solutions of Liquids with Solids and Gases
- Energy and Entropy Changes
- Equilibrium
- Concentration Units
- Colligative Properties
- Colloids

Text: Silberberg, Chemistry: *The Molecular Nature of Matter and Change*, McGraw Hill, 4th Edition, 2006.

Grading: Based on four tests (400 points), lab (150 points) and final exam (200 points).

Prepared by C. Kirkpatrick

C. Faculty Curriculum Vita

WILLIAM J. EBEL
Associate Professor

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Email: ebelwj@slu.edu

EDUCATION

Ph.D. Electrical Engineering, University of Missouri-Rolla, 1991 Advisor: *William H. Tranter*, Bradley Professor of Electrical Engineering, Virginia Polytechnic and State University Dissertation: *Simulation and Evaluation of Reed-Solomon Codes in a Burst Noise Environment*

M.S. Electrical Engineering, University of Missouri - Rolla, 1985 Advisor: *Gordon Carlson* Thesis: *Algorithm development for Target Classification Using Fourier Boundary Descriptor Features*

B.S. Electrical Engineering, University of Missouri-Rolla, 1983. Honor graduate.

PROFESSIONAL EXPERIENCE

7/1/05 - present, Saint Louis University
Associate Professor of Electrical and Computer Engineering

7/1/02 - 6/30/05, Saint Louis University Department Chairman and Associate Professor of Electrical Engineering

8/00 - 6/31/02, Saint Louis University, Tenured.
Associate Professor of Electrical Engineering

8/99 - 8/00, Virginia Polytechnic Institute and State University, Tenured.
Associate Professor of Electrical & Computer Engineering, Tenured

5/96-5/99, Mississippi State University (MSU), Tenured.
Associate Professor of Electrical & Computer Engineering

9/91-5/96, Mississippi State University (MSU)
Assistant Professor of Electrical & Computer Engineering, Tenured 1996

8/85 - 1/91, McDonnell Douglas, Corp. St. Louis Division
Senior Engineer

SCIENTIFIC AND PROFESSIONAL SOCIETIES

Member IEEE Member IEEE Communications Society Member IEEE Information Theory Society Member IEEE Signal Processing Society Member Eta Kappa Nu Member Tau Beta Pi Member of the American Society of Engineering Education (ASEE)

INSTITUTIONAL AND PROFESSIONAL SERVICES

Treasurer, St. Louis Section of the IEEE, 2004 and 2005 Department Chairman, Department of Electrical and Computer Engineering, 2002-2005 Tutorials Co-Chairman, IEEE Global Communications Conference, St. Louis, 2004

HONORS AND AWARDS

Outstanding Educator Award, St. Louis Section IEEE, 2004

RESEARCH INTERESTS

Digital and Cellular Communications Error Correcting Codes Digital Signal Processing Sensors and Sensor Technologies

SELECTED FUNDING

"Practical Coding for 4th Generation Cellular Systems", W. Ebel, Beaumont Faculty Development fund, $4,070, 8/01 - 5/02 (SLU).

"Research and Development for IMT-2000", B. Tranter, J. Reed, and W. Ebel, LG Information and Communication (LGIC), $350,000, 6/00 (Virginia Tech).

"Application of the C62xx to Turbo Encoders/Decoders", W.J. Ebel, University Research Grant, Texas Instruments, $69,470, 8/99 - 8/00 (Virginia Tech).

"Performance of Turbo Decoders using Fixed Point Arithmetic", W.J. Ebel, University Research Grant, Texas Instruments, $21,497, 8/97 - 8/98 (MSU).

"A Neural Network Hardware Decoding Complexity Study", W.J. Ebel, Northrop Grummen Corporation, $24,900, February 1, 1995 through December 1996 (MSU)

SELECTED PUBLICATIONS

Gharabagi, R., and Ebel, W.J., "The Senior Design Project: From Concept to Reality", ASEE Conference, Nashville, TN, June 25, 2003.

Ebel, W.J., "Convergence of Iterative Decoding for Fixed-Point Implementations", The 2002 45th Midwest Symposium on Circuits and Systems, August 4-7, 2002, Tulsa OK.

T. Muharemovic, A. Gatherer, W. Ebel, S. Hosur, D. Hocevar, and E. Huang, "Space-Time Coding with Bit Interleaving", *Globecom*, San Antonio, TX, 2001.

Y. Wu, B. Woerner, W. Ebel, "A Simple Stopping Criteria for Turbo Decoding", *IEEE Communications Letters*, Vol. 4, No. 8, August 2000, pp. 258-260.

"Turbo Code Implementations on the TMS320 DSP", by Eric Cress and W. Ebel, *1999 Symposium on Wireless Personal Communications*, MPRG, Virginia Tech, June 2-4, 1999.

"Forward Computation of Backward Path Metrics for MAP Decoders", Yufei Wu, W.J. Ebel, and B.D. Woerner, *IEEE Global Telecommunications Conference*, Dec. 5-9, 1999, Rio de Janeiro.

ROOBIK GHARABAGI
Associate Professor

Department Of Electrical Engineering

Parks College of Engineering, Aviation and Technology

Saint Louis University
3450 Lindell Blvd.
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Tel: (314) 977-8294
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EDUCATION

Ph.D., Electrical Engineering, the University of Pittsburgh, Pittsburgh, PA, 1989
Dissertation: Modeling of Short-Channel MOS Transistor Capacitances.
Advisor: Dr. M. L. El-Nokali (Ph.D. from McGill University).

MS, Electrical Engineering, the University of Pittsburgh, Pittsburgh, PA, 1984
Thesis: Infrared Detection by Upconversion. (NASA Sponsored Research).
Advisor: Dr. J. Falk (Ph.D. from Stanford University).

BS, Electrical Engineering, the University of Pittsburgh, Pittsburgh, PA, 1981
Senior Project: Fabrication of P-N Junctions
Advisor: Dr. M Guvenc (Ph.D. from Case Western University).

PROFESSIONSL EXPERIENCE

Associate Professor and Chair, Department of Electrical and Computer Engineering, Saint Louis University, July 2005 till present.

Associate Professor, Department of Electrical Engineering, Saint Louis University, 1993 to present.

Assistant Professor, Department of Electrical Engineering, Saint Louis University, 1988 to 1993.

Teaching Fellow and Instructor, Department of Electrical Engineering, University of Pittsburgh, 1984 to 1988.

Research Assistant, Department of Electrical Engineering, University of Pittsburgh, 1981 to 1984.

SCIENTIFIC AND PROFESSIONAL SOCIETIES

- Institute of Electrical and Electronics Engineers, IEEE
- IEEE Electron Device Society
- American Society of Engineering Education

INSTITUTIONAL AND PROFESSIONAL SERVICES

1989 – Present: Very Active in Local IEEE Chapter (Past Chair, Chair of D&D Forum Globecom 2005, etc.)

2005 – Present: Department Chair

2005 – Present: Faculty Senate: Affirmative Action Committee

2005 – Present: College Affairs Committee

HONORS AND AWARDS

- Outstanding IEEE Counselor Award
- Outstanding Dissertation Award
- Summer Research Award – Saint Louis University
- Beaumont Faculty Development Award – Saint Louis University

RESEARCH INTERESTS

- Nanotechnology and Nano scale semiconductor devices modeling and simulation.

- Investigation of thermal effects on semiconductor devices and its effects on Integrated Circuits performance.

- Investigation of defects in semiconductor by studying device characteristics.

- Modeling small geometry Lightly Doped Drain region MOS Transistors.

- Modeling small geometry MOS transistor on bulk silicon static and dynamic characteristics.

SELECTED PUBLICATIONS

1. Roobik Gharabagi, "Study of Thermal Effects on Thin Double Gate SOI MOSFETs Characteristics", Presented in IEEE R-5 Conference, April 2004.

2. Roobik Gharabagi, William J. Ebel, "The Senior Design Project: From Concept to Reality", Presented to American Society for Engineering Education Annual Conference and Exposition, June, 2003.

3. Roobik Gharabagi, A Model for Fully Depleted Double Gate SOI MOS transistors including temperature effects, Presented in the Fourth Conference on Modeling and Simulation of Microsystems, Hilton Head, South Carolina, March 2001.

4. Roobik Gharabagi, A Quasi-Two Dimensional Model for Fully Depleted Single Gate SOI MOSFETs Including Thermal effects, presented at the National Aerospace and Electronics Conference, Dayton, OH, October 10-12, 2000.

5. Roobik Gharabagi, An Analytical Model for Fully Depleted Single Gate SOI MOS Transistors Including Lattice Temperature Effects, International Journal of Electronics, Vol. 87, No. 2, pp. 129-136, 2000.

Professional Development Activities

- Attended Globecom 2005 – co-Chair of Design and Developers Forum
- Attended ABET workshop, Portland, OR, 2005.
- Attended ABET workshop, New Orleans, LA, 2005.
- Attended IEEE Region 5 Conference, Normal OK, 2003
- Attended NSF Sponsored Workshops on IC Fabrication and IC Packaging.
- Attended ASEE meetings

Huliyar Mallikarjuna, Ph. D
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Associate Professor
Electrical and Computer Engineering Department
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Education
B.S.E.E Bangalore University, India, 1980
M.S.E.E. Electrical Engineering, University of Pittsburgh, Pittsburgh, PA. 1984
Ph. D. in Electrical Engineering, University of Pittsburgh, Pittsburgh, PA 1989

Experience:
Assistant Professor 1989-1994
Department of Electrical Engineering
Parks College, Saint Louis University

Associate Professor 1994-Current
Department of Electrical Engineering
Parks College, Saint Louis University

Teaching Interests:
Linear Circuits, Signals and Systems, Electric Machines, Power Systems, Filter Design, Automatic Control Systems, Senior (Capstone) Design.

Research Interests
Energy Systems, Engineering Education

Professional Society Membership
Institute of Electrical and Electronics Engineers - IEEE,
American Society for Engineering Education - ASEE.

Institutional and professional service
Chair, Electrical Engineering Department 1999-2002
Treasurer, IEEE St. Louis Section 2006
Member of various committees at College and University level

Teaching Areas
Circuits, Linear systems, Signals and Systems, Analog and Digital Filter Design, Automatic Control Systems, Electric Machines, and Power Systems

Professional Development
Attended various ABET Workshops:

March 2005 ABET Workshop New Orleans LA
June 2005 ABET Workshop Portland OR
October 2005 ABET Workshop on Assessment San Diego CA

Kyle Mitchell
Assistant Professor

Electrical and Computer Engineering

Parks School of Engineering, Aviation, and Technology

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St. Louis, MO 63103
Tel: (314) 977-8301
Email: mitchekk@slu.edu

EDUCATION

Ph.D., Computer Engineering, the University of Missouri - Rolla, Rolla, MO, 2004
Dissertation: Intelligent Agent Based Autonomous Real-Time Structural Health Monitoring System
Advisors: Dr. V. S. Rao, Dr. H. J. Pottinger

MS, Electrical Engineering, the University of Missouri – Rolla, Rolla, MO, 1999
Thesis: Development of Teaching Aids for use in an Undergraduate Computer Engineering Course in Embedded Systems Design
Advisor: Dr. H. J. Pottinger

BS, Electrical Engineering, the University of Missouri – Rolla, Rolla, MO, 1996

PROFESSIONSL EXPERIENCE

Assistant Professor, Department of Electrical and Computer Engineering, St. Louis University, 2004 to Present.

Instructor, Department of Electrical and Computer Engineering, St. Louis University, 2002 to 2004.

Research Engineer, Intelligent Systems Center, University of Missouri – Rolla, 2001 to 2002.

SCIENTIFIC AND PROFESSIONAL SOCIETIES

- Institute of Electrical and Electronics Engineers, IEEE
- IEEE Computer Society
- American Society of Engineering Education
- International Council on Systems Engineering, INCOSE

INSTITUTIONAL AND PROFESSIONAL SERVICES

2002 – Present: Active in Local IEEE Chapter

2003 – Present: Mobile Computing Committee

2002 – 2005: Faculty Search Committees, ECE and EET

2002: Student Affairs Committee

RESEARCH INTERESTS

- Intelligent Sensor Hardware design and application
- Light weight low power computer modeling and design
- Aircraft flight monitoring
- Civil infrastructure monitoring

SELECTED PUBLICATIONS

1. K. Mitchell, N. Dang, P. Liu, V. S. Rao, H. J. Pottinger, "Web-Controlled Wireless Network Sensors for Structural Health Monitoring, Smart Structures and Materials", Proceedings of SPIE Volume: 4334, pp 234-243, 2001

2. K. Mitchell, V. S. Rao, H. Pottinger, "Lessons Learned About Wireless Technologies for Data Acquisition", Proc. SPIE Vol. 4700, p. 331-341, Smart Structures and Materials 2002: Smart Electronics, MEMS, and Nanotechnology

3. K. Mitchell, N. Dang, P. Liu, V. Rao, and H.J. Pottinger. "Web-controlledwireless network sensors for structural health monitoring." Proc. of SPIE the International Society for Optical Engrg., 4334:234, 243, 2001

4. K. Mitchell, S. Sana, P. Liu, K. Cingirikonda, S. Rao, H.J. Pottinger, "Distributed Computing and Sensing for Structural Health Monitoring Systems", Smart Structures and Materials 2000: Smart Electronics and MEMS., Varadan, V. K., Ed., Proc. SPIE Vol 3990 (2000)

5. Amaravadi, V.K., Mitchell, K., Rao, V.S., Derriso, M., "Structural integrity monitoring of composite patch repairs using wavelet analysis and neural networks", Proc. SPIE Vol. 4701, pp. 156-166, Smart Structures and Materials 2002

6. James W. Fonda, Steve E. Watkins, and Kyle K. Mitchell, Student Design and Engineering of Pre-school and Primary School Resource, 38th Midwest Section Conference of the American Society for Engineering Education 2003

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Habib Rahman, Ph.D.

Professor of Electrical and Computer Engineering
Parks College of Engineering, Aviation and Technology
Saint Louis University

EDUCATION:

Ph.D. Electrical Engineering, Syracuse University, New York, 1984
Advisor: Professor Jose Perini
Dissertation: Analysis of a Wire in a Rectangular Cavity
M. Eng. Electrical Engineering, McMaster University, Canada, 1979
Advisor: Professor Simon Haykin
Thesis: Digital Baseband Processing of a Mills Cross Array
B. Sc. Eng. Electrical Engineering, Bangladesh University of Engineering & Tech., 1972

INTEREST:

Electromagnetic Theory and Applications
Radar System and Satellite Communications
Engineering Education

EXPERIENCE:

1999-Present, Saint Louis University
Professor of Electrical and Computer Engineering
1991-1999, Saint Louis University
Chairman, Department of Electrical Engineering
1988-1999, Saint Louis University
Associate Professor of Electrical Engineering
1994-1988, Saint Louis University
Assistant Professor of Electrical Engineering
1979-1980, Sulaimania University
Lecturer, Department of Electrical Engineering
1972-1975, Bangladesh University of Engineering & Technology
Lecturer, Department of Electrical Engineering

MEMBERSHIPS:

Institute of Electrical and Electronic Engineers (IEEE), Senior Member
Electromagnetic Academy, Member

SERVICE:

Chairman, Department of Electrical Engineering
Vice-Chairman, Parks College faculty Assembly
Senator, Saint Louis University Faculty Senate
Chairman, Internal Review Committee, Parks College
Member, University Compensation and Benefits Committee
Reviewer of National Science Foundation, CISE Directorate

SELECTED PUBLICATIONS:

H. Rahman, "A Design Paradigm in Undergraduate Electrical Engineering Curriculum", *International Conference in Engineering Education*, San Juan, Puerto Rico, July 23-28, 2006.

H. Rahman, "An On-surface Generatrix Boundary Conditions Approach to Electromagnetic Penetration into a Shielded Enclosure", *Proceedings of the 2004 Progress in Electromagnetic Research Symposium*, Pisa, March 28—31, 2004.

H. Rahman, "Fourier Series Approach to the Computation of Currents on Multiple Cables Enclosed in a Shielded Enclosure", *Proceedings of the 2003*

Progress in Electromagnetic Research Symposium, Honolulu, Hawaii, October 13—16, 2003.

H. Rahman, "An Overview of the Fourier Series Method to the Analysis of an Externally Excited Cable Enclosed in an Electromagnetic Cavity", *Proceedings of the 2003 Progress in Electromagnetic Research Symposium*, Singapore, January 7–10, 2003.

H. Rahman, and B. Sholy, "Development of an Undergraduate Course in Radar Systems", 2002 American Society of Engineering Education Annual Conference, Montreal, Canada.

B. Sholy, and H. Rahman, "Microwave Measurements and Techniques laboratory in an Undergraduate Radar Systems Course", 2002 American Society of Engineering Education Annual Conference, Montreal, Canada, 2002.

H. Rahman, "Design Experience in Electrical Engineering Curriculum: An Integrated Approach", 2002 International Conference on Engineering Education, Manchester, UK.

H. Rahman, "Electromagnetic Excitation of a Cable of Arbitrary Thickness Enclosed Within a Shielded Enclosure", Proceedings of the 1999 *Progress in Electromagnetic Research Symposium*, Taiwan, March 22-26, 1999.

H. Rahman, "Electromagnetic Susceptibility of a Folded Cable of Finite Thickness, in a Shielded Enclosure, to External Excitation," *Journal of Electromagnetic Waves and Applications*, *Vol.* 12, No. 10, pp. 1349-1356, 1998.

H. Rahman, "A Novel Approach to Computation of Fields Inside Waveguides and Cavities by Fourier Series, " *Proceedings of the 1998 International Conference on Mathematical Methods in Electromagnetic Theory*, Kharkov, Ukraine, June 2-5, 1998.

H. Rahman, "Electromagnetic Behavior of a Bent Wire in a Shielded Enclosure," *Journal of Electromagnetic Waves and Applications*, *Vol.* 12, No. 8, pp. 1087-1099, 1998.

H. Rahman, "Coupling Characterization of Multiple Wires in a Rectangular Cavity: Part-I Thin Wire
Approximation", *Journal* of *Electromagnetic Waves and Applications*, *Vol.*11, No. 1, pp 77-88, 1997.

H. Rahman, "Coupling Characterization of Multiple Wires in a Rectangular Cavity: Part II - Thick Wire Approximation", *Journal of Electromagnetic Waves and Applications*, Vol. 11, No. 1, pp. 89-99, 1997.

H. Rahman, "Analysis of a Folded Wire of Arbitrary Dimension Enclosed in an Electromagnetic Cavity", *Proceedings of the 1997 Progress in Electromagnetic Research Symposium,* Hong Kong, January, 1997.

H. Rahman, "Fourier Series Method for the Computation of Current on a Bent Wire Enclosed in a Rectangular Cavity", *Proceedings of the 1996 Progress in Electromagnetic Research Symposium,* Innsbruck, Austria, July 8-12, 1996.

H. Rahman, and J. Prerini, "Susceptibility of Cables in a Shielded Environment to External Excitations", *IEEE International Symposium on Electromagnetic Compatibility Digest,* Seattle, WA, 1988.

D. Sample of Assessment Tools

D.1. Program Educational Objectives Survey Forms
D.2. Program Educational Outcomes Assessment Tools

D.1. Program Educational Objectives Survey Forms

Sample

Alumni Survey Form

Instructions: Based on the department's Program Educational Objectives stated below, please assess your personal opinion of the levels of attainment achieved by our graduates on a scale ranging from "Strongly Disagree" to "Strongly Agree".

Name:_____

Program Educational Objectives	Strongly Disagree	Somewhat Disagree	Neutral	Agree	Strongly Agree	N/A
1. Pursue scientific and technical careers beginning with entry-level electrical engineering positions in industry or government.						
2. Pursue continuing education through graduate studies in related engineering fields, as well as law, business, or management.						
3. Fill the needs of society in solving technical problems using electrical engineering principles, tools, and practices.						

Please provide us with the following additional information:

1. **Graduation date?**
2. **Degrees attained after graduation:**
3. **Are you currently employed? If yes, please provide us the company's name.**
4. **Are you currently attending graduate school on a full time basis? If yes please provide us with the school's name.**
5. **Are you currently attending graduate school on a part time basis? If yes, please provide us with the school's name.**
6. **Are you employed by the Military? If yes, Please specify branch, rank, and position.**
7. **Additional suggestions for enhancing the program's ability to attain the stated objectives.** (Please use additional sheets as needed.)

Sample

IAB member survey Form

Instructions: Program Educational Objectives (PEO) according to ABET definition are the program expectations from our graduates 2-5 years after graduation. Your valuable input as practitioners and members of our Industrial Advisory Board would allow our program to assess and if needed make adjustments our stated objectives. Please assess your personal opinion on a scale ranging from "Strongly Disagree" to "Strongly Agree".

Program Educational Objectives	Strongly Disagree	Somewhat Disagree	Neutral	Agree	Strongly Agree	N/A
1. Pursue scientific and technical careers beginning with entry-level electrical engineering positions in industry or government.						
2. Pursue continuing education through graduate studies in related engineering fields, as well as law, business, or management.						
3. Fill the needs of society in solving technical problems using electrical engineering principles, tools, and practices.						

Please provide us with the following information:

1. **Name:**

2. Educational Background:

3. Company Affiliation:

1. **Position/Job Title:**

5. Please provide us with any additional comments and suggestions in improving our stated objectives.

Sample

2005 ECE Students Survey Form

Instructions: The following are stated Electrical and Computer Engineering department's Program Educational Objectives, PEO. Program Educational Objectives are our department's goals for our students after graduation from the program.
Please use a scale ranging from "Strongly Disagree" to "Strongly Agree". Your comments and inputs are very valuable to us. They provide us with the feedback in a continuous assessment and improvement of the quality of our program and quality of our graduates.

Name: _____

Program Educational Objectives	Strongly Disagree	Somewhat Disagree	Neutral	Agree	Strongly Agree	N/A
1. Pursue scientific and technical careers beginning with entry-level electrical engineering positions in industry or government.						
2. Pursue continuing education through graduate studies in related engineering fields, as well as law, business, or management.						
3. Fill the needs of society in solving technical problems using electrical engineering principles, tools, and practices.						

How do our stated objectives meet with your expectations?

What other objectives you would suggest for our program?

Please provide us with the additional comments and suggestions:

D.2. Program Educational Outcomes Assessment Tools

Sample

Senior Students Survey

Part I:

Department of Electrical and Computer Engineering
Saint Louis University

Senior Exit Survey
(April 25, 2006)

Dear Graduating Seniors,

As part of the Electrical and Computer Engineering Department's ongoing evaluation, assessment, and improvement process of its Program Outcomes and in preparation for the ABET accreditation visit the following survey has been prepared to determine whether stated **Program Outcomes** are being achieved. Your unique perspective as our graduating seniors is very valuable to the department's **continuous improvement processes.**

The following senior exit survey will allow you the opportunity to asses the program in each areas that have been identified as **Program Outcomes**. Your feedback is very valuable to us in our ongoing efforts to provide the best educational experience to our deserving students.

This information is being collected anonymously, therefore, we ask you to make candid and constructive comments. We thank you for your time and effort in helping us to continuously improve our program.

Program Outcomes (Educational Goals)

Please tell us how well we have met the stated Program Outcomes by answering the following questions. Please circle one of the five possible choices for each question.

1. I am able to apply knowledge of mathematics, science, and engineering principles to solve electrical engineering problems. Although the major emphasis was on electrical engineering principles, I am also proficient in general engineering and science areas as well.
    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

2. I have the ability to design and conduct experiments, as well as analyze and interpret data related to electrical engineering.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

3. I am able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

4. I am able to function successfully as a member of a multi-disciplinary team. I am aware of leadership and group dynamics issues and exhibit a level of cooperation that allows for team productivity.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

5. I am able to identify, formulate, and solve general engineering and electrical engineering problems systematically employing the skills of critical thinking and creative problem solving.
    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

6. I understand and appreciate the need for professional integrity and ethical decision making in the professional practice of electrical engineering.
    a. Strongly Agree
    b. Agree
    c. Neutral

d. Disagree
e. Strongly Disagree

7. I am able to communicate effectively in both written and oral forms.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

8. I appreciate the need for the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

9. I recognize the need for, and ability to engage in life-long learning.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

10. I have knowledge of contemporary issues related to electrical engineering and engineering in general.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

11. I am able to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice. I am proficient in the use of modern hardware and software packages.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

12. I have a knowledge and ability to apply probability and statistics, differential equations, linear algebra, and discrete mathematics to electrical engineering.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

13. I have knowledge of mathematics and basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic systems which may include hardware and software.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

14. I have knowledge of discrete mathematics.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

Please provide us with additional comments that would enable us to better meet our educational goals and better serve our deserving students.

Departmental Questions

Your valuable response to the following set of questions will allow us to better prepare and serve our students.

1. I am satisfied with departmental laboratory space and facilities.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

2. I am satisfied with electrical engineering laboratory test equipments.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

3. I am satisfied with modern electrical engineering computer hardware and software housed in electrical engineering laboratory.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

4. I am satisfied with the support provided to me by the department, faculty, and staff to succeed in my chosen field.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

5. Overall I am happy with my decision to come to electrical engineering program at the Saint Louis University.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

6. My education at the Department of Electrical Engineering of the Saint Louis University has prepared me to be successful in dealing with challenges of modern world.

    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

Additional Comments: Your opinion is important to us. Please provide us with additional comments on strength and weaknesses of our program.

Additional Questions

1. Have you started your job search?

    - Yes
    - No

2. Have you received an offer? If yes please provide us with the name of the organization and the salary amount offered?

3. Are you planning to continue with graduate or professional studies?

4. Have you applied and been accepted to a graduate or a professional degree program? If yes please provide us with the name of the institution and graduate or professional program.

5. We would like to keep in touch with our graduates. If possible please provide us with your contact information (non SLU e-mail or address).

We welcome your valuable comments which help us to better serve our students and continuously improve the quality of our program. We wish you all a great success in life.

Thank you,

ECE Department Faculty, Staff, and Students

Sample

Part II:

Department of Electrical Engineering
Parks College of Engineering, Aviation and Technology
Saint Louis University

Graduate Survey

May 2006

Name: _____

Graduation Date: _____

1. Have you send out your resume? Yes____ No___

2. If yes, how many companies have you applied to?

   A) 1-2 B) 3-4 C) 5 or more

3. Have you received any offers? Yes___ No__
   List companies:

4. Have you accepted a position? Yes___ No___

   Company's Name:
   Position/Title:
   Salary:

5. Have you applied to graduate school? Yes___ No___

6. If yes, how many schools have you applied to?

7. Have you been accepted to a graduate school? Yes___ No___

   Name of the University:
   Degree Sought:
   Assistantship/Fellowship:

8. Are you entering military service? Yes___ No___

   Which branch of military?

9. Have you taken FE exam? Yes___ No___

10. Are you a member of any professional society?

a) IEEE b) SWE c) Others (please specify)

11. Approximately how many seminars, field trips, and workshops did you attend during your undergraduate degree years?

a) 0 b) 1-3 c) 4-6 d) 7-10 e) more than 10

12. Please indicate your level of proficiency in the following courses (Check the appropriate box)

Subject Area	N/A	Very weak	Weak	Average	Strong	Very Strong
Calculus I, II, & III						
Differential Equations						
Probability and Statistics						
Linear Algebra						
Discrete Math						
Chemistry						
Physics I & II						
Ethics						
Non Technical Electives (Humanities, Social and Behavioral Science, General Elec., etc.)						
Theological Foundations						
Advance writing for professional Engineers						
Small Group Presentations						
Intro to Object Oriented Programming						
Circuits I & II						
Digital Design						
Microprocessors						
Electromagnetic Fields						
Semiconductor Devices						
Electronics Circuit Design						
Energy Conversion						
Computer System Design						
Computer Architecture						

Lines and Waves						
Communications						
Auto Control						
Digital IC Design						
Technical Elective_____						
Eng. Science Elec._____						
Science or Math Elec._____						
ECE Elective_____						
ECE Elective_____						
ECE Elective_____						
CSCI Elective_____						
CSCI Elective_____						

13. Did you receive any minors? Yes___ No___

If yes please specify_____

Please answer the following questions (use a blank page if more space is needed)

14. Are you satisfied with your education at the Saint Louis University?

a) Very satisfied b) Satisfied c) Neutral d) Unsatisfied e) Very unsatisfied

15. What was the most favorable feature of your education?

16. What was the least favorable feature of your education?

17. What changes, additions, or deletions would you recommend?

18. Would you recommend others to attending ECE Dept. at The Saint Louis University?

19. Other comments.

Sample

Department of Electrical and Computer Engineering
Saint Louis University
Semiconductor Devices EENG 303
Faculty Teaching Self Assessment

Course: _____ Semester: _____
Instructor: _____ Year: _____
Date: _____

For each outcome, rate student performance on scale of 1 to 5 with 5 implying a very high level of performance and 1 very low level of performance.

1- Poor
2- Below Average (inadequate)
3- Average
4- Good
5- Excellent

EENG 303 Electronic Design (3 cr.)

The purpose of this course is to introduce students to fundamentals of solid state devices. Key topics covered in this course are intro to crystal properties and growth of semiconductors, atoms and electrons, energy bands and charge carriers in semiconductors, excess carriers in semiconductors, junctions, field effects transistors, bipolar junction transistors, and some fundamentals of integrated circuits.

EENG 303 Semiconductor Devices (3 cr.) – Outcomes Assessment

Student Learning Outcomes	**Student Performance**	**Comments**
1. Understand the basics of bulk crystal growth.		
2. Understand some basic fundamentals in quantum mechanics		
3. Understand fundamental properties of key semiconductor materials such as Silicon, GaAs, etc.		
4. Understand concept of		

doping and impurities in semiconductors		
5. Understand presence of positive and negative charge carriers in semiconductors and the effect of temperature, impurity concentration, and high fields on carrier velocity.		
6. Understand and extract information related to energy band diagrams of n-type and p-type semiconductors.		
7. Be able to draw energy band diagram of fundamental semiconductor devices such as diodes and transistors, under various bias conditions.		
8. Understand the relation between excess carriers, minority carrier lifetime, diffusion, and current density.		
9. Understand fundamental characteristics of key junctions such as semiconductor-semiconductor and metal-semiconductor.		
10. Be able to explain various contributions to I-V characteristics of p-n junctions under various bias conditions.		
11. Understand the behavior and characteristics of Field Effect Transistors under various bias conditions.		
12. Understand the behavior and characteristics of Bipolar Junction transistor		

under various bias conditions.		
13. Understand some fundamentals and challenges in advance integrated circuit design and manufacturing.		

Additional Comments:_____

What course improvements were made this semester? Were they successful?

List any improvements that would make the course better next time it is taught.

Course Outcomes to Programs Outcomes Mapping

1. The table below represents the current course outcome mapping to ABET criteria a-k. Please review this mapping and suggest needed changes based on your experience in the course this semester. (X's indicate a significant contribution to the program outcome based on the course outcome.)

Prog. Cont. Leave														
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l	m	n
1					X									
2	X		X		X							X	X	
3					X									
4	X		X		X								X	
5	X		X		X									
6	X		X		X								X	
7	X		X		X									
8	X		X		X									
9					X									
10	X		X		X								X	
11	X		X		X									
12	X		X		X									
13					X		X		X					

Suggested Outcomes Changes

_____
_____
_____
_____
_____
_____
_____
_____
_____

Faculty Collaboration Course Review and Improvement Suggestions
Faculty Members: _____ Date: _____
_____
_____

Based on pre and post assessment surveys and faculty self assessment propose changes to improve the course next time it is taught.

Comments:_____

List any improvement that would make the course better the next time it is taught.

Sample

Program Educational Outcomes
Evaluation
EENG -303

Evaluation and continuous improvement process has been established at both course level as well as program level. The decision has been made to have five achievements levels for evaluation and possible required actions to correct possible deficiencies.

- Level 1 (strongly disagree or poor)
- Level 2 (disagree or below average)
- Level 3 (Neutral or average)
- Level 4 (agree or good)
- Level 5 (strongly agree or excellent)

Please provide us your evaluation of outcome (s) relevant to this course in the following table.

Outcomes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
a					X	
c				X		
e					X	
h				X		
i				X		
j				X		
l				X		
m					X	

Comments: The course was a success in meeting its stated objectives. Homework assignments such as researching the web for more current and contemporary issues were success. It allowed students to search the web for more awareness of industry trends.
We were able to give more time on the chapter about Quantum Mechanics and issues related to current and future devices.
We were able to place a greater emphasis on FETs.
Need to increase the pace in order to give a bit more time to BJTs.

Department of Electrical Engineering
Senior Design II Presentations
EENG 491 Spring 2006
May 2, 2006

Name_____

Title of Presentation_____

Evaluation Scale: Excellent 4 3 2 1 0 Poor

Criteria	**Score**
Presentation Style:	
1. Personal appearance is appropriate	_____
2. Speaks clearly and with sufficient volume	_____
3. Achieves rapport with the audience	_____
4. Uses engaging vocalization	_____
5. Responds effectively to questions and comments	_____
6. Uses audience-appropriate vocabulary, content, and style	_____
Presentation Style Total	_____
Content:	
7. Uses the grammar of Standard English	_____
8. Presentation includes introduction, body, and conclusion	_____
9. Organizes content logically and sequentially	_____
10. Presents ideas and arguments clearly and logically	_____
11. Uses appropriate audiovisual materials	_____
12. Cites sources appropriately	_____

Comments: