SELF-STUDY REPORT
FOR THE
JOINT ELECTRICAL ENGINEERING (JEE)
PROGRAM

Leading to the

Bachelor of Science in Electrical Engineering (BSEE) Degree

Granted by

University of Missouri – St. Louis
8001 Natural Bridge Road
St. Louis, MO 63121-4499

Supported by the

Washington University in St. Louis
School of Engineering and Applied Science
Department of Electrical and Systems Engineering
One Brookings Drive
St. Louis, MO 63130-4899

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A. Background Information

1. Degree Title: Bachelor of Science in Electrical Engineering (BSEE)

The BSEE degree is granted by the University of Missouri-St. Louis (UMSL). This is a joint program between UMSL and Washington University in St. Louis (WUSTL or WU) as described below. The joint BSEE program is known as the Joint Electrical Engineering (JEE) program.

2. Program Mode

In accordance with the charter for this program at the University of Missouri – St. Louis (UMSL), this program is intended to serve individuals who are job-bound/location-bound to the St. Louis area and, therefore, cannot avail themselves of the full-time, day BSEE programs available on other University of Missouri System campuses in Columbia or Rolla. For this reason, this program is primarily an evening program allowing students to work full time if necessary during the daytime. It is primarily a part-time program wherein students typically take one or two courses per semester. However, a recent trend is for younger place-bound students living at home to take four or more courses each semester in order to receive financial assistance and complete their degrees faster. In fact, in the winter 2006 semester, 45% (27 out of 60) of the BSEE students registered for 12 or more semester credit hours. These full time students of necessity limit their work to part-time in order to carry the heavier course load.

The required general education courses (humanities, social sciences, etc.) and pre-engineering courses (mathematics, physics, chemistry, etc.) are available to the students through the UMSL campus although most of these courses may also be taken at local Community Colleges. The courses in electrical engineering and other related engineering courses are offered at the Washington University in St. Louis (WU) campus through the Department of Electrical and Systems Engineering (ESE) and other engineering departments on the WU campus.

The JEE program had its first graduate in August 1994. Since that time, the program has grown substantially as shown in Figure A-1. Note that the 4 BSEE degrees that are expected to be granted in August 2006 have also been included in the chart. As shown, there will have been 20 or more BSEE degrees granted in 4 of the last 6 academic years and the average over the last 3 academic years will have been 21 BSEE degrees. Including those expected in August 2006, there will have been 136 graduates by the end of the 2005-2006 academic year. While the number of new students has dropped slightly the last few semesters, we expect to graduate approximately 16 to 20 students per academic year for the foreseeable future.

One mission of the Joint Undergraduate Engineering Program is “to provide a well-trained, sophisticated work force for the St. Louis region.” Graduates of the JEE program have been hired by many local companies including AmerenUE, ATT, Boeing, Burns & McDonnell, Distribution Control Systems, Emerson Electric, Missouri-American Water, Missouri Department of Transportation, Monsanto, Procter & Gamble, and Watlow Electric. Based on this record, we believe that value of the JEE Program is apparent to local industry in the St. Louis region and that the program is accomplishing the stated mission.

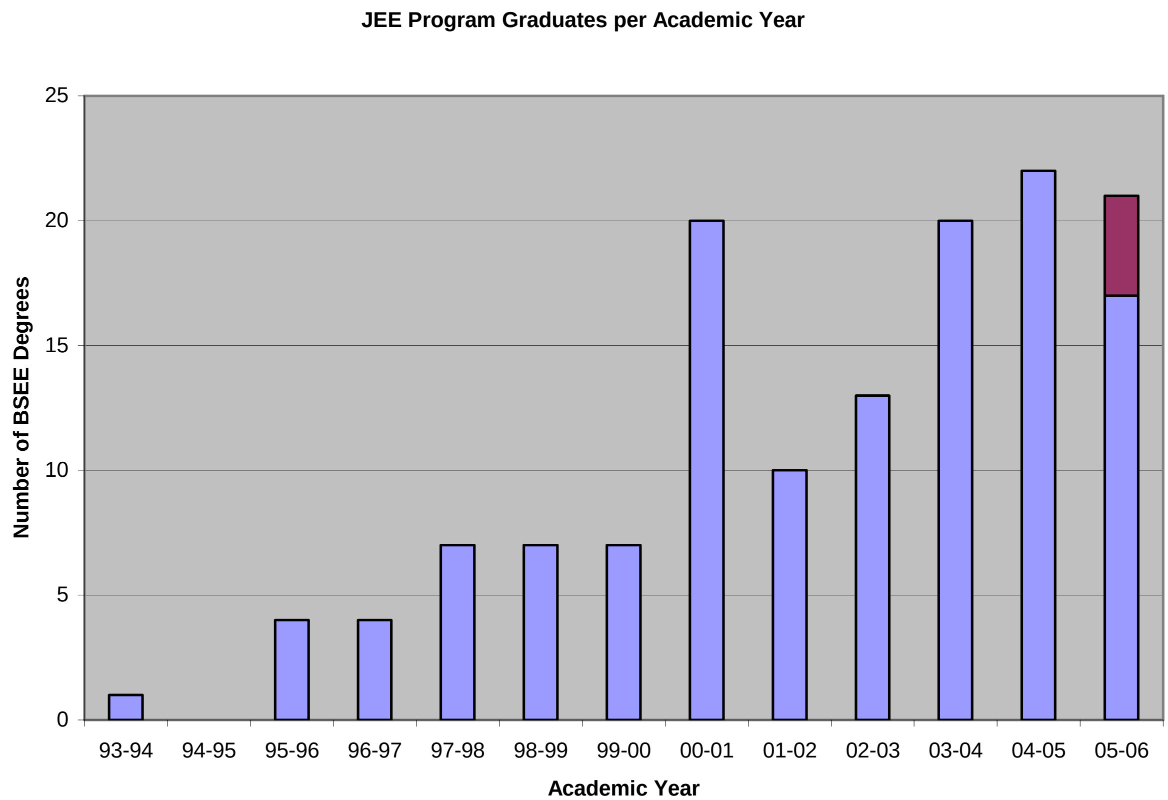

Figure A-1. BSEE Degrees Granted by UMSL by Academic Year

Joint Electrical Engineering (JEE) program is one of three ABET accredited undergraduate programs within the Department of Electrical and Systems Engineering (ESE). The other two are the day school Electrical Engineering (EE) and Systems Science and Engineering (SSE) programs. Adding the 21 JEE program graduates to the day school total, the ESE department had 55 Bachelor of Science (BS) graduates this past academic year.

After several years of planning, ESE was formed with the merger of System Science and Mathematics (SSM) and Electrical Engineering (EE) departments in 2003. Prior to that merger, the program of Computer Engineering, which had been a joint effort in both Electrical Engineering and Computer Science was consolidated within Computer Science, which then became Computer Science and Engineering (CSE).

These changes had a significant impact on our operation and on our preparation for the accreditation visit scheduled in 2006. The consolidation of Computer Engineering meant moving four faculty members, space and equipment to Computer Science and Engineering. During this time, we also faced the additional challenge of the loss of five Electrical Engineering faculty members due to retirement and relocation. The merger in 2003 required reconstituting both office and technical support staffs, merging of courses, and rewriting our catalog and web pages.

After the consequences of these major reorganizations were brought under control in 2004, we began preparation for the accreditation visit in 2006. In addition to our Undergraduate Curriculum Committee, we established an “ABET” Committee for accreditation issues common to our program in Electrical Engineering, our Program in System Science and Engineering, and our Joint Program in Electrical Engineering with the University of Missouri – St. Louis.

3. Actions to Correct Previous Shortcomings

The Joint BSEE evening program offered through the UMSL campus is based primarily on the course requirements and follows the courses outlines of the daytime BSEE program offered at Washington University in St. Louis (WU). There is some tailoring of JEE courses where necessary to be responsive to the needs of evening students and local industry. With regard to the daytime BSEE program offered at WU, the previous ABET visit was in the fall 2000 and the program was given accreditation for a full six years.

This is the second ABET visit for the evening BSEE program offered by UMSL with engineering courses taught at and by WU. The first visit was made in the fall 2001. There were no deficiencies or weaknesses identified for this Joint Electrical Engineering (JEE) program during the first visit and the program was given accreditation for a full six years. There were, however, several items of concern and several observations. There were both institutional concerns and observations applying to all joint engineering programs (JCE, JEE, JME) as well as concerns and observations applying directly to the JEE program. These concerns and observations were addressed in the 14-day response and, we believe, satisfactorily answered. The following paragraphs review these concerns and observations and indicate the actions taken subsequent to the fall 2001 visit to insure that they have been adequately resolved.

Institutional Concerns

1. <u>Criterion 2: Program Educational Objectives.</u> This was a concern that the joint engineering program should have its own set of objectives to recognize the significant differences between this evening program and that of the day time WU program and that each program should have its own objective statement.

Actually, both of these educational objective statements were included in the UMSL 2001-2002 Bulletin, but they may not have been communicated clearly as they were not repeated in the Self-Assessment Report. For completeness, these objectives are given here.

The joint program goal (objective) was given on page 497 of the UMSL 2001-2002 Bulletin as follows:

“The goal of the UMSL/WU Joint program is consistent with the mission on UM-St. Louis, which is to provide a high-quality education to enhance the occupational and professional careers of citizens in the entire region, including the minorities and economically disadvantaged population and to provide a well-trained, sophisticated work force for the St. Louis region. The partnership is an appropriate way for Washington University to share its campus, resources, and personnel with the citizens of Missouri.”

The Joint Electrical Engineering program goal (objective) was given on page 498 of the UMSL 2001-2002 Bulletin as follows.

> "The mission of the Electrical Engineering program is to instill knowledge and understanding of the fundamental principles necessary to become proficient in electrical circuits, computer systems, digital and linear electronics, electromagnetic engineering, signal analysis, and electrical laboratory methods. Graduates will have:
>
> - Ability to design and analyze advanced and complex systems in at least one of the following areas:
>   1. Solid-state devices and circuits
>   2. Control components and systems
>   3. Communications
>   4. Computer software and hardware
>   5. Electrical power and energy.
>
>   This ability will include the integration of thoroughly mastered mathematics and science in solving engineering problems.
> - Proficiency with experimental instrumentation and techniques spanning areas of electrical energy systems and digital systems. This proficiency will include the ability to design and conduct experiments, as well as ability to analyze and interpret data.
> - Proficiency in engineering design of a system, component, or process to meet desired needs.
> - Ability to communicate, both orally and in writing, with special emphasis on technical writing.
> - Ability to interact effectively with other people by providing experience in working with other students in teams as both a team leader and a team member.
> - Understanding and appreciation of one's professional and ethical responsibility and historical and contemporary global and societal issues.
> - Recognition of the need for and ability to engage in lifelong learning."

2. <u>Criterion 3: Program Outcomes and Assessment.</u> This was a concern that was described as follows. "Because of the unique nature of this joint program, the team examined closely the 'hand-off' between lower- and upper- division courses. After careful study of available process documentation and interviews with faculty members and support department leaders, the team concluded that is virtually no engagement of recognition of an assessment of the outcomes of the lower-division courses to ensure adequate preparation for the upper-division engineering courses; nor is there a mechanism for feedback going from WU back to the feeder programs. The ABET review team recommends that such an assessment be performed to further develop and improve the joint programs. "

In response to the above concern, we established**,** reviewed, and revised a formal assessment mechanism to provide feedback to the institutions that provided the preparatory mathematics and science courses work for students in the upper-division; that is, for those students actually taking engineering course work on the campus of Washington University.

Many students take their preparatory courses in mathematics and science at UM-St. Louis. However, a nearly equal number of the students enter the Joint Program after completing course work toward an associate's degree at area community colleges or after completing some or all of their pre-engineering courses at other four-year institutions. It is common for our students to have completed the foundational math and science courses at several institutions.

Our challenge was to establish a formal mechanism for assessing how well our students' math and science courses are preparing them for their upper-division engineering course work and to regularly report the results to representatives of those institutions involved. The mechanism currently in place and its evolution are described in Appendix II-7.

Institutional Observations

1. "There is apparently no consistent policy regarding separate industrial advisory committees." In this regard, the existing Department of Electrical and Systems Engineering (ESE) External Advisory Board (EAB) has been augmented to include several representatives from local industry. A meeting was held on November 18, 2005, to discuss various issues facing both of the day school programs, namely, the Electrical Engineering (EE) program and the Systems Engineering (SE) program, as well as the UMSL/WU Joint Electrical Engineering (JEE) evening program. A follow-up meeting to introduce the new department Chair and to discuss the three undergraduate programs was held on June 7, 2006. See section B.2 for more information on the results of these EAB meetings.

2. "A five-year rolling contract binds the joint program into a long-term, stable relationship." The contract between WU and UMSL is renewed each year for an additional five years. This process has been in place for many years already and there is every expectation that it will continue for the foreseeable future.

3. "The joint engineering program does not have a faculty or its own." The Joint Electrical Engineering (JEE) program uses a combination of day school faculty and adjunct faculty. Most of the adjunct faculty are highly educated and work full time in local industry and, therefore, are able to bring a unique and valuable perspective the JEE program. This is particularly advantageous since the goal of the joint program is "to provide a high-quality education to enhance the occupational and professional careers of citizens in the entire region, including the minorities and economically disadvantaged population and to provide a well-trained, sophisticated work force for the St. Louis region." Most of the JEE elective courses are joint courses with the day school and are taught by the day school faculty.

4. "The corresponding Washington University programs that are part of the joint program were recently re-accredited under the conventional ABET criteria in effect at the time of the most recent visit in the fall of 2006." While the day time WU electrical engineering program was evaluated in the fall 2001 using a prior criteria, no deficiencies were identified and it was given a full six year accreditation, so it logically provides a strong basis program for the JEE program.

Joint Electrical Engineering Program Concerns

1. <u>Criterion 1: Students.</u> "There is a concern with respect to student advising." This was really a concern with respect to the timeliness of "grade and admission status information" for each student. Aggressive changes introduced by Dean Chris Kroeger, who replaced Dean John Russell when he retired as Registrar, have greatly alleviated this concern. E-grades are now used throughout the engineering school and student records are updated instantaneously when grades are submitted using the internet at the end of the semester. Both the JEE student and the JEE program advisor can view these records on the internet. This instant visibility now allows the JEE advisor to track student accomplishments and see that the student has completed the necessary prerequisites and is on track to complete the BSEE degree in a timely manner. In addition, there is an analysis program known as the ANALYSER that is used by the SEAS Registrar's Office to track student progress. This program has been updated to reflect the current JEE curriculum requirements. The Registrar's office has been prompt to answer all requests by the JEE Advisor for status information regarding JEE students.

2. <u>Criterion 1: Students.</u> "Concomitant with the advising concern is a concern in the *Policies for Acceptance of Transfer Students in Place and Enforced."* The Final Statement from ABET for the BSEE program for the visit on September 9-11, 2001, raised as a "concern" the general topic of admission of transfer students and the transferability of courses that had been taken many years ago. This concern was not raised in either of the Final Statements for the BSCE or BSME programs.

Current Practice Regarding Policies for Acceptance of Transfer Students

Admission - The criterion for admission to the upper division of the Joint Undergraduate Engineering Program, as published in the UM-St. Louis Bulletin, is a 2.75 GPA (out of 4.00) calculated "over all mathematics, chemistry, physics, and introductory engineering courses (Statics and Dynamics)."

All students admitted to the program, but not on a probationary basis, (as described below) must first complete JEMT-3170 (Engineering Mathematics) with a C- or better. Mechanical and Electrical Engineering majors must also complete JEE-2800 (Introduction to Electrical Networks) with a C- or better. Civil Engineering majors must complete either JEE-2800 (Introduction to Electrical Networks) or JCHE-4430 (Environmental Engineering Chemistry) with a C- or better.

Probationary Admission - Students with less than a 2.75 GPA, but with "at least a C in all their science and math courses may be admitted on a probationary basis. These students must pass a mathematics workshop with a grade of B or better and then pass JEMT-3170 (Engineering Mathematics) and JEE-2800 (Introduction to Electrical Networks) with a C- or better, in order to continue in the program."

The Associate Dean of the Joint Program verifies that the above criteria have been met before allowing students to advance in their course work.

Age of Courses - In the early stages of the Joint Program, as we expected, we attracted a number of students whose engineering education had been suspended or abandoned many years ago. The establishment of the Joint Program in 1992 gave them the opportunity to complete their engineering degrees. While we carefully monitored the content of transfer courses and verified that transfer courses taken more than six years prior to initial enrollment in the Joint Program did represent current technology, ABET rightfully raised that as a concern.

As the Joint Program developed over the past 12 years, the "pent-up demand" by individuals who wanted to enter the Joint Program to complete their engineering degrees with course work taken long ago has largely been satisfied. Students now fairly rarely come to us as with course work older than six years.

For example, of the courses taken by students entering the upper division and beginning to take their upper-level engineering courses on the Washington University Campus during the 2004-05 academic year, the vast majority were taken within the past six years, as shown in the Table A-1 below. For those courses taken in the past six years, the average age of the mathematics and science courses was 2-3 years. Nonetheless, for the 5-10 percent of the mathematics and science course work that is greater than six years old, and for all engineering courses that are transferred into the Joint Program, qualified engineering faculty members evaluate each case individually to ensure that the course content represents current technology.

Table A-1 Age of Courses for Students Entering the Joint Undergraduate Program

	Mathematics	Chemistry	Physics
Total number of course sections taken	196	98	98
Six years old or less			
Percent	91.3%	89.1%	95.6%
Mean age of course section	3.06	2.83	1.7
Older than six years			
Percent	8.7%	10.9%	4.4%
Mean age of course section	12.1	15.5	24.4

3. Criterion 2: Program Educational Objectives. "The ABET review team is concerned that the local industrial community has apparently not had input into the evaluation process." The review team further recommended that "there be a separate Industrial Advisory Committee for the joint electrical engineering program to provide more frequent and more focused local industry input." In this regard, the existing Department of Electrical and Systems Engineering (ESE) External Advisory Board (EAB) has been augmented to include several representatives from local industry. A meeting was held on November 18, 2005, to discuss various issues facing the WU day school Electrical Engineering (EE) and Systems Engineering (SE) programs as well as the evening UMSL/WU Joint Electrical Engineering (JEE). A follow-up meeting was held on June 7, 2006, to introduce the new ESE Department Chair, Dr. Arye Nehorai, and discuss the three undergraduate programs. See Section B.2 of this report for details on these EAB meetings.

4. Criterion 3: Program Outcomes and Assessment. "There is a concern regarding the assessment process and documentation of results to measure outcomes required by Criterion 3." In this regard, prerequisite testing is now in place in virtually all JEE courses. The results are included in the Outcomes and Assessment Reports written at the end of the semester by the course instructor. These reports are reviewed by the appointed "Course Coordinators" to determine any changes needed to the course. If the prerequisite course is a JEE course, pertinent information on any identified deficits are passed to the Course Coordinator for the prerequisite course. Major changes to any JEE course are presented by the Course Coordinator to the ESE Undergraduate Curriculum Committee for review and approval prior to implementation. If the prerequisite course is one of the pre-engineering courses offered by UMSL or local Community Colleges, pertinent information on any identified deficits are passed to the Associate Dean of the Joint Engineering Program at UMSL for his dissemination to the proper department or college.

5. Criterion 3: Program Outcomes Assessment and Criterion 4: Professional Component. "Consequently, there is a concern with respect to joint electrical engineering program students satisfying Criteria 3 (c) and 3(d) outcomes on a consistent basis through the JEE 380 course." JEE380, Senior Design, referred to above is now JEE4980, Electrical Engineering Design Projects. It is the capstone senior design course.

This concern was in regard to the results after the 97-98 school years. The JEE program recognized that improvement in this course was needed. As a result, Professor R. Martin Arthur was appointed as course coordinator with the authority to institute changes as needed. Meetings between Professor Arthur and the course Instructors were held to review the course plan and to institute improvements. As a result, the course description was recently rewritten as follows.

"Working in teams, students address design tasks assigned by faculty. Projects are chosen to emphasize the design process, with the designers choosing one of several paths to a possible result. The solution of a real technological or societal problem is carried through completely, including initial specification, consideration of alternatives, preparation of written proposal, and implementation and documentation of the design. Required documents are a written proposal and final report on the project. Oral presentations of progress reports and the final project are also required. Collaboration with industry and all divisions of the University is encouraged."

As indicated elsewhere in this report, the evening JEE courses follow the day school courses very closely in content and structure and, in fact, the capstone "Electrical Engineering Design Projects" course is often offered as a joint day school/evening school course beginning at 5:30 PM. For the fall 2006, significant changes and improvements are planned for the day school course and the evening JEE course will follow the lead of the day school course.

One other note is that the capstone "Electrical Engineering Design Projects" course (JEE4980) is not the only course that includes significant design projects. The "Power, Energy, and Polyphase Circuits" course (JEE3320) that all JEE students are required to take is taught by an Adjunct Professor from AmerenUE, the local electrical power company. Based on his work as an engineer at AmerenUE, the instructor always assigns a design project in which students develop a real world design in response to a set of requirements. The final report includes a parts list and cost estimate as well as other defining documents.

JEE students are also required to take either the “Electronics Laboratory” (JEE3310) or the “Digital Systems Laboratory” (JEE4650). Both of these courses, in which students work in groups, also provide significant design experience for students. JEE3310 has a 3 week design/build/test/demo/report project while JEE4650 has a minimum of 3 software/system design projects completed during the semester.

Joint Electrical Engineering Program Observations

1. “The joint electrical engineering program requires 131 semester credits to graduate.” The observation was that ”because of the length of times associated with a part-time program, several courses in the pre-engineering program have changed their number of credits and, from an advising viewpoint, this must be reviewed on a case-by-case basis.” The good news is that pre-engineering requirements have remained constant since the last review in the fall of 2001 and most new students satisfy these requirements by taking courses at UMSL or the local community colleges, so only a small percentage of new students require a detailed analysis by the JEE advisor. The major need for analysis is now generally associated with transfer students who have taken pre-requisite courses and electrical engineering courses at other four-year institutions in the recent time period.

4. Contact Information

The primary pre-visit contact person for the Program Evaluator for the Program in Systems Science and Engineering is:

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B. Accreditation Summary

1. Students

Evaluation, Advising and Monitoring of Students

The Joint Electrical Engineering program course requirements are split into two parts: Lower Level Per-Engineering Requirements tracked by UMSL and Upper Level Engineering Requirements tracked by both WU and UMSL. All requirements must be completed satisfactorily for UMSL to grant the BSEE degree.

The Lower Level Pre-Engineering Requirements include all general education requirements set by UMSL. These requirements include courses in English, Mathematics, Science, Humanities, Social Studies, etc. The evaluation, advising, and monitoring of students for completion of the general education requirements is performed by an Advisor at UMSL, Ms. Mary McManus.

Admission into the Joint Undergraduate Engineering Program is based on acceptable completion of a specific pre-engineering curriculum that includes English Composition, Calculus I, II, & III, Differential Equations, Chemistry I and II, and Physics I and II, as well as two introductory engineering courses, namely, Statics and Dynamics. The criterion for admission to the upper division of the Joint Undergraduate Engineering Program, as published in the UMSL Bulletin, is a 2.75 GPA (out of 4.00) calculated "over all mathematics, chemistry, physics, and introductory engineering courses (Statics and Dynamics)."

The evaluation, advising, and monitoring of students for completion of pre-engineering requirements is also performed by Ms. Mary McManus, the UMSL Advisor. Upon satisfactory completion, the Dr. Bernard Feldman, the Associate Dean of the Joint Undergraduate Engineering Program at UMSL, admits students to the Joint Electrical Engineering (JEE) program.

Once a student has been admitted to the JEE program, the student is eligible to take upper level engineering courses at Washington University. Evaluation, advising, and monitoring of JEE students for completion of upper level course requirements is performed within the ESE department at WU by Dr. John Corrigan, Affiliate Professor.

All students admitted to the Joint Electrical Engineering program, but not on a probationary basis (as described below), must complete both Engineering Mathematics and Introduction to Electrical Networks with a C- or better in order to remain in the program.

Students with less than a 2.75 GPA, but with "at least a C in all of their science and math courses, may be admitted on a probationary basis. These students must pass a mathematics workshop with a grade of B or better before taking Engineering Mathematics. The student must then complete both Engineering Mathematics and Introduction to Electrical Networks with a C- or better in order to continue in the program." The Associate Dean of the Joint Program, Dr. Bernard Feldman, verifies that the above criteria have been met before allowing students to advance in their course work.

The Upper Level Requirements for the BSEE degree consist of 23 courses (68 credit hours) which must be satisfactorily completed. These 68 credit hours consist of 60 units of Engineering Topics, 5 units of college level Mathematics, and 3 units of Engineering Communication. Note that Statics and Dynamics are included in the 23 courses identified above. Note also that the upper level course requirements are such that each JEE student inherently completes 15 or more credit hours of "Engineering Design" within the 60 units of Engineering Topics.

Graduation from UMSL with a BSEE degree requires a minimum on campus (UMSL & WU) grade point of 2.0 with no more than 25% D's. In addition, the minimum grade point average of 2.0 is required in all engineering courses. Final evaluation of grade point requirements is made by the Associate Dean of the Joint Program at UMSL with input regarding satisfactory completion of the upper level engineering requirements from the JEE Advisor.

The process described below for evaluation, advising, and monitoring of students has been highly successful. Approximately 21 students received BSEE degrees in each of the last 3 academic years. Most have gained employment in local industry, including major employers such as Boeing, AmerenUE, and Emerson Electric as well as other smaller local companies. Informal feedback from these graduates to the JEE Advisor indicates that they are doing well in their engineering positions.

Grades for upper level engineering courses taken at WU are submitted by the instructor at the end of each semester to both WU and UMSL. WU grades are submitted electronically via an internet connection and grades are posted immediately on an internet page available for viewing by both the student and the advisor.

The JEE Advisor monitors progress of all of the JEE students using several tools, two of which are provided by the WU Registrar's Office. The first tool is an unofficial computerized record kept by the JEE Advisor for each student. A second tool is the "Analyzer" program print out provided by the WU Registrar's Office upon request. The third tool is an internet web page listing all of the JEE students with a link to a secure internet page for each student showing their grades for each semester at WU. A fourth tool is the "Degree Audit" that is provided by UMSL upon request. This "Degree Audit" provides the "Official Record" for each JEE student and includes grades for all courses taken at any college or university, so it is also valuable in reviewing and assigning credit for upper level engineering courses that were not taken at WU.

The registration process for JEE students begins with a meeting between the student and the advisor. At this meeting, progress in completing upper level courses is reviewed and courses for the next semester are selected. The advisor insures that prerequisite courses have been or are currently being satisfactorily completed for each selected course. Note that a minimum grade of "C-" must be made in all prerequisite courses. Exceptions, while rare, may be made on a course by course basis.

The advisor also helps the student determine how many courses may be taken during a semester based on the student's employment work load and his record in previous courses. Students working full time (40 hours a week) are generally limited to taking only 2 courses whereas students working 30 hours may take 3 courses and students working 20 hours may take 4 courses. Students who are not employed may take 5 courses and may petition the Associate Dean at UMSL to take a heavier load. Students taking 4 or more courses are often taking a mix of engineering courses at WU and non-engineering courses at UMSL.

Once the student has made a decision on the course schedule for the next semester, the Advisor sends a registration request via email to the Joint Undergraduate Engineering Program office at UMSL. Program office personnel at UMSL then complete the registration for the student for the requested upper level courses as well as any other lower level courses that might still be needed. Approval to take lower level general education courses must be obtained by the student from the UMSL Advisor. The student then receives confirmation of the course registration directly from UMSL.

One further note on the registration process is in order. At the second or third registration meeting, the student and JEE advisor usually define a tentative schedule for completion of the upper level courses. This allows the student to contact the advisor via telephone or email to select courses for the next semester if the student is doing well academically and there are no significant changes needed to the plan. The advisor then submits an email registration request to the UMSL program office or requests a meeting with the student if there are any issues that must be discussed.

As noted previously, the JEE Advisor keeps an unofficial record of courses completed by each student based grades reported to the WU Registrar's Office and courses requested for the student. The Analyzer report is requested periodically from the WU Registrar's Office to officially verify each student's status. Degree Audits are requested from UMSL on an as needed basis.

For many years, the Engineering Registrar's Office has used an in-house created FORTRAN program called "ANALYSER" to verify that students have satisfied engineering degree requirements. Table B-1 on the next page presents a blank copy of the JEE ANALYSER program output.

For the Joint Electrical Engineering program, the ANALYSER program displays and prints all Upper Level Requirements for the program. These requirements are broken down into Core Requirements (WU-UMSL EE REQS 1), EE required courses (WU-UMSL REQS2) and EE Electives (WU-UMSL EE ELEC CRS) as shown on the Sample Printout in Table B-1 The WU ANALYSER Printout does not include the UMSL General Education Requirements. ANALYSER reports can only be viewed in paper form, and are only accessible from computers located in the Engineering Registrar's Office. Copies are also given to faculty advisors and students upon request.

Table B-1 Analyzer Program Used for Tacking Student Progress

```
ANALYSER Program V4.0                    Created

Name=                 I.D.=          Semester of entry=          Cum units=
                                                                 Cum GPA=

    [The cumulative data above do not include current courses]

        Open programs:
         Joint  IE0001

******************************************************************************************
  The analysis printed below assumes that you will satisfactorily complete all of your current courses!!!
******************************************************************************************
                 Degree audit for IE6501   WU-UMSL B.S.E.E.

Name=                 I.D.=          Semester of entry=          Cum units=

WU-UMSL EE REQS 1
 1 ENGI 2310
        OR
   ESC  203          <at SLCC?
        OR
   ENGI 144
 2 ENGI 2320
        OR
   ESC  204          <at SLCC?
        OR
   ENGI 145
 3 JME  3200
        OR
   ESC  207          <at SLCC?
        OR
   JME  220
 4 JME  4310
        OR
   JEE  4410
        OR
   JME  331
 5 JEMT 3170
        OR
   JEMT 217
 6 JEMT 3260
        OR
   MATH 1320
        OR
   JEMT 3261
        OR
   JEMT 226
 7 JCS  1260
        OR
   JCS  1250
        OR
   CMPS 1250
        OR
   CMPS 125
        OR
   JCS  125
 8 JCS  1002
 9 JEC  3100
        OR
   ENGL 3130
        OR
   JEC  210
        OR
   ENGL 213
10 JEE  2300
        OR
   JEE  2800
        OR
   JEE  180
11 JEE  2330
        OR
   JEE  2500
        OR
   JEE  150
Each item completed?      No

WU-UMSL EE REQS 2
 1 JEE  2600
        OR
   JEE  2609
        OR
   JEE  160
 2 JEE  2320
        OR
   JEE  2900
        OR
   JEE  190
 3 JEE  3300
        OR
   PHYS 3223
        OR
   JEE  3149
        OR
   JEE  214
        OR
   PHYS 223
 4 JEE  3320
        OR
   JEE  3270
        OR
   JEE  227
 5 JEE  3510
        OR
   JEE  3790
        OR
   JEE  279
 6 JEE  4350
        OR
   JEE  4160
        OR
   JEE  316
 7 JEE  4650
        OR
   JEE  4550
        OR
   JEE  355
        OR
   JEE  3310
        OR
   JEE  4480
        OR
   JEE  4880
 8 JEE  4980
        OR
   JEE  4800
        OR
   JEE  380
Each item completed?      No

WU-UMSL EE ELE CRS
 1 JEE  2++
 2 JEE  2++
 3 JEE  2++
 4 JEE  2++
 5 JEE  3++
 6 JEE  3++
 7 JEE  3++
 8 JEE  3++
 9 JEE  3++
10 JEE  3++
11 JEE  3++
12 JEE  3++
13 PHYS 3++
14 PHYS 3++
```

Table B-1 Analyzer Program Used for Tacking Student Progress (Continued)

```
ENGINEERING TOPICS:               FREE ELECTIVES               ANALYSER NOTES:
                          .00                                  Grades:
At least  48.0 units?      No                                   'AS'--> Advanced Standing
                                                                'IP'--> In Progress
                                                                'I#'--> In Progress P/F
                                                                 [Analyser assumes you will
                                                                   pass this course with the
                                                                     minimum grade required]
                                                               Course number Nxxx-->Elective
                                                                 of the Nth year. e.g. 1xxx
                                                                 is a freshman elective
                                                               Date(e.g. FL94) is the
                                                                 semester during which the
                                                                 course was added to your
                                                                 transcript.

***********************************************************************************************
    Courses not counting


***********************************************************************************************
```

The Engineering Registrar's Office has purchased a license and has begun programming a new Web-enabled application, called DARS (Degree Audit Reporting System), for evaluating engineering degree requirements. All engineering degrees should be programmed into DARS by the end of August 2006. The School will run ANALYSER and DARS in parallel for the fall 2006 and spring 2007 semesters, and then DARS will replace ANALYSER starting in fall 2007. In addition to all undergraduate engineering degrees offered by the School, the three UM-St. Louis Joint Engineering Program degrees will also be programmed into DARS, which allow Joint Program students and advisors to easily monitor degree completion progress.

DARS was created by Miami University (Oxford, Ohio) in the early 1980's and was then licensed to other universities. Currently, DARS is licensed and used by nearly 300 institutions in the US and in Canada. DARwin is DARS' graphical user interface providing windows to support the DARS table-driven system. DARwin will be the interface that will be used by the School of Engineering and Applied Science at WU. It will provide all of the features currently included on the ANALYSER program and it will offer greater usability to both students and faculty. DARwin will allow students and advisors to view degree audits on-line over the Web at any time from any Web-enabled computer.

Procedures and Processes for Transfer Students

As described previously, students must first be admitted to UMSL and then must satisfactorily complete the pre-engineering requirements before being admitted the JEE program.

The Associate Dean of the Joint Undergraduate Engineering Program at UMSL evaluates all applications for transfer students. Often, these involve transfer of credit for general education courses or pre-engineering courses from local Community Colleges. UMSL has agreements in place regarding transfer credit from other public universities and colleges in Missouri.

In cases where courses corresponding to upper level engineering courses have been taken at other universities or colleges, these are referred by the Associate Dean of the Joint Undergraduate Engineering Program at UMSL to the JEE Advisor for evaluation. One aid in evaluating transfer credit is the online Course Equivalent list kept by the WU School of Engineering and Applied Science (SEAS). These course evaluations were done by examining not only the description of the course but also the syllabus and the textbook from the previous university. If the contents of the previous course are reasonably similar to those of a WU course, the course transfers directly. Otherwise, the previous course transfers as an elective in an appropriate field at a specified class level. Courses with grades below "C" will not generally transfer unless they were elective courses. Since the evening JEE courses follow the day time EE course requirements, the SEAS Equivalent Course is used routinely by the JEE Advisor to determine transfer credit for the JEE program.

For cases where a course has not been evaluated by SEAS, the JEE Advisor requests a syllabus and other information for the course, including the book and examples of the students work before making a decision as to equivalent credit.

In the early years of the Joint Program, as was expected, the JEE program attracted a number of transfer students whose engineering education had been suspended or abandoned many years earlier. The establishment of the Joint Program in 1992 gave them the opportunity to finally complete their engineering degrees. For these students, the JEE Advisor carefully monitored the content of transfer courses and verified that transfer courses taken more than six years prior to initial enrollment in the Joint Program did represent current technology.

As the Joint Program developed over the past 14 years, the “pent-up demand” by individuals who wanted to enter the Joint Program to complete their engineering degrees with course work taken years earlier has largely been satisfied. Students now fairly rarely come to us as with course work more than six years old.

Procedures and Processes for Transferring Credits

Once admitted to the JEE program, there are generally few requests for transfer of credit from out of town colleges or universities since most JEE students are local residents. However, when this does happen, the request to transfer credit is handled using the procedure described above.

There are several required upper level engineering courses, including Statics, Dynamics, and Thermodynamics, that may be taken at the local Community Colleges. These credits are transferred automatically if the grade is a C- or better per the agreement between UMSL and these Missouri Colleges.

There are also several courses that may be taken at UMSL instead of WU. These include Statics, Dynamics, Technical Writing, Introduction to Computing, and Applied Statistics I. Note that Statics and Dynamics are part of the UMSL pre-engineering course work and are not offered at WU for the Joint Program.

In order to take elective courses not usually offered in the evening and/or complete their upper level course work in a timely manner, JEE students are allowed to take up to two (2) day time EE courses for JEE credit at UMSL tuition prices. For these courses, JEE sections are opened for the student and these day time EE courses become joint EE/JEE courses.

A JEE student wishing to take more than two (2) day classes at WU may take an engineering course as a "Student Not Candidate for Degree" at WU tuition prices. This course will, of course, transfer directly to the JEE program if there is an equivalent JEE course.

Note that only students admitted to the Joint Undergraduate Engineering Program by UMSL are allowed to register for Joint Program courses. Consequently, day time EE students at WU are not allowed to register for evening JEE courses. However, in some cases, especially elective courses, late afternoon and early evening courses are designated as "Joint EE/JEE" courses and have both day time and evening students in the same class.

2. Program Educational Objectives

The Joint Electrical Engineering (JEE) program is, as described previously, is a part of the Joint Undergraduate Engineering Program between Washington University (WU) and the University of Missouri–St. Louis (UMSL). Engineering courses are taught on the Washington University campus under contract with the UMSL with the BSEE degree being granted by UMSL. Consequently, JEE program must strive to accomplish the educational objectives of both universities, the educational objectives of the School of Engineering and Applied Science (SEAS) at WU, the objectives of the UMSL/WU Joint Undergraduate Program as well as the stated goals of the JEE program itself.

The top level educational objectives for the two universities are contained in the mission statements repeated below.

Washington University in St. Louis Mission Statement

Washington University's educational mission is the promotion of learning-learning by students and by faculty[1]. Teaching, or the transmission of knowledge, is central to our mission, as is research, or the creation of new knowledge[2]. The faculty, composed of scholars, scientists, artists, and members of the learned professions, serves society by teaching; by adding to the store of human art, understanding, and wisdom; and by providing direct services, such as health care.

Central to our mission are our goals, which are to foster excellence in our teaching, research, scholarship, and service; to prepare students with the attitudes, skills, and habits of lifelong learning and with leadership skills, enabling them to be useful members of a global society; and to be an exemplary institution in our home community of St. Louis, as well as in the nation and in the world.

Through our goals Washington University intends to judge itself by the most demanding standards; to attract people of great ability from all types of backgrounds; to encourage faculty and students to be bold, independent, and creative thinkers; and to provide the infrastructure to support teaching, research, scholarship, and service for the present and for future generations.

University of Missouri – St. Louis Mission Statement

The University of Missouri-St. Louis is a land-grant research institution committed to meeting the diverse needs in the state's largest metropolitan community. It educates traditional and nontraditional students in undergraduate, graduate, and professional programs so that they may provide leadership in health professions, liberal and fine arts, science and technology, and metropolitan affairs such as business, education, and public policy. University research advances knowledge in all areas, and through outreach and public service, assists in solving, in particular, problems of the St. Louis region.

Academic programs are enriched through advanced technologies and partnerships that link UM-St. Louis to institutions and businesses locally, regionally, nationally, and internationally. Its special commitment to partnership provides UM-St. Louis with a leadership responsibility among public educational and cultural institutions in improving the region's quality of life, while its relations with two- and four-year colleges and universities in the St. Louis region promote seamless educational opportunities.

As is apparent from the previous mission statements, the goals of the two universities are quite compatible with WU having a somewhat more global perspective and UM-St. Louis having a somewhat more regional outlook. The Joint Undergraduate Engineering Program is, in fact, one of the partnership links referenced in the UM-St. Louis mission statement.

The educational objectives of School of Engineering and Applied Science at WU are considered next along with those of the UMSL/WU Joint Undergraduate Engineering Program.

WU School of Engineering and Applied Science Mission Statement
The mission of the School of Engineering and Applied Science at Washington University is to serve society as a center for learning in engineering, science, and technology. It is our duty to disseminate and create knowledge through teaching, research, publications, and the transfer of important ideas and research into the development of new products and technologies. We strive to provide an environment that nurtures critical thinking and the education of innovators and leaders for the future.

UMSL/WU Joint Undergraduate Engineering Program Goal
The goal of the UMSL/WU Joint program is consistent with the mission of the UM-St. Louis, which is to provide a high-quality education to enhance the occupational and professional careers of citizens in the entire region, including the minorities and economically disadvantaged population and to provide a well-trained, sophisticated work force for the St. Louis region. The partnership is an appropriate way for Washington University to share its campus, resources, and personnel with the citizens of Missouri.

Comparison of the WU School of Engineering and Applied Science (SEAS) Mission Statement and the UMSL/WU Joint Undergraduate Engineering Program Goal shows the compatibility of these two programs. Again, the UM-St. Louis program goal is more regional than that of SEAS, but this is merely representative of the more focused mission of the University of Missouri-St. Louis compared to the more global mission of Washington University

Finally, we consider the educational objectives of the Joint Electrical Engineering (JEE) program itself as presented in the UMSL Bulletin for the Bachelor of Science in Electrical Engineering (BSEE) degree granted by the University of Missouri-St. Louis. These educational objectives, taken directly from the UMSL 2006-2007 Bulletin, are shown in Table B-2 on the next page.

The BSEE Program Educational Objectives presented in the UMSL Bulletin and shown in Table B-2 are really a combination of program objectives and program outcomes per ABET definitions. The first paragraph and first bullet shown in Table B-2 do express program objectives while the last six bullets really present program outcomes. Since there is a benefit in the presentation of both objectives and some of the outcomes to the student reading the UMSL Bulletin, there is no need to change the UMSL Bulletin. However, for this Self-Study report, we do need to clearly state the JEE Program Objectives.

Table B-2 UMSL 2006-2007 Bulletin Program Educational Objectives

B.S. in Electrical Engineering The mission of the Electrical Engineering program is prepare graduates for a professional career in (a) traditional electrical engineering positions or (b) other positions that require quantitative problem-solving skills and a working knowledge of modern electrical engineering. Graduates will be knowledgeable of and proficient in electrical circuits, computer systems, digital and linear electronics, electromagnetic engineering, signal analysis, and electrical laboratory methods. Graduates will have: • An ability to design and analyze advanced and complex systems in at least two of the following additional areas of specialization: Electrical power and energy, Solid-state devices and circuits, Control components and systems, Communication and information systems and signals, Computer architecture, hardware, and software, Electromagnetic engineering techniques. This ability will include the integration of thoroughly mastered mathematics and science in solving engineering problems. • A proficiency with experimental instrumentation and techniques spanning areas of electrical and electronic circuits, electrical energy systems, and digital or electronic or communication or control systems. This proficiency will include the ability to design and conduct experiments, as well as ability to analyze and interpret data. • A proficiency in engineering design of a system, component, or process to meet desired needs. • An ability to communicate, both orally and in writing, with special emphasis on technical writing. • An ability to interact effectively with other people by providing experience in working with other students in teams as both a team leader and a team member. • An understanding and appreciation of one's professional and ethical responsibility and historical and contemporary global and societal issues. • A recognition of the need for and ability to engage in lifelong learning."

Program objectives can be categorized more succinctly as stated in Table B-3 on the next page. The objectives shown in Table B-3 will be used as the primary Program Objectives for the JEE Program discussed in this self-study report. Information on achievement of these program objectives will be discussed later in this section and these program objectives will be related to program outcomes in Section B.3 of this report.

The use of the term JEE Program Objectives for the threefold items shown in Table B-3 is not meant to cause confusion. Rather, it is intended to separate true program objectives from program outcomes.

Table B-3 JEE Program Objectives

The objectives of the Joint Electrical Engineering program are threefold: **1. Professional Career in Engineering -**Graduates will have a professional career in (a) traditional electrical engineering positions or (b) other positions that require quantitative problem-solving skills and a working knowledge of modern electrical engineering. **2. Breath of Knowledge in Electrical Engineering -** Graduates will be knowledgeable of and proficient in (a) electrical circuits, (b) computer systems, (c) digital and linear electronics, (d) electromagnetic engineering, (e) signal analysis, and (e) electrical laboratory methods. **3. Depth of Knowledge in Electrical Engineering -** Graduates will to be able to design and analyze more advanced and complex systems in at least two of the following areas of specialization: (a) electrical power systems, (b) solid-state devices and circuits, (c) control components and systems, (d) communication and information systems, (e) computer architecture, hardware, and software, and (f) electromagnetic engineering techniques.

The courses in the JEE curriculum have been examined to see how well they contribute to the achievement of the trio of program objectives shown above. Table B-4 shown on the next page provides a list of all required and elective courses in the JEE program except for calculus, differential equations, chemistry, and physics. The table also indicates which of the required and elective courses makes a significant contribution to achieving the trio of program objectives.

As shown, the first objective, Professional Career in Engineering, is well supported the required general education courses as well as the laboratory courses and senior design course (JEE4980). The second objective, Breath of Knowledge in Electrical Engineering, is supported by the required JEE courses. Likewise, the third objective, Depth of Knowledge in Electrical Engineering, is obtained through selection from the many available electives and laboratory courses.

As discussed in the previous paragraphs and shown in the various tables, there are established program objectives for the Joint Electrical Engineering program and the BSEE degree granted by the University of Missouri-St. Louis. The following subsections will identify the constituents of the JEE program and the process, based on the needs of the various constituents, by which the objectives are periodically evaluated and updated.

The educational program that prepares the students to attain program outcomes and fosters accomplishment by graduates that are consistent with the established program objectives is discussed extensively in Sections B.3, B.4, and B.8 of this self-study report.

Table B-4 Courses Contributing Directly to Achievement of JEE Program Objectives.

JEE PROGRAM COURSES			JEE PROGRAM OBJECTIVES		
Course Number	**Required or Elective?**	**Course Title**	**Professional Career**	**Breadth of Knowledge**	**Depth of Knowledge**
ENGL 1001*	Required	English Composition	•		
Humanities*	Required (3)	Three Humanities courses must be taken	•		
Social Studies*	Required (3)	Three Social Studies courses must be taken	•		
JEC3100	Required	Engineeting Communication (Engl3130 at UMSL)	•		
ENG2310*	Required	Statics		•	
ENG2320*	Required	Dynamics		•	
JME3200	Required	Thermodynamics		•	
JEM3170	Required	Engineering Mathematics		•	•
JEM3260	Required	Probability and Statistics (Math 1320 at UMSL)		•	
JCS1002	Required	Intro to Computing Tools: MATLAB Skills		•	
JCS1260	Required	Intro to Computer Programming (CS1250 at UMSL)		•	
JEE2300	Required	Introduction to Electrical Networks		•	
JEE2320	Required	Introduction to Electronic Circuits		•	
JEE2330	Required (Lab 1)	Electrical and Electronic Circuits Laboratory	•	•	
JEE2600	Required	Introduction to Digital Logic and Computer Design		•	
JEE3300	Required	Engineering Electromagnetics Principles		•	
JEE3310***	Elective** (Lab 3***	Electronics Laboratory	•		•
JEE3320	Required	Power, Energy and Polyphase Circuits		•	
JEE3340**	Elective**	Network Analysis			•
JEE3360**	Elective**	Principles of Electronic Devices			•
JEE3370**	Elective**	Electronic Devices and Circuits			•
JEE3510	Required	Signals and Systems		•	
JEE3610	Elective**	Introduction to System Software			•
JEE3620**	Elective**	Computer Architecture			•
JEE4000**	Elective**	Independent Study			•
JEE4020**	Elective**	Computer Aided Design Systems			•
JEE4050**	Elective**	Patent Law for Electrical Engineers			•
JEE4090**	Elective**	Reliability and Quality Control			•
JEE4300**	Elective**	Engineering Electromagnetics Applications			•
JEE4330**	Elective**	RF & Microwave Technology for Wireless Systems			•
JEE4340**	Elective**	Solid-State Power Circuits and Applications			•
JEE4350***	Required (Lab 2)	Electrical Energy Laboratory	•		•
JEE4380**	Elective**	Applied Optics			•
JEE4410	Required	Control Systems (or JME4310)		•	
JEE4420**	Elective**	Digital Control Systems			•
JEE4480***	Elective** (Lab 3***	Systems Engineering Laboratory (Day only****)	•		•
JEE4600**	Elective**	Switching Theory			•
JEE4630**	Elective**	Digital Integrated Circuit Design and Architecture			•
JEE4640**	Elective**	Digital Systems Engineering			•
JEE4650***	Elective** (Lab 3***	Digital Systems Laboratory	•		•
JEE4670**	Elective**	Embedded Computer Systems			•
JEE4710**	Elective**	Communication Theory and Systems			•
JEE4820**	Elective**	Digital Signal Processing			•
JEE4880***	Elective** (Lab 3***	Signals and Systems Laboratory (Day only****)	•		•
JEE4920**	Elective**	Advanced Analog Electronics			•
JEE4980	Required	Electrical Engineering Design Projects	•		•

* UMSL Course Numbers

** JEE students are required to take 4 JEE electives (12 semester credits) as part of their engineering requirenments.

*** Three lab courses are required; there are 4 choices for the third laboratory (Lab3); a fourth lab course may be taken as an elective.

**** JEE students are allowed to take 2 daytime clases in order to fulfill elective/laboratory requirements.

Legend	Contributor?
•	Yes
(BLANK)	No

Significant Constituencies of the Joint Electrical Engineering (JEE) Program

The significant constituencies of the JEE Program are

- The Students in the program
- The Employers (Primarily local industry)
- Professional Electrical Engineers
- The Faculty of the two universities (WU and UMSL)

The students in the program are our primary constituents. First and foremost, we must provide them with an education that will allow them to become productive professional engineers.

A stated objective of the joint program is to support the local industry, so employers are our next important constituents.

It is mandatory that we provide a quality education in electrical engineering that lives up to the standards of the profession, so, in effect, professional electrical engineers are our third constituent.

Lastly, the faculties at each of the universities are also our constituents. Their reputations depend on the quality of our graduates in the joint electrical engineering program and, conversely, the number of students enrolled in the program depends to some extent on the reputation of the faculty and their universities.

Processes Used to Establish and Review the Program Educational Objectives

The Program Educational Objectives for the BSEE Washington University day program were first established in February 1998 by a task force of regular faculty from the Department of Electrical Engineering, led by Prof. and Chair, Barry E. Spielman. The draft of those objectives was then discussed and ratified at a regular faculty meeting of the Department of Electrical Engineering. Subsequently, the Washington University School of Engineering and Applied Science convened several meetings of about 15 to 20 faculty from the seven engineering departments of the School at which the departmental and School goals were discussed and further modified.

The engineering course work in the Joint Electrical Engineering (JEE) Program is heavily based upon the structure of the Washington University BSEE Program. The primary difference between these two programs is that the joint program does not offer quite the range of flexibility for its students. The Program Educational Objectives for the Joint BSEE program have been derived from the Program Educational Objectives for the Washington University BSEE program. The original modifications that led to the objectives for the Joint BSEE program were made by Professor Barry E. Spielman, then Chair of the EE Department, in consultation with then JEE coordinator Prof. Robert O. Gregory and other EE Professors. The objectives for the JEE program have continued to evolve to best serve the constituents of this program.

Student Feedback

The JEE Program's primary constituents, i.e., the students, provide inputs through several interactive paths. These include (1) direct communication with the JEE Program Advisor, (2) the Student Advisory Board (SAB), (3) the Online Course Evaluations, (4) the Graduating Senior Survey, and (5) the Exit Interviews.

The JEE Program Advisor and Coordinator, Dr. John Corrigan, maintains an open door, open communication policy. Students often drop in before evening classes to discuss issues and problems. They also send email messages and leave voice mail messages. In most cases, advice is given as appropriate and problems are quickly solved. When major issues arise, the Advisor may ask the Student Advisory Board to investigate the problem or answer a survey or, if it involves a specific course, he may send a survey directly to the students in the course.

The Student Advisory Board (SAB) provides an excellent feedback path. The SAB is comprised of a diverse set of at least three students from the JEE program. Students serving on the SAB are generally selected to be representative of the JEE student body at-large in terms of job experience, age, and range of academic abilities and ethnicity. The SAB for the past 2005-2006 academic year was comprised of Joshua Muench, Adrienne Scott and Kasey Kramer Woods. Joshua Muench has graduated, but Adrienne Scott (as20@cec.wustl.edu) and Kasey Woods (klk3@cec.wustl.edu) will remain on the SAB and Tom O'Hara (tpo1@cec.wustl.edu) will replace Joshua for the 2006-2007 academic year.

The SAB, which has been in continuous existence since 2001, endorsed the original program educational objectives at a meeting on February 26, 2001. Answers by the SAB to a 25 question survey in the fall 2004 led to a number of important changes in the Digital Systems Laboratory (JEE4650) course and to the introduction of the Electronics Laboratory (JEE3310) course as a suitable alternative for those students more interested in electronics than digital systems. A summary of survey answers is included in Appendix I, Section D. For the past year, a short survey was answered by two members of the SAB. This survey requested opinions regarding program strengths, weaknesses, and bureaucracy.

Online Course Evaluations provide another path by which we involve students in the feedback process. The questions in this voluntary online survey help to rate the course in relation to overall objectives and desired outcomes. Tables B-5 and B-6 show the Overall Satisfaction ratings for the various JEE courses for the spring 2005 and fall 2005 semesters, respectively. The rating scale for Overall Satisfaction is: 1-poor, 5-satisfactory, and 9-outstanding. As shown, most ratings are well above 5 (satisfactory) with some in the 8 to 9 (Outstanding) category. The lowest rating was 4.1 in a very difficult Digital Systems Engineering (JEE4650) elective course. Problem with the previous form of this course and corrective actions taken are discussed elsewhere in this report.

One other note is that participation in 2005 was not as good as we would like. However, we've just implemented the online web-based course evaluation system that includes both normative and summative components. We did this to provide students easily accessible opportunities to offer feedback to their instructors both at the midpoint and at the end of courses. The online system assures anonymity of written student comments and allows us to provide data and results of the evaluations to instructors much more quickly than the previously used in-class paper course evaluation forms did. As expected, student participation has declined initially, but we are working to increase student participation to at least the prior rate and participation in the fall 2005 was better than that in the previous semester.

Table B-5 Student Overall Satisfaction with Courses - Spring 2005

Course Number	Course Name	Course Evaluations Checked	Students Responding Percent	Overall Satisfaction (1-9)
2300	Intro to Electrical Networks	Yes	29	8.00
2320	Intro to Electronic Circuits	Yes	20	5.33
2330	Electrical & Electronics Lab	Yes	18	4.33
2600	Intro to Digital Logic and Computer Design	Yes	0	N/A
3300	Engineering Electromagnetics Principles	Yes	25	7.33
3320	Power, Energy and Polyphase Circuits	Yes	19	6.50
3360	Principles of Electronic Devices	Yes	0	N/A
3351	Signals and Systems	Yes	0	N/A
4090	Patent Law for Electrical Engineers	Yes	0	N/A
4330	RF & Microwave Technology for Wireless Systems	Yes	10	8.00
4350	Electrical Energy Lab	Yes	5	9.00
4420	Digital Control Systems	Yes	0	N/A
4640	Digital Systems Engineering	Yes	25	4.10
4710	Communication Theory and Systems	Yes	0	N/A
4920	Advanced Analog Electronics	Yes	0	N/A
4980	Electrical Engineering Design Projects	Yes	0	N/A

Table B-6 Student Overall Satisfaction with Courses - Fall 2005

Course Number	Course Name	Course Evaluations Checked	Students Responding Percent	Overall Satisfaction (1 to 9)
2300	Intro to Electrical Networks	Y	56	4.33
2320	Intro to Electronic Circuits	Y	38	5
2330	Electrical & Electronics Lab	Y	27	9
3300	Engineering Electromagnetics Principles	Y	0	N/A
3310	Electronics Laboratory	Y	35	8.5
3370	Electronic Devices and Circuits	Y	25	5.67
4050	Reliability and Quality Control	Y	0	N/A
4340	Solid State Power Circuits & Applications	Y	21	7.25
4410	Control Systems	Y	29	7.14
4650	Digital Systems Laboratory	Y	0	N/A
4980	Electrical Engineering Design Projects	Y	0	N/A

The Graduating Senior Survey recently instituted by the JEE Program Advisor is the third path by which we involve students in the feedback process. JEE students in the capstone senior design course are being given a 20 question survey covering educational objectives, course outcomes, laboratory course experience, and overall program satisfaction. Again, the rating system ranged from 1 (Strongly Disagree) to 9 (Strongly Agree) with 5 (Agree) being the median. Table B-7 shows the results to the questions related to program educational objectives.

Table B-7 Graduating Senior Survey Results for JEE Program Objectives

The JEE program provided the following: Rating
(1) A breath of knowledge of electrical engineering…………………………...... 7.0
(2) A depth of knowledge in an area of electrical engineering..…………………..6.1
(3) A preparation for life as a professional electrical engineer……………………6.9

Overall Rating……………………………………………………………………6.7

As shown in Table B-7, seniors in the spring 2006 rate the program high with an overall rating of 6.7 (71 Percentile). These students also rate their **Breath of Knowledge of Electrical Engineering** and their **Preparation for Life as a Professional Engineer** quite high. **Depth of Knowledge in an Area of Electrical Engineering** is given the lowest rating. While still well above the median, this **Depth of Knowledge** rating is strongly dependent on the electives taken by to the student. Additional electives have been added for the fall 2006 semester and students will be allowed to take 2 day-time ESE courses as JEE elective classes if their work schedule allows them to attend classes during the day.

The Exit Interview conducted with each Joint Program Graduate by the UMSL Associate Dean for the Joint Program provides still another feedback path for student involvement. During the interview, the graduating seniors are asked what they consider the strengths and weaknesses of the program to be and to identify bureaucratic issues in the program. The results are compiled by the Associate Dean and forwarded to each joint program office at WU for consideration. The JEE Coordinator has paid particular attention to the comments offered by the graduating students and a number of changes and improvements in the program have been made as a result.

The comments obtained during Exit Interviews are summarized in Table B-8 below. These were obtained from interviews with graduates over the last 2 school years. Note that these student comments are not listed in any order of priority.

Table B-8 Exit Interview Summary

Strengths: Evening classes; Price; Public program; Part time structure; Associated with WU; WU classes, especially electives; WU facilities and faculty; Excellent teachers; Faculty expertise in their fields; Variety of courses; High quality education; Location. **Weaknesses:** None (7 of 43 students); Multiple campuses; Scheduling conflicts – evening classes at UMSL and WU at the same time; Limited class offerings; Low frequency of course offerings; Not enough electives; Lack of power electives; Hard to get help from faculty since they work during the day; Not enough labs; Need more hands-on experience; Hard to get a sense of community. **Bureaucracy:** None (23 of 43 students); Parking costs; Parking tickets at WU; Parking after 4 pm a problem; Earlier than 5 pm parking would be useful; WU parking pass should be valid at UMSL during the day; Hard to meet up with students during the day due to parking sticker; Spring break misalignment between WU and UMSL; Advisor at WU was not as accessible as the one at UMSL.

Employer (Local Industry) Feedback

Constituents from local industry are involved through the National Council for the Washington University School of Engineering and Applied Science (SEAS), the Department of Electrical Engineering External Advisory Board (EAB), and as Adjunct Faculty teaching evening courses.

National Council This is a group of about 30 to 40 outstanding individuals that reports to the Dean of the School of Engineering and Applied Science (SEAS) at WU. This council is queried about many facets of the School's operations, including the appropriateness of goals within the Programs of each department. The members of this council include successful alumni, local and national business leaders, faculty, and university and Government researchers and administrators. The National Council has been in operation for at least 14 years.

External Advisory Board (ESB) The EAB was first constituted during the summer of 2000 and met for the first time on January 4, 2001. Following the merger of the Systems Science and Mathematics (SSM) department and the Electrical Engineering (EE) department into the Electrical and Systems Engineering (ESE) department and recognizing the need for input from local industry for the JEE program, the EAB was reconstituted and expanded to serve all three ESE programs. It is currently comprised of the following individuals:

Mr. Jerome Brasch, President, Brasch Manufacturing Co., Inc.,
Mr. David Schepers, P.E., Vice President, Energy Delivery Services, Ameren Services
Mr. Gregory A. Sullivan, G. A. Sullivan Division, Avande
Dr. Santanu Das, Chairman of the board and CEO, TransSwitch Corporation
Dr. Panganamala R. Kumar, Department of ECE, University of Illinois at Urbana-Champaign
Dr. Kenneth Senne (MIT – Lincoln Laboratory)
Dr. John C. Sommerer, Chief Technology Officer, APL, The Johns Hopkins University.

Misters Brasch, Schepers, and Sullivan represent local industry on the EAB.

Two meetings of the EAB were held this academic year. The first one was convened on November 18, 2005, from 1 to 3 PM in Jolley Hall, Room 431. Misters Brash, Schepers, and Sullivan attended in person while the other members were connected on line via videoconferencing. ESE department representatives included Professors R. Martin Arthur, Hiro Mukai, and Norman Katz and Researcher/Instructor Chrysanthe Preza. The full minutes from this meeting are included in Appendix I, Section D. Table B-8 on the next page provides abridged version of the minutes of this EAB meeting indicating items and issues that are pertinent to the JEE Program.

As shown in Table B-8, the External Advisory Board identified some major issues in the Electrical and Systems Engineering department. At this time, all of these issues are being addressed.

The new chairman, Dr. Arye Nehorai, is in place and there is an active search for new full-time faculty members. Many interviews have been conducted, several offers have been made, and two new faculty members have been hired. The new faculty members will help revitalize the department.

The concern about the Senior Design course continues to be addressed and plans are in progress for major changes to this course in the fall 2006 semester. These plans are described in more detail later in this self-study report.

B-9 Abridged Minutes for the External Advisory Board Meeting in November 2005

- Faculty size and the use of adjunct faculty
  - The board noted the reduction in the regular faculty from 26 to 15, 4 of which moved to Computer Science and Engineering, which accounted for a proportional reduction in the teaching load and research activities.
  - At least 6 faculty need to be replaced in ESE.
  - The department should reduce its reliance on adjunct faculty with (in part) new hires as planned.
  - To support the need for more faculty members, Dr. Kumar suggested that we benchmark ourselves against comparable institutions, for example, Princeton.
  - The board emphasized that, given the small size of our department, we need to select a few subjects and plan to excel in them.
  - Job 1 is to revitalize the Department with new hires.

- Our concerns with regard to ABET
  - Concern about the Senior Design course in the EE program. Current idea is to split this course in two semesters and have local companies be involved. The consensus is that ESE needs to demonstrate strength in Senior Design for all three programs.

- Impact of new Chairman's arrival in January.
  - EAB members requested a meeting with Arye Nehorai
  - Plan the next EAB meeting in the spring of 2006 (within 6 months).
  - That meeting should focus on our undergraduate programs and the upcoming ABET visit.

The second meeting of the EAB was convened on June 7, 2006, from 12 to 2 PM in Jolley Hall, Room 431. All EAB members were connected on line via videoconferencing. ESE department representatives included Professors R. Martin Arthur, John Corrigan, Norman Katz, Hiro Mukai, Arye Nehorai, and Instructor Chrysanthe Preza. The purpose of the meeting was to (1) introduce the new ESE Department Chair, Professor Arye Nehorai, to the EAB members and (2) to discuss the undergraduate programs in the department. The full minutes from this meeting are included in Appendix I, Section F. Comments relative to the JEE program were as follows.

Brasch: The Joint EE program is a very good idea.

Schepers: Are the evening students more practical engineers? Answer: Yes, the program aims to produce well-educated, sophisticated engineers for the local industry. Only 10-15% of the students go to graduate school immediately after graduation, mainly through the University of Missouri – Rolla Extension Center on the UMSL campus

Brasch: This is a great service to the community!

Adjunct Faculty The Adjunct Faculty, by virtue of their relationship to the program and their local employment in industry, provide an informal but effective means of obtaining feedback from local industry. Their insight of the engineering needs of local industry also helps to guide the curriculum and motivate the students.

Professional Electrical Engineers Feedback

Another means by which the JEE Program Coordinator receives feedback from professional electrical engineers and as well as local industry is via the Adjunct Professors who teach a large number of the evening courses. These Adjunct Professors, graduates of various universities, bring the interests of local industry to the JEE Program Coordinator as well as to the students in the class room. In fact, one of the strengths noted by graduates during their exit interviews is that the adjunct "instructors work in the field and share work experiences".

Faculty Feedback

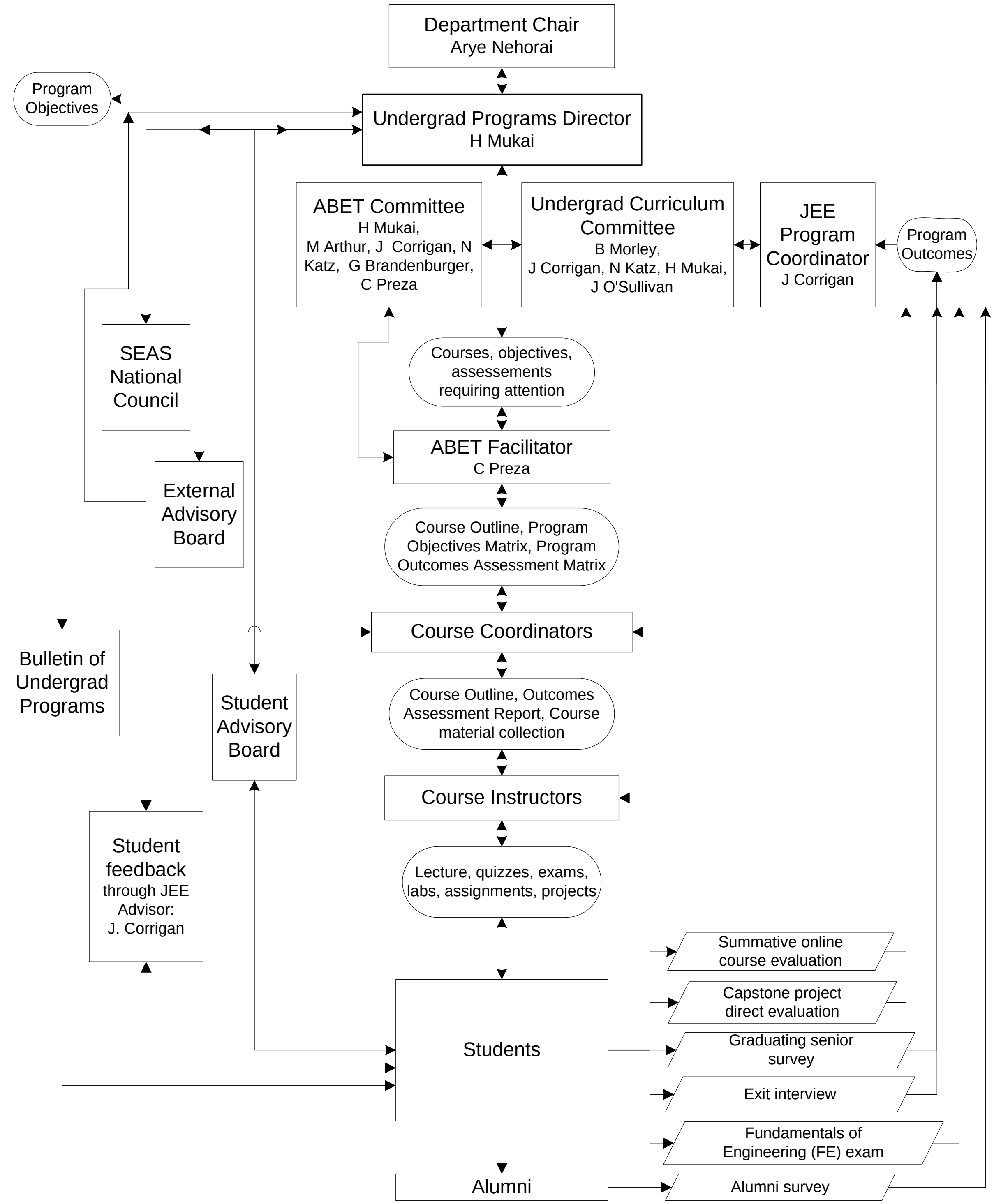
Faculty feedback comes primarily from the Outcomes Assessment Reports written each semester by faculty teaching undergraduate courses. The Undergraduate Curriculum Committee reviews these Outcomes Assessment Reports to see if the goals of the course are being accomplished and if changes to the individual course or to the overall curriculum need to be made to insure the students are being taught is accordance with the Program Objectives.

Processes to Ensure Achievement of the Program Educational Objectives.

The ABET Committee (Chair: Prof. Mukai) and the Undergraduate Curriculum Committee (Chair: Prof. Morley) oversee our educational processes to ensure achievement of the Program Educational Objectives. In particular the ABET Committee has revised the Program Objectives Matrix and the Program Outcomes & Assessment Matrix and the Undergraduate Curriculum Committee has been making sure that our courses are taught as prescribed by the Program Outcomes & Assessment Matrix. Furthermore the overall processes are monitored by the Undergraduate Programs Director (Prof. Mukai).

The flowchart for the overall process to ensure achievement of Program Objectives is shown in Figure B-1. Note that Dr. John Corrigan, the JEE Program Coordinator and Advisor, is a member of both the ABET Committee and the Undergraduate Curriculum Committee. As JEE Program Advisor, he is responsible for bringing information communicated to him from the students to the ABET Committee. As JEE Program Ccoordinator, he is responsible for reviewing various evaluation, survey, exit interview, and exam data and providing summarized information to the Undergraduate Curriculum Committee.

Figure B-1 Diagram of the Process Used to Ensure Achievement of the Program Objectives



3. Program Outcomes and Assessment

Program Outcomes

The Joint Electrical Engineering (JEE) Program Objectives were discussed at some length in the previous section. These Objectives are defined in terms of a student's preparation for successful careers as professional engineers. Of course, it literally takes years before the two universities and associated engineering programs really know how well these objectives are being achieved. This is true since evaluation involves feedback from the constituents, namely, graduates, industry leaders, coworkers and faculty and this feedback must be accumulated over time. Considering the newness of the program and the fact that over 55% of its graduates obtained their BSEE degrees in the last 4 years, it is not totally clear how successful the program has been in meeting its program objectives. However, feedback from graduates and the hiring of new graduates by local industry indicates that the program is successful.

Ultimately, the achievement of Program Objectives depends on the strength of the engineering curriculum, the quality of the students, the educational opportunities offered by the engineering program, and the knowledge gained by the graduates. Defining Program Outcomes in terms of the engineering curriculum and its educational opportunities provides a means for near term assessments that predict the long term results.

There are many Program Outcomes that could be defined. The desire is, of course, for these outcomes to be easily evaluated during the student's undergraduate career and immediately upon the student's graduation. Over the past year, the members of the ABET Committee in the Electrical and Systems Engineering department have proposed and discussed a number of potential program outcomes. These include, of course, the Program Objectives listed by ABET under Criterion 3. In the end, the committee decided that the objectives stated by ABET Criterion 3 generally covered the topics of concern. Consequently, the JEE program wholeheartedly endorses and adopts the (a) through (k) objectives defined by Criterion 3

One additional objective that relates to this nontraditional electrical engineering program is the need to support local industry. Therefore, the JEE program includes an additional objective stating that students attain "the knowledge needed for careers in local industry". In other words, at graduation, the JEE program students must have the taken the appropriate course work and have the knowledge needed to be hired for engineering positions in local industry in the St. Louis region.

A review of the three program objectives and the program outcomes resulted in the correlation matrix shown in Table B-10 on the next page. Note that the additional outcome is shown as (l) in Table B-10.

The correlation matrix indicates which objectives and outcomes have strong correlation. The expectation is that if the outcomes can be achieved, then the program objectives will be achieved in the long term. Therefore, it is important that the tools for assessing program outcomes be defined and in place in the program and this is indeed the case.

Table B-10 JEE Program Objectives and Outcomes Correlation Matrix

The objectives of the Joint Electrical Engineering progam are threefold:		(a) apply math, science, engineering	(b) experiments; analyze & intterpret data	(c) design system, component, or process to meet	(d) functon on multi-disciplinary teams	(e) identify, formulate, & solve engin problems	(f) understand professional & ethical responsibility	(g) communicate effectively	(h) understand engineering solutions in a global contex	(i) recognize need for lifelong learning	(j) knowlecge of contemporary issues	(k) ability to use engineering tools for engineering	(l) knowledge needed for careers in local industry
1. Graduates will have a professional engineer in	(a) traditional electrical engineering positions or			•	•		•	•	•	•	•	•	•
	(b) other positions that require quantitative problem-solving skills and a working knowledge of modern electrical engineering.			•	•		•	•	•	•	•	•	•
2. Graduates will be knowledgeable of and proficient in	(a) electrical circuits,	•	•	•		•	•	•				•	
	(b) computer systems,	•	•	•		•	•	•				•	
	(c) digital and linear electronics,	•	•	•		•	•	•				•	
	(d) electromagnetic engineering,	•	•	•		•	•	•				•	
	(e) signal analysis, and	•	•	•									
	(f) electrical laboratory methods.	•	•	•		•	•	•				•	•
3. Graduates will to be able to design and analyze more advanced and complex systems in at least two of the following areas of specialization:	(a) electrical power systems,	•	•	•	•	•		•				•	•
	(b) solid-state devices and circuits,	•	•	•	•	•		•				•	•
	(c) control components and systems,	•	•	•	•	•		•				•	•
	(d) communication and information systems,	•	•	•	•	•		•				•	•
	(e) computer architecture, hardware, and software, and	•	•	•	•	•		•				•	•
	(f) electromagnetic engineering techniques.	•	•	•	•	•		•				•	•

Legend	**Strong correlation between to objectives and outcomes.**
•	Yes
(blank)	No

A review of the required and elective courses in the JEE program relative to the Program Outcomes was performed with the results shown in Table B-11 on the next page. Note that each of the (a) through (l) program outcomes is supported by more than one course. It is believed that the program has the correct mix of courses to allow students to achieve the desired program outcomes. The hiring of graduates by local industry certainly indicates that this is true.

Table B-11 Correlation of Courses and Program Outcomes

Course Number	Course Title	(a)apply math, science, and engineering	(b) experiments; analyze & interpret data	(c) design system, component, or process to meet desired needs	(d) function on multi-disciplinary teams	(e) identify, formulate, and solve engineering problems	(f) understand professional and ethical responsibility	(g) communicate effectively	(h) Understand engineering solutions in global context	(i) recognize need for and lifelong learning	(j) Knowledge of contemporary issues	(k) Ability to use engineering tools in engineering practice	(l) knowlecge needed for careers in local industry
Course Numbers and Titles		**JEE Program Outcomes**											
ENGL1001*	English Composition							•					•
Humanities*	Three Humanities courses required						•	•		•	•		
Social Studies*	Three Social Studies course required						•	•		•	•		
JEC3100	Engineeting Communication (Engl3130 at UMSL)							•					•
ENG2310*	Statics	•				•							•
ENG2320*	Dynamics	•				•							•
JME3200	Thermodynamics	•				•							•
JEM3170	Engineering Mathematics	•				•							•
JEM3260	Probability and Statistics for Engr. (Math 1320 at UMSL	•				•							•
JCS1002	Intro to Computing Tools: MATLAB Skills	•				•						•	•
JCS1260	Intro to Computer Programming (CS1250 at UMSL)	•				•						•	•
JEE2300	Introduction to Electrical Networks	•		•		•						•	•
JEE2320	Introduction to Electronic Circuits	•		•		•						•	•
JEE2330	Electrical and Electronic Circuits Laboratory	•	•	•	•	•	•	•	•	•	•	•	•
JEE2600	Introduction to Digital Logic and Computer Design	•		•		•							•
JEE3300	Engineering Electromagnetics Principles	•		•		•							•
JEE3310***	Electronics Laboratory	•	•	•	•	•		•					•
JEE3320	Power, Energy and Polyphase Circuits	•		•		•							•
JEE3340**	Network Analysis	•		•		•							
JEE3360**	Principles of Electronic Devices	•		•		•							
JEE3370**	Electronic Devices and Circuits	•		•		•						•	
JEE3510	Signals and Systems	•		•		•						•	•
JEE3610**	Intro to System Software	•				•							
JEE3620**	Computer Architecture	•		•		•							
JEE4000**	Independent Study												
JEE4020**	Computer Aided Design Systems	•		•		•						•	
JEE4050**	Reliability and Quality Control	•				•							
JEE4090**	Patent Law for Electrical Engineers								•				
JEE4300**	Engineering Electromagnetics Applications	•		•		•							
JEE4330**	RF and Microwave Technology for Wireless Systems	•		•		•						•	•
JEE4340**	Solid-State Power Circuits and Applications	•		•		•						•	
JEE4350***	Electrical Energy Laboratory	•	•	•	•	•		•				•	•
JEE4380**	Applied Optics	•		•		•							•
JEE4410	Control Systems (or JME4310)	•		•		•						•	•
JEE4420**	Digital Control Systems	•		•		•						•	
JEE4480***	Systems Engineering Laboratory (Day class only****)	•	•	•	•	•		•				•	
JEE4600**	Switching Theory	•		•		•							
JEE4630**	Digital Integrated Circuit Design and Architecture	•		•		•						•	
JEE4640**	Digital Systems Engineering	•		•		•						•	
JEE4650***	Digital Systems Laboratory	•	•	•	•	•						•	
JEE4670**	Embedded Computer Systems	•		•		•						•	
JEE4710**	Communication Theory and Systems	•		•		•							
JEE4820**	Digital Signal Processing	•		•		•							
JEE4880***	Signals and Systems Laboratory (Day class only****)	•	•	•	•	•						•	
JEE4920**	Advanced Analog Electronics	•		•		•						•	
JEE4980	Electrical Engineering Design Projects	•	•	•	•	•	•	•	•	•		•	•

* UMSL Course Numbers

** JEE students are required to take 4 JEE electives (12 semester credits) as part of their engineering requirenments.

*** Three laboratory courses are required course; there are 4 choices for the third laboratory (Lab3); a fourth laboratory course may be taken as an elective.

**** JEE students are allowed to take 2 daytime classes to fulfill elective/laboratory requirements.

Assessment Processes for Measuring JEE Program Outcomes

The process used to determine if graduates are achieving the desired JEE program outcomes involves the use of appropriate assessment tools, the evaluation of results, and a process for applying the results to make changes in the curriculum, course topics, prerequisite topics, instructors, etc. The assessment tools utilized are described next and the results are then summarized. Subsequently, the process to make changes is described and the actual changes to the JEE curriculum and courses and prerequisites are discussed.

Assessment Tools **–** There are a number of very valuable tools for assessing program outcomes. The eleven chosen for the JEE program are shown in Table B-12. The assessment tools shown are not in any particular order, but more information is generally available for the sources listed early. Table B-12 also shows which assessment tool addresses which program outcome.

Table B-12 Program Outcomes and Assessment Tool Correlation Matrix

JEE Program Assessment Tools	JEE Program Outcomes											
	(a) Apply math, science, and engineering	(b) Experiments; analyze & interpret data	(c) Design system, component, or process to meet desired	(d) Function on multi-disciplinary teams	(e) Identify, formulate, and solve engineering problems	(f) Understand professional and ethical responsibility	(g) Communicate effectively	(h) Understand engineering solutions in global context	(i) Recognize need and have ability for lifelong learning	(j) Knowledge of contemporary issues	(k) Ability to use engineering tools in engineering practice	(l) Knowledge needed for careers in local industry
Outcome Assessment Reports	•	•	•	•	•	•	•	•	•	•	•	
Student Course Work	•	•	•	•	•	•	•	•	•	•	•	
Electrical Power Project Evaluation	•		•		•		•		•			•
Capstone Project Evaluation	•	•	•	•	•		•		•		•	•
Fundamentals of Engineering (FE) Exam	•		•		•						•	•
Graduating Senior Survey	•	•	•	•	•	•	•	•	•	•	•	
Summative Online Course Evaluations	•	•	•	•	•	•	•	•	•	•	•	
Student Advisory Board (SAB) Survey	•	•	•	•	•	•	•	•	•	•	•	•
Alumni Surveys	•	•	•	•	•	•	•	•	•	•	•	
Student Communication with Advisor	•	•	•	•	•	•	•	•	•	•	•	•
Exit Interviews						•	•		•	•		

Does the assessment address this outcome?	
Yes	•
No	

Outcome Assessment Reports **–** Each semester, the instructor for any electrical engineering (JEE) course is asked to write an Outcomes Assessment Report for the course. This Outcomes Assessment Report covers four important topics. These are: (1) Prerequisite topics definition and assessment, (2) Topics to be learned during the course and degree to which students gained sufficient knowledge of these topics, (3) Design skills and extent to which students acquired this skill, and (4) Coverage of topics and a self-assessment of the ability of the instructor to address the listed topics. For each topic, recommended actions are identified by the instructor.

Student Course Work – The course instructors are required to follow the Course Outline (Course Syllabus) for each engineering course. Course Outlines are included in Appendix I. The Course Outline identifies the topics to be covered and the Program Outcomes that should be obtained. The course work done by each student is used to determine final grades. This course work as well as a prerequisite assessment quiz or take-home problems also provide the basis for the Outcomes Assessment Reports described above. Samples of student course work are kept to support the assessments given in these reports. These samples include homework, exams and quizzes, and reports. Generally, samples of work with high, median, and low scores are kept. Hardcopies of student course work are available for the spring 2005 and fall 2005 semesters. Beginning with the spring 2006, all copies are being kept electronically in PDF format.

Electrical Power Project Evaluation – The Power, Energy, and Polyphase Circuits course (JEE3320), which is junior level course that all JEE students are required to take, is taught each spring. In this course, the instructor assigns a comprehensive project that must be done individually by each student. This project offers these students a first look at a fairly complex project which could be required in the electrical power industry. This project is in the form of a "Project Bid". The reporting includes such items a Scope, Electrical Service Requirements, Documentation, Training, Maintenance, Facilities, Delivery, Installation, Testing, Project Management, and Project Bid Content and Format. In order to complete the project, the students are required to obtain much information not included in the textbook, giving them some idea that their learning will need to be life long. Students are required to make design decisions that are not always black or white. This electrical power project offers a chance to obtain an early evaluation of students versus many of the JEE Program Outcomes as shown in Table B-12.

Capstone Project Evaluation – A capstone experience has been an ABET requirement and has, for many years, been a critical part of every undergraduate degree program in the engineering school at Washington University. Capstone experiences are one of the most effective ways for engineering programs to ensure the desired program outcomes are being achieved.

We recognize that course grades assigned by the course instructor are not typically considered a valid assessment method because there may be some conflict of interest involved. Nonetheless, we believe grades in a capstone experience can provide a reasonable assessment of a student's preparation for entry into the engineering profession. The capstone course really does not focus on presenting new material to learn or understand. That has been the focus of the required (and elective) course work leading up to the capstone experience. The purpose of the capstone experience is to provide an opportunity for students to synthesize "all" they have learned in their engineering curriculum in a mentoring environment that often tackles engineering problems posed by outside clients. When outside clients are involved, they typically provide evaluations of the students' work that are considered in assigning grades.

Engineering analysis and design principles learned in preparatory engineering courses, along with considerations such as economics, legal and regulatory requirements, ergonomics, ethics, aesthetics, marketing – subjects learned in other courses, often from other divisions of the

University – all come to bear on the student's capstone experience to produce a creditable engineering solution to a problem.

The grade a student earns in an engineering course, for example, may be considered tainted as an assessment method because it may not only reflect how well the student knows the material, but it may also reflect how well the instructor assigning the grade can teach the material While we recognize the grade on a capstone experience is still an imperfect method, we believe the grade earned in a capstone experience really reflects the student's holistic preparation for the practice of engineering – it is a direct assessment by one instructor of how well-prepared the student is on the basis of what he or she has learned from many instructors in many courses.

Fundamentals of Engineering (FE) Exam - The Fundamentals of Engineering (FE) exam, formerly the Engineering in Training (EIT) exam, is offered in Missouri in December and April of each year. JEE students can take a 1 credit hour course called Fundamentals of Engineering Review (JCE4950) in preparation for this exam. Since the JEE program leading to the BSEE degree granted by UMSL is now accredited, we will receive a summary of results for students taking this exam. These results should provide an assessment for several of the JEE Program Outcomes.

Graduating Senior Surveys – A 20 question survey was given to the graduating seniors in the capstone senior design course in the spring 2006 semester. These questions considered the three JEE program objectives, the JEE program outcomes, the value of the laboratory and capstone design courses, and the overall satisfaction with the program. This was the first semester for this survey, but the plan is for this survey to be conducted every semester. This will allow a history to be accumulated on these important topics.

Summative Online Course Evaluations - These forms are completed online by students in all of our engineering courses. These provide useful information about the course, teaching quality and outcomes. These forms expressly assess outcomes related to ABET Criterion 3 (a) through (k). However, since they are anonymous and completed online, students are not required to complete these evaluations and many have chosen not do so.

Student Advisory Board - This board is comprised of three students who are asked each year to consider various issues about our program and report back to the JEE Program Coordinator. Meetings with the Program Coordinator are generally held once a year. The JEE SAB has been in continuous existence since the fall of 2001.

Alumni Surveys – The WU School of Engineering and Applied Science (SEAS) has been conducting alumni surveys at about 5-year intervals for quite some time. For the joint program, surveys were sent to Joint Program alumni in August 2004 by the Dean of the Joint Undergraduate Engineering Program. This 47 question survey coverd many subjects including the ABET Criterion 3 (a) through (k) program outcomes.

Student Feedback through Advisor – The JEE Program Advisor is in a unique position to interact with the students since he is both the program coordinator and also the advisor for all JEE students. As described previously, each student must interface with the Program Advisor in order to register for the next semester's or summer's classes. This is usually done in a face to face meeting in the Program Advisor's office and he gets to know most of the JEE students fairly well. The Program Advisor usually teaches mid-afternoon classes and is therefore available prior to the start of evening classes. He maintains an open door policy with students as well as adjunct faculty who are invited to come in and visit at any time prior to evening classes. Students often drop in to discuss current classes and next semester's schedule. They feel free to talk about how well classes are going and any perceived problems or issues. Likewise, adjunct faculty instructors often drop in to discuss various issues, including students who may be having problems. Prior to his afternoon class, the Advisor is in contact with many of the regular faculty. He is also a member of both the ABET Committee and the Undergraduate Curriculum Committee.

***Exit Interviews* –** Exit interviews are conducted each semester with each graduating Joint Program student by the Associate Dean of the Joint Undergraduate Engineering Program at UMSL. Relative to the Joint Program, the Dean asks each graduating senior about (1) its strengths, (2) its weaknesses, and (3) any bureaucracy associated with the program. Results on the JEE program are forwarded to the JEE Program Coordinator. While the comments made by BSEE graduates do not relate directly to the defined JEE Program Outcomes, the comments do give a general sense as to the effectiveness of the program and, therefore, they are included as an assessment tool.

***Assessment Results* –** Assessment results obtained for the past academic year are discussed in the following paragraphs.

***Outcome Assessment Reports* –** Each semester, the instructor for any electrical engineering (JEE) course is asked to write an Outcomes Assessment Report for the course. The Outcomes Assessment Report covers four important topics. These are: (1) Prerequisite topics definition and assessment, (2) Topics to be learned during the course and degree to which students gained sufficient knowledge of these topics, (3) Design skills and extent to which students acquired this skill, and (4) Coverage of topics and a self-assessment of the ability of the instructor to address the listed topics. For each topic, recommended actions, if deemed needed, are identified.

Tables B-13 and B-14 provide summaries of the Outcomes Assessment Reports for electrical engineering (JEE courses) for the spring 2005 and fall 2005 semesters, respectively. The spring 2006 semester Outcomes Assessment Reports had not yet been reviewed and summarized at the time this report was issued.

A review of Tables B-13 and B-14 indicates some problems with knowledge of prerequisite topics. In all cases, the prerequisite courses had been taken so that the student had been exposed to the topic. In most cases, remedial action was recommended to the student having a problem and the student was able to become proficient in the topic as the course progressed.

Other issues indicated in the tables mostly deal with changes in the approach to or coverage of topics by the instructors themselves or desired changes in the text books. These changes are generally made by the instructor the next time he teaches the course. The instructor must, of course, cover all required topics per the Course Outlines shown in Appendix I.B.

Table B-13 Outcomes Assessment Reports Summary – Spring 2005

Course Number	Course Name	Course Outcomes Assessment Reports Summaries
2300	Intro to Electrical Networks	This course serves both JEE and JME students with Physics II as the prerequisite and Differential Equations as a corequisite. Instructor noted some lack of math skills despite the Differential Equations corequisite.
2320	Intro to Electronic Circuits	Intro to Electrical Circuits (JEE2300) is the prerequisite. Instructor identified several prerequisite deficiencies and recommended addition of a major design project using PSpice simulation as a design verification tool.
2330	Electrical & Electronics Lab	This course serves both JEE and JME students with Intro to Electrical Networks (JEE2300) as the prerequisite. Instructor noted that JME students were ill prepared for some experiments and recommended simplyfing them as well as some design problems.
2600	Intro to Digital Logic and Computer Design	Intro to Computer Programming (JCS1260) is the prerequisite course. Eighty percent retained knowledge of prerequisite topics. Instructor need more time to cover topics and recommended reducing the number of quizzes given from 8 to 6.
3300	Engineering Electromagnetics Principles	Engineering Mathematics (JEM3170) is the prerequisite for this course. Instructor reviews prerequisite topics first week. Recommends change in emphasis to allow presentation pulse response of transmission lines. Recommends a change in book.
3320	Power, Energy and Polyphase Circuits	This is a joint day/evening school class with Intro to Electrical Circuits (JEE2300) as the prerequisite. Instructor recommends more emphasis on energy storage devices and transients in the prerequisite course.
3360	Principles of Electronic Devices	This is a joint day school/evening school class with Physics II as the prerequisite for this course. All but two students demonstrated suitable competence to complete the course. No systemic action deemed necessary.
3351	Signals and Systems	Engineering Mathematics (JEM3170) is the prerequisite for this course. Students who did poorly on the prerequisite exam were encourged to work with a tutor and/or do self-review. No systemic aciton deemed necessary.
4090	Patent Law for Electrical Engineers	This is a joint day school/evening school class with no specific prerequisite. It is taught by an instructor from the Law School. No action was recommended.
4330	RF & Microwave Technology for Wireless Systems	Prerequisite is Intro to Electronic Circuits (JEE2320). Instructor recommended reduction in time spent on modulation & detection to afford more time for other subjects.
4350	Electrical Energy Lab	Power, Energy, and Polyphase Circuits (JEE3320) is the coorequisite. No systemic action deemed necessary.
4420	Digital Control Systems	This is a joint day school/evening school class with Control Systems (JEE4410) as the prerequisite. Outcome Assessment Report (OSR) for spring 2005 not available. Instructor has retired at end of semester due to health problems.
4640	Digital Systems Engineering	This is a joint day school/evening school class with Intro to Electroinc Circuits (JEE2320) as the prerequisite. Outcome Assessment Report (OSR) for spring 2005 not available. Instructor has retired due to health problems.
4710	Communication Theory and Systems	This is a joint day school/evening school class with Signals and Systems (JEE3510) as the prerequisite. No Outcomes Assessment Report was submitted. Instructor has moved out of town and is no longer teaching at WU.
4920	Advanced Analog Electronics	This is a joint day school/evening school class with Electronic Devices and Circuits (JEE3370) as prerequisite. Only one JEE student took this class. No action was deemed
4980	Electrical Engineering Design Projects	Senior Standing is prerequisite. This is a joint day/evening school course. The instructor uses analog circuit design problems as the basis for the course and senses lack of preparation or interest by some students. Written final reports are required.

Table B-14 Outcomes Assessment Reports Summary – Fall 2005

Course Number	Course Name	Course Outcomes Assessment Report Summaries
2300	Intro to Electrical Networks	This course serves both JEE and JME students with Physics II as the prerequisite and Diff. Eq. as a corequisite, but Instructor noted a certain lack of math skills. An increase in design-oriented material by assigning PSpice/MATLAB homework was recommende
2320	Intro to Electronic Circuits	Instructor identified several prerequisite deficiencies, but made no specific recommendatons.
2330	Electrical & Electronics Lab	This course serves both JEE and JME students with JEE2300 as the prerequisite. Instructor noted that JME students were ill prepared for some experiments and recommended simplyfing them as well as some design problems.
3300	Engineering Electromagnetics Principles	Engineering Mathematics (JEM3170) is the prerequisite for this course. Instructor reviews prerequisite topics first week. Recommends change in emphasis to allow presentation pulse response of transmission lines.
3310	Electronics Laboratory	Intro to Electronic Circuits (JEE2320) and Engineering Electromagnetic Principles (JEE3300) are both prerequisites. Instructor recommended that JEE3300 be deleted as a prerequisite and that the 3 week design/build/test/demo project be continued.
3370	Electronic Devices and Circuits	Intro to Electronic Circuits (JEE2320) is the prerequisite. Two students performed poorly on the prerequisite quiz, but both were able to perform satisfactorily and finish the course. No need for action indicated by the instructor.
4050	Reliability and Quality Control	Probability ans Statistics for Engineering (JEM3620) is prerequisite. No Outcomes Assessment Report was submitted.
4340	Solid State Power Circuits & Applications	Intro to Electronic Circuits (JEE2320) and Signals and Systems (JEE3510) are prerequisites. Instructor noted lack of understanding of transient and AC circuit analysis and AC power calculations and provided a review of this material.
4410	Control Systems	This course serves both JEE and JME students with Engineering Mathematics (JEM3170) as the prerequisite. Instructor recommends an increase in the use of MATLAB in lecture and homework. No systemic action deemed necessary.
4650	Digital Systems Laboratory	Intro to Digital Logic and Computer Design (JEE2600) is the prerequisite. Instructor found that knowledge of prerequisie topics was recgained during the course. Course followed the new outline with new lab equipment and processes. No systemic action ne
4980	Electrical Engineering Design Projects	Senior Standing is the prerequisite. This is a joint day /evening school course. The instructor uses analog circuit design as the basis for the course. The report indicates that analog circuit design itself rather than the design process is emphasized

Student Course Work – The course work done by each student is used to determine final grades. As a matter policy, sample work has been saved to illustrate the range of work with a given class. These samples include homework, exams and quizzes, and reports. Whenever possible, samples of work with high, median, and low scores are kept. Generally speaking, this course work indicates that the electrical engineering courses are achieving the desired program outcomes. When questions arise regarding information given by the instructor in the Outcomes Assessment Reports, the student course work is often reviewed to obtain a better insight into the problem.

Hardcopies of student course work are available for the spring 2005 and fall 2005 semesters. Beginning with the spring 2006, all copies are being kept electronically in PDF format.

Electrical Power Project Evaluation –Grades for the Electrical Power Project are available and the best, median, and low scoring projects have been archived. However, all projects were also archived prior to grading by the instructor. As time permits, these projects may be reviewed to assess how well the students demonstrated the several program outcomes related to this project. It is hoped that time will permit this assessment will be available for the ABET review in the fall 2006.

Capstone Project Direct Evaluation –Grades for the Electrical Engineering Design Projects course (JEE4980) are available and the best, median, and low scoring projects and reports have been archived. As time permits, these projects may be reviewed to assess how well the students demonstrated the several program outcomes related to this project. It is hoped that this assessment will be available for the ABET review in the fall 2006.

In the future, the plan is to be proactive in obtaining information by which to assess achievement of program outcomes. This can be done in several ways, but a final approach has not yet been finalized.

Fundamentals of Engineering (FE) Exam – As discussed earlier, the majority of BSEE degrees to students in this program have been granted during the last four years. Many of these students have been hired by large companies such as Boeing where Professional Engineer (PE) licenses are not needed. Only recently has PE licensure become a need as graduates have gone to work for Ameren, Emerson Electric, and local electrical contractors and suppliers and other small companies dealing directly with the public. Consequently, a number of the recent graduates and current candidates have taken the FE exam. Unfortunately, we do not have any information available for these students at the present time.

Graduating Senior Survey – A 20 question survey (item 16 has (a) and (b) parts) was given to graduating seniors in the capstone senior design course in the spring 2006 semester. These questions considered the JEE program objectives, the JEE program outcomes, the value of the laboratories and the capstone design courses, and the overall satisfaction with the program. Statement were rated by the students from 1 to 9 (1-Strongly Disagree, 5-Agree, 9-Strongly Agree) with 5 being the middle score. The survey results based on a 55% response are summarized in Table B-15 on the next page.

Achieving an Overall Rating of 6.4 or 80th percentile, obtained by averaging the 20 individual ratings as shown at the bottom of Table B-15, is deemed to be quite good for the JEE program.

As shown, all ratings were in the “Agree” to “Strongly Agree” range except for one. Using a 60th percentile rating of 5.8 as the goal, 17 of the 21 or 81% of the statements received ratings above this value.

There was one serious exception, statement 16b, for the Digital Systems Laboratory,. However, only two students rated this course and it is clear that one of the students took it in its old form when it had significant problems as described elsewhere since he gave it a rating of 1. This course was greatly improved for its last presentation in the fall 2005 and received a reasonably good mark of 6 by the other student. Experience by the instructor with the new form of this course is expected to improve its presentation and raise its rating beginning in the fall 2006.

Reviewing the ratings shown in Table B-15, there were 3 other statements that received ratings less that 5.8. These were statements 11, 13, and 14 that are all related to JEE program outcomes.

Items 11 and 13 deal with the impact of engineering solutions in a global and societal context and with knowledge of contemporary issues. These issues are being addresses by the improved capstone senior design course discussed elsewhere in this report as well as the addition of Engineering Ethics (Philosophy 2259) in the pre-engineering course requirements at UMSL.

Table B-15 Graduating Senior Survey - April 2006

The JEE program provided the following:	Rating
(1) A breath of knowledge of electrical engineering	6.7
(2) A depth of knowledge in an area of electrical engineering	6.7
(3) A preparation for life as a professional electrical engineer	7.2
The JEE curriculum and learning experiences provided the following:	
(4) An ability to apply knowledge of mathematics, science, and engineering	7.3
(5) An ability to design and conduct experiments, as well as to analyze and interpret data	6.8
(6) An ability to design a system, component, or process to meet desired needs	5.8
(7) An ability to function on multi-disciplinary teams	6.5
(8) An ability to identify, formulate, and solve engineering problems	6.0
(9) An understanding of professional and ethical responsibility	5.8
(10) An ability to communicate effectively	6.8
(11) The broad education necessary to understand the impact of engineering solutions in a global and societal context	5.5
(12) A recognition of the need for and an ability to engage in life-long learning	7.2
(13) A knowledge of contemporary issues	5.7
(14) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	5.3
The following JEE Laboratory courses provided a valuable learning experience:	
(15) JEE2330, Electrical and Electronic Circuits Lab	7.0
(16a)JEE3310, Electronics Laboratory (Rate only if you took this lab.)	7.5
(16b)JEE4650, Digital Systems Laboratory (Rate only if you took this lab.)	3.5
(17) JEE4350, Electrical Energy Laboratory	7.2
(18) JEE4980, Electrical Engineering Design Projects course provided a valuable learning experience	6.7
JEE Program overall satisfaction:	
(19) I was satisfied with the instructors teaching the courses	6.2
(20) I was satisfied with the engineering curriculum	6.0
Overall Rating	6.4

Item 14 deals with use of techniques, skills, and modern engineering tools for engineering practice. Improvement in this area is being made through by the addition of the Introduction to Computing Tools: MATLAB Skills (JCS1002) course and the emphasis on using MATLAB in several required JEE courses, namely, Engineering Electromagnetics Principles (JEE3300), Signals and Systems (JEE3510) and Control Systems (JEE4410). Also, PSpice simulation is now being introduced in the Introduction to Electrical Networks (JEE2300) course and emphasized in the Introduction to Electronic Circuits (JEE2320) and Electrical and Electronics Laboratory (JEE2330) courses. Much better ratings for item 14 are expected in the future.

Summative Online Course Evaluations – Even though the participation in Summative Online Course Evaluations by students is less than desired, the results are extensive as this is a many part survey. It results are available on line to the instructor as well as the students and faculty of the university. However, only the comments by students can only be seen by the instructor.

The results are generally used by the instructor to improve the organization and presentation of the course. Many times, the survey results and comments will alert the instructor to problems or issues with the book or homework or student consultant or student grader.

The Undergraduate Curriculum Committee did a general review of all electrical engineering online surveys this past winter. The committee summarized the student's Overall Satisfaction with each course where information was available. This information was presented for the spring and fall 2005 semesters in Tables B-5 and B-6 and will not be repeated here.

The rating scale for Overall Satisfaction is: 1-poor, 5-satisfactory, and 9-outstanding. As shown, in Tables B-5 and B-6, most ratings are well above 5 (satisfactory) with some in the 8 to 9 (Outstanding) category. The lowest rating being 4.1 for a very difficult Digital Systems Engineering elective course.

Student Advisory Board (SAB) –A very significant SAB meeting was held in late fall 2004. The resulting action was for the SAB members to answer a 25 question survey to document issues and problems. The results of this survey are summarized in Appendix I.E. The survey results, exit interviews, as well as many comments by students directly to the Program Coordinator during the semester uncovered a significant problem with the JEE4650 Digital Systems Laboratory course. The following description summarizes the problem.

The main problems were: (1) use of outmoded assembly language for this course, (2) the equipment used during the fall 2004 semester was old and poorly maintained, (3) there were no students available with the needed experience to act as Teaching Assistants (TAs) for the course, and (4) not all JEE students are interested in Digital Systems Engineering, but it was a required course. Another problem was that while the day school had a prerequisite course in Assembly Language, it was not available for the WU/UMSL JEE program. Therefore, the evening course tried supplement the content with 3 lectures on assembly language programming and then do only 3 instead of 4 design problems.

One of the reasons for the equipment problems in the evening lab was that CSE changed the day course significantly in the fall 2004 to use the "C" programming language and a more automated approach to downloading files to the Field Programmable Gate Arrays (FPGAs). Hence, the day classes were not using the same equipment and, therefore, the hardware problems were not being found and fixed. The day school also changed the prerequisite to a 3 hour course that introduces "C" programming as well as other aspects associated with managing computer software.

Note that the fall 2004 evening course followed the day school syllabus used previously in the fall 2003 since (1) there was an adjunct instructor, Dr. Alan Johnston, familiar with this approach, (2) the course in its altered form was being offered for the first time in the day school, and (3) there was not enough equipment available to support both day and evening lab sections. An additional problem occurred do to the high enrollment in this lab course due to the increasing number of JEE students approaching graduation. This was accommodated by opening a second evening lab section with Mr. David Kuefler as the instructor. While David works in the Avionics Software Engineering department at Boeing and had taken this course many years ago, this was nevertheless a difficult semester as there were not any qualified students to act as TAs for the course. Consequently, having a common lecture and two separate labs with different instructors did not work very well.

An additional recurring problem was that not all JEE students are interested in Digital Systems Engineering, but this Digital Systems Lab was a required course. Many JEE students would rather take a laboratory course in electronics or control systems or signals and systems.

Discussions with Drs. Roger Chamberlain and Martin Arthur, Interim Chair of the ESE department, concluded that the evening version of the Digital Systems Lab needed to be changed for the fall 2005 semester to follow the day school course and that in the near future it would be desirable for this evening course to be offered by the CSE department rather than ESE. This would insure that the needed equipment was available and that the course tracked the day school course as close as possible.

During discussions, Martin Arthur also expressed the desire for the JEE program to be as similar as possible to the day school EE program. One major difference was that the day school BSEE students take Intro to Electrical and Computer Engineering (ESE102) and have the choice of taking 2 of 4 possible junior/senior laboratories whereas the JEE program required students to take Electrical and Electronic Circuits Lab (JEE2320), Electrical Energy Lab (JEE4350), and Digital Systems Lab (JEE4650) even if they were not interested in Digital Systems Engineering.

In order to alleviate the problems with the lack of laboratory course choices and to insure that the students taking the Digital Systems Lab are taking it because they are interested in Digital Systems Engineering, changes to the JEE curriculum were made starting in the fall 2005 as detailed under Curriculum Changes and Course Content later in this section.

Alumni Surveys – Surveys were sent to 184 graduates of the joint program with known addresses and 42 were returned. Of these, 17 were by BSEE graduates of the JEE program, which represents a response of approximately 25%. The results of the Alumni Survey have been complied and may be viewed online at www.surveymonkey.com/report.asp?U=581049310. By applying a filter, the results for the 17 BSEE alumni can be viewed. Table B-17 shows the results for program outcomes (a) –(k). Note that outcome (b) was broken into two parts.

Several comments relative to the results shown in Table B-17 results may be made. First, it appears that at the stage of the program at the time of the survey in August 2004, the program was doing quite well at achieving the desired program outcomes. Using a rating of 3.7 (67.5 Percentile) as the goal, 9 of the 12 outcomes ranked above this value. A review of Table B-17 shows that these all deal with core engineering outcomes. Obviously, the overall desired results are being achieved by the electrical engineering curriculum and its presentation of engineering courses.

Second, the outcomes that ranked lower than a 3.7 rating, namely, (f), (h), and (j), deal with professional, ethical, and societal issues. These are outcomes that are related to the general education requirements as well as issues which can be discussed in the capstone senior design course.

Table B-16 Alumni Survey Results Related to Program Outcomes

Program Outcome	**Rating (1 = Poorly & 5 = Very well)**
(a) Apply knowledge of mathematics, science, and engineering	4.24
(b-1) Design and conduct experiments	3.82
(b-2) Analyze and interpret data	4.00
(c) Design a system, component, or process to meet desired needs	3.82
(d) Function on a multidisciplinary teams	4.06
(e) Identify, formulate, and solve engineering problems	4.06
(f) Understand professional and ethical responsibility	3.29
(g) Communicate effectively	3.82
(h) Understand the broad impacts of engineering solutions in a global and societal context	3.18
(i) Recognize the need for, and to engage in, life-long learning	3.71
(j) Understand contemporary social issues	2.53
(k) Use the techniques, skills, and modern engineering tools necessary for engineering practice	4.00

To strengthen the future results for these professional, ethical, and societal outcomes, UMSL has developed a new online course on Engineering Ethics (Philosophy 2259) which is given credit as a Humanities course. Beginning in the fall 2006, Engineering Ethics will be a required humanities course in the UMSL Pre-Engineering Curriculum.

As discussed previously, the senior capstone design course, Electrical Engineering Design Projects (JEE4980) is undergoing further revision for the fall 2006 semester. A significant effort will be made to address professional, ethical, and societal issues in this course.

Student Feedback through Advisor – As a result of the open door policy as well as the advising sessions held each semester, the Program Advisor was aware early on and first hand of the problems identified by SAB Survey and the weaknesses and bureaucracy issues identified by the Exit Interviews discussed next. It was, in fact, the face to face meetings with individual students that prompted many of the questions on the SAB Survey. However, the Survey and the Exit Interviews serve as a more formal process for documenting the seriousness of various issues and problems.

Exit Interviews – During the Exit Interviews, each graduating senior about (1) program strengths, (2) program weaknesses, and (3) any bureaucracy associated with the program. The responses from 42 JEE graduating seniors that were obtained from fall 2004 through fall 2005 are summarized in Table B-17. There has been no intentional editing except that duplications were not repeated and course titles were added for clarity.

It is clear from the statements in Table B-17 that the program has its strengths and its weaknesses as well as some bureaucratic problems. One interesting dilemma is that a characteristic seen as strength by one student may be seen as a weakness by another. An example is "evening classes".

Table B-17 Exit Interview Results

Strengths: Evening classes (10 students); Price or tuition (6 times); Public, evening, well-run program; Part time structure; Associated with WU; WU classes, especially electives; WU facilities and faculty; Excellent teachers; Easy to network; Scholarship; Able to stay at home and find a co-op job; Faculty expertise in their fields; Practical applications by engineering faculty; Variety of courses; High quality education; Location; computer science and digital classes.
Weaknesses: None (7 students); Multiple campuses; Scheduling conflicts; Scheduling difficulties – evening classes at UMSL and WU at the same time; Limited class offerings; Low frequency of course offerings; Not enough electives; Lack of power electives; More electives dealing with CAD and Computer software (needed); Hard to get help from faculty since they work during the day; JEE327 (Power, Energy, and Polyphase Circuits) and JEE280 (Intro to Electrical Networks) covered too much material; Program should require more courses; One faculty member assumed an unreasonable amount of student background (for Digital Systems Laboratory); JEE455 (Digital Systems Laboratory) should use a more practical language; Labs need to be updated - more micro processing, current board design needed; JEE4800 (Senior Design) and JEE4550 (Digital Systems Lab) need a CS prerequisite; Program needs another class in digital circuitry; better coordination between classes- JEE150 (Electrical and Electronic Circuits Lab) used Fourier analysis taught in JEMT217 (Engineering Mathematics); Not enough labs; Need more hands-on experience; TAs inadequate due to language and being students; Help sessions not very useful; UMSL students are separate from WU students; Hard to get a sense of community; Cannot use career services (at WU) for co-op and intern positions; Dr. Corrigan is hard to reach; Sometimes treated as second class citizens; There is confusion between the two universities – program not well organized.
Bureaucracy: None (23 students); Unequal enforcement of prerequisites; WU advisors (he is referring to instructors, not program advisors) not knowledgeable of joint program or prerequisites or order of classes; Because of joint physics major (at UMSL) and Honors College (at UMSL), hard for advisers to coordinate class schedules; WU parking pass should be valid at UMSL during the day; He (student) received a parking ticket because he arrived before 5 pm; Parking tickets at WU; Spring break misalignment (between WU and UMSL); Advisor at WU was not as accessible as the one at UMSL; Parking costs; Time limits on WU passes; Dr. Corrigan was slow to respond to email; Corrigan (was) very helpful; Hard to meet up with students during the day due to parking sticker; Parking after 4 pm a problem; Evaluating credit from foreign universities is a problem; Parking for SOFE meetings at UMSL is not possible; Not told about FE reimbursement; Computer class evaluations do not work for UMSL students because they do not have a password; Earlier than 5 pm parking would be useful; Hard to contact Dr. Corrigan (because he is part-time).

The JEE Program Coordinator has made note of the serious weaknesses described during the Exit Interviews and many of these issues have already been resolved. This is particularly true for issues involving scheduling conflicts, lack of electives, and problems with the Digital Systems Laboratory course (JEE4650).

Process Used to Apply Outcomes Assessment Results

The process used to apply the results of the outcomes assessment is illustrated in Figure B-1 and described as follows. A number of assessment tools are employed to assess Program Outcomes. The data obtained from most of these tools are initially interpreted in summary fashion by the JEE Program Coordinator to identify key findings and preliminary conclusions regarding the outcomes. The Department of Electrical and Systems Engineering (ESE) Undergraduate Curriculum Committee then reviews this summarized information.

The Undergraduate Curriculum Committee is currently chaired by Dr. Robert Morley. It is comprised of the JEE Program Coordinator and 4 members of the regular faculty in the Department of Electrical and Systems Engineering. The findings and conclusions emerging from the Undergraduate Curriculum Committee deliberations are assigned to the appropriate person or people for action as required.

In many cased, the findings and conclusions of the committee are referred to the Course Coordinator, that is, the faculty coordinator for a particular course. In some cases, the ESE Department Director of Undergraduate Programs, who is also a member of the Undergraduate Curriculum Committee, may need to communicate with specific faculty. In other cases, a member of the Undergraduate Curriculum Committee may be requested to serve as an agent on behalf of this committee to confer with another faculty member to resolve an issue that has emerged for a particular course with which that committee representative is familiar. In other cases, an ad hoc subcommittee may be created to further resolve more long-term, systemic issues.

It is the responsibility of the Undergraduate Curriculum Committee to follow through to ensure that remedial actions of any type are both implemented as necessary and effective.

Changes Resulting from Outcomes Assessments

A significant number of changes have been made in the JEE Program since the last ABET review in the fall 2001 as a result of the various assessments. These changes range from some rather major changes in curriculum requirements to minor changes in the course content. The most important changes are highlighted herein.

<u>Curriculum Changes</u> – As a result primarily of the Student Feedback through the JEE Advisor, a meeting of the SAB in late fall 2004, and Exit Interviews, a number of curriculum changes have been made to correct problems and improve the program as described below.

JEE students are now given a choice for their third laboratory course. They are now required to take the Electrical and Electronic Circuits Lab (JEE2330), the Electrical Energy Lab (JEE4350), and one of the following as the third lab: the Electronics Lab (JEE3310) or the Digital Systems Lab (JEE4650) or the Systems Engineering Laboratory (JEE4480) or the Signals and Systems Lab (JEE4880). Note JEE4480 and JEE4880 are offered only as a joint classes with the day school section. JEE students are currently allowed to take two day classes at UMSL rates in order to finish their degree and/or take elective courses that they prefer, so students desiring to take JEE4480 or JEE4880 must be able to attend classes in the day time. The choice of subject or the third laboratory insures that students electing to take the Digital System Laboratory (JEE465) are really interested in digital systems, which previously was not always the case. It also allows students more interested in electronics to take the Electronics Laboratory (JEE3310) while those more interested control systems may take the Systems Engineering Laboratory (JEE4480) and those interested in signals and systems may take the Signals and Systems Laboratory (JEE4880). None of these three alternate laboratory courses were previously available to JEE students.

JEE students wanting more laboratory experience will be allowed to take one additional lab course for elective credit. JEE students are currently required to take 4 JEE elective courses in addition to the 19 required courses. Many students indicated that they wanted more laboratory experience. The availability of the additional laboratories now makes this possible and several have already taken the Signals and System Lab (JEE4880) as an elective.

JEE students are now required to take both Introduction to Computing Tools: MATLAB Skills (JCS1002) and Introduction to Computer Programming (JCS1260). The **"**MATLAB**"** computer program and its "Tool Boxes" are used extensively in a number of JEE courses, including Engineering Electromagnetic Engineering (JEE3300), Signals and Systems (JEE3510), Control Systems (JEE4410) and to a lesser extent in other JEE courses. Generally, the MATLAB program was being introduced as needed in these courses.

Student comments to the Program Coordinator as well as the SAB Survey results indicated that quite often a considerable amount of time was being spent by students trying to write the needed MATLAB programs to the detriment of the understanding of the course theory itself. The need for an introductory course on the use of MATLAB was obvious. When the Computer Science and Engineering (CSE) department reduced the required Introduction to Computer Programming (JCS1250) course from 4 credit hours to 3 credit hours and renumbered it as JCS1260, the opportunity to add the 1 credit hour Intro to Computing Tools: MATLAB Skills (JCS1002) course without increasing the overall required number of credit hours presented itself.

Additional Electives **–** A number of day school ESE courses, not previously available to JEE students, are now being cross listed as JEE courses. This is being done in response to Student Feedback and Exit Interview comments by students that more electives were needed in order to obtain a depth of knowledge in selected areas of specialization. As shown in Table B-18, many additional courses were added as electives since the last ABET review in the fall 2001.

Table B-18 Elective Courses Added to Curriculum Since the Fall 2001 ABET Review

JEE3310	Electronics Laboratory (Same as ESE331)
JEE3610	Introduction to Systems Software (same as CSE361)
JEE4000	Independent Study
JEE4050	Patent Law for Electrical Engineers (Same as ESE405)
JEE4090	Reliability and Quality Control (Same as ESE409)
JEE4330	RF and Microwave Technology for Wireless Systems (Same as433)
JEE4340	Solid State Power Circuits and Applications (Same as ESE434)
JEE4480	Systems Engineering Laboratory (Same as ESE448)
JEE4670	Embedded Computer Systems (Same as ESE467)
JEE4880	Signals and Systems Laboratory (Same as ESE488)
JEE4920	Advanced Analog Electronics (Same as ESE432)

Course Content Changes – As a result primarily of the Open Door Policy, a meeting of the SAB in late fall 2004, and Exit Interviews, a number of changes course structure and content have been made to correct problems and improve these course as described below.

Introduction to Electrical Networks (JEE2300) – This course has been modified to introduce PSpice as a simulation and analysis tool. Also, the coverage of operational amplifiers has been deferred to the Intro Electronic Circuits (JEE2320) course and the coverage of mutual inductance and transformers has been made optional as mutual inductance and transformers are covered in detail in the Power, Energy, and Polyphase Circuits (JEE3320) course. These changes were made in order to allow more time to concentrate on required subjects, especially AC circuit analysis using Phasors.

Introduction to Electronic Circuits (JEE2320) – This course has been modified to include significant use of PSpice as an analysis and simulation tool. Also, a design project is being added to this course since use of PSpice simulation now allows easy verification of project designs.

Electrical and Electronic Circuits Laboratory (JEE2330) - This course has been modified to include significant use of PSpice as an analysis and simulation tool in the first three experiments. The seventh experiment based on the bipolar transistor has been modified to serve as a common emitter amplifier design problem. Amplifier design requirements are given and the students are required to design, build and test a common emitter amplifier and report on its performance characteristics.

Introduction to Digital Logic and Computer Design (JEE2600) – This course has been modernized and now includes use of VHDL programming.

Engineering Electromagnetic Principles (JEE3300) – This course has been modified to make significant use of the MATLAB computer program as an analysis tool. This has been enabled by the requirement for students to take the Introduction to Computing Tools: MATLAB Skills (JCS1002). Also, the recitation section previously associated with this course had been dropped. This was done because of student complaints that the course required much more effort and time than other 3 credit hour courses. The oral presentations made periodically by the students during the recitation section are now being emphasized in the Electrical Engineering Design Projects capstone design course.

Power, Energy and Polyphase Circuits (JEE3320) – This course, which is offered in the spring semester as a joint day and evening school course, has evolved over the last few years to include a significant design project. This joint ESE434/JEE4340 is taught by an Adjunct Professor from AmerenUE, the local electrical power company. Based on his work as an engineer at AmerenUE, the instructor assigns a new term project in which students develop a real world design in response to a set of requirements. The final design report includes a parts list and cost estimate as well as other defining documents.

Signals and Systems (JEE3510) - This course has been modified to include study of discrete time systems and use state space analysis techniques. It also makes significant use of MATLAB and MATLAB Tool Boxes for analysis. Use of the MATLAB computer program has been enabled by the requirement for students to take the Introduction to Computing Tools: MATLAB Skills (JCS1002). Also, the recitation section previously associated with this course had been dropped. This was done because of student complaints that the course required much more effort and time than other 3 credit hour courses. The oral presentations made periodically by the students during the recitation section are now being emphasized in the Electrical Engineering Design Projects capstone design course.

Electrical Energy Laboratory (JEE4350) – A three phase circuit experiment using balanced and unbalanced resistive loads has been added to this course. The Power, Energy, and Polyphase Circuits (JEE3320) course has been made a co-requisite and the experiments have also been re-sequenced to coordinate with the subject sequence in JEE3320. In addition, much of the equipment has been replaced or modernized. For example, digital AC watt meters have been purchased and incorporated into the laboratory experiments. The thermoelectric devices have been replaced by more capable devices. The dynamometers used to measure motor torque and speed in several experiments have been refurbished.

Digital Systems Laboratory (JEE4650) – This course was modified to follow the changes made in the day school course (CSE/ESE465). The Computer Science and Engineering (CSE) department pioneered significant changes to the day school Digital Systems Laboratory course in the fall 2004 and spring 2005. These changes were successfully implemented for the evening Digital Systems Laboratory course (JEE4650) in the fall 2005. This change alleviated the problems with the use of Assembly Language Programming and old, outdated equipment by replacing these with the "C" programming language and modern computerized software development tools.

Electrical Engineering Design Projects (JEE4980) **–**There was a concern voiced by the previous ABET review team in the fall 2001 in regard to this capstone senior design course and its results after the 97-98 school years. It was recognized by the ESE department that improvement in this course was needed. As a result, Professor R. Martin Author was appointed as course coordinator with the authority to institute changes as needed. Meetings between Professor Arthur and the course instructors were held to review the course plan and to institute improvements. As a result, the course description was recently rewritten as follows.

"Working in teams, students address design tasks assigned by faculty. Projects are chosen to emphasize the design process, with the designers choosing one of several paths to a possible result. The solution of a real technological or societal problem is carried through completely, including initial specification, consideration of alternatives, preparation of written proposal, and implementation and documentation of the design. Required documents are a written proposal and final report on the project. Oral presentations of progress reports and of the final project are also required. Collaboration with industry and all divisions of the University is encouraged."

As indicated elsewhere in this report, the evening JEE courses follow the day school courses very closely in content and structure. In fact, since the last ABET review in fall 2001, a joint section of this course has been taught each semester with both day time EE students and evening JEE students in the same class with the same instructor. For the fall 2006, significant changes and improvements are planned for the day school course (ESE498 and the evening JEE course (JEE4980) it will follow the lead of the day school course. It is also anticipated that JEE4980 will have a different instructor beginning in the fall 2006.

Outcomes Assessment Documentation

Actions were taken recently to further improve our assessment process. Beginning in the fall 2005, we switched to an electronic version for most of the materials archived for the JEE program. These materials are now being saved in PDF format as part of the "ABET Community" on Telesis (https://telesis.wustl.edu).

Telesis is a web-based environment developed at Washington University and available to all faculty members for course management. Telesis offers secure sites for all courses taught at the University. Course materials on Telesis can be accessed by the instructor as well as the students. An additional feature of Telesis is that of providing secure sites for "Communities" to allow a group of people to communicate, exchange and archive information for a common purpose. The ESE Department decided to use this feature of Telesis to improve collection and archiving of ABET related material such as: report drafts, meeting agendas & minutes, support documents, sample materials from each course, links to course websites etc.

The ESE ABET secure site on Telesis was opened in the fall 2005 and is accessible from anywhere through a web browser. Access to the site is password protected. Faculty, teaching assistants, and support personnel can access the ESE ABET repository once they become members of the Community. Electronic files can be uploaded and downloaded directly to designated folders. This facilitates the collection, organization, long term archiving, and retrieval of course material and other material necessary in our on-going quality assessment process. Course materials are uploaded and stored in course folders.

Available Documentation

The following documentation will be available during the visit by the ABET review team in the fall of 2006 to demonstrate that the processes are working and producing the desired results and that the results are being used to improve the effectiveness of the JEE Program:

1) The 2006-2007 UMSL Bulletin section for the Joint Undergraduate Engineering Program will be online.
2) Instructor's Outcome Assessment Reports will be provided online through Telesis.
3) Summary of student Summative Online Course Evaluation for spring 2005, fall 2005, spring 2006, and summer 2006 will be available online.
4) Copies of the spring 2006 Graduating Senior Survey individual sheets will be available.
5) Summaries of the Exit Interviews conducted with each graduate by the Associate Dean at UMSL for each period from fall 2004 through summer 2006.
6) Websites for each JEE Course will be available online.
8) Textbooks and/or laboratory exercise manuals for each JEE course will be available.
9) Samples of student course work for each JEE Course will be available online through Telesis.

4. Professional Component

Preparation for engineering practice

Admission into the Joint Undergraduate Engineering Program is based on acceptable completion of a pre-engineering curriculum that includes English Composition, Calculus I, II, & III, Differential Equations, Chemistry I and II, and Physics I and II, as well as two introductory engineering courses, namely, Statics and Dynamics. In addition to the Pre-Engineering Curriculum, students also complete their general education by taking courses in Humanities and Social Studies. These pre-engineering and general education courses are usually taken at the University of Missouri – St. Louis (UMSL), but may also be taken at the regional Community Colleges or other Universities and transferred to UMSL. In total, 14 course totaling 65 credit hours must be taken. Note that this includes two engineering courses, namely Statics and Dynamics, totaling 6 credit hours. These courses are listed in Table 1-1 in the Appendix I.

Following admission to the Joint Program, students complete a set of Core Engineering Courses and a set of Engineering Courses in their Major, in this case, Electrical Engineering. These courses taught at Washington University in St. Louis as part of the Joint Undergraduate Engineering Program. In some cases, students transferring to UMSL from other universities may have taken some of the Core or Major Courses and credit is given when appropriate as explained in Section B.1.

There are 8 required Core Engineering Courses totaling 23 credit hours that must be completed. These include 3 electrical engineering courses, namely, Introduction to Electrical Networks (JEE2300), the Electrical and Electronic Circuits Laboratory (JEE2330), and Control Systems (JEE4410/JME4310). These courses are included in the Core Engineering list since they are also taken by Joint Mechanical Engineering (JME) students. See Table 1-1 in Appendix I for the full list of Core Engineering Courses.

There are 13 Joint Electrical Engineering (JEE) courses totaling 39 credit hours included as Major Courses for candidates for the BSEE degree. These include Probability and Statistics for Engineering (JEM3260), 3 laboratory courses, a capstone senior design course (JEE4980) and 4 JEE electives. These electives provide the student with the opportunity to obtain a depth of knowledge in at least two areas of specialization in electrical engineering.

In total, the BSEE candidate must successfully complete 127 credit hours to graduate. The complete list of courses is given in Table I-1 in Appendix I. This comprehensive JEE program provides the student with (1) the knowledge and tools for a Professional Career in Engineering, (2) a Breath of Knowledge in Electrical Engineering, and (3) a Depth of Knowledge in Electrical Engineering in at least two areas of specialization.

The JEE program more than satisfies Criterion 4 as defined by ABET for Electrical Engineers. The following discussion illustrates how this is accomplished by the program.

Criterion 4(a) – Mathematics and Basic Science Criterion 4(a) states that the professional component must include one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to Electrical Engineering.

As part of the JEE program, each student is required to take the mathematics and basic science courses listed in Table B-19.

Table B-19: Required Courses in College Mathematics and Basic Sciences.

Subject	Course	Units	Notes
Analytic Geometry & Calculus I	Math 1800	5	Core Engineering Course at WU
Analytic Geometry & Calculus II	Math 1900	5	Core Engineering Course at WU
Analytic Geometry & Calculus III	Math 2000	5	Core Engineering Course at WU
Differential Equations	Math 2020	3	Core Engineering Course at WU
Introductory Chemistry I	Chem 1111	5	Core Engineering Course at WU
Introductory Chemistry II	Chem 2111	5	Core Engineering Course at WU
Physics: Mechanics & Heat	Physics 2111	5	Core Engineering Course at WU
Physics: Electricity, Magnetism and Optics	Physics 2112	5	Core Engineering Course at WU
Engineering Mathematics	JEM 3170	4	Core Engineering Course at WU
Probability and Statistics for Engineering	JEM 3260	1 of 3	Core Engineering Course at WU; Course units (3) are split into math (1) and engineering science (2)
Total Units (Credit Hours)		43	

Note that both Chemistry and both Physics courses each have the equivalent of 1 unit of laboratory work associated with them, so these 4 units of laboratory work satisfy the requirement for “some with experimental experience”.

The total number of units required for the BS in Electrical Engineering is 127 units which is approximately 16 credit hours per semester if the curriculum is completed in 4 years. The total number of 43 units attributable to college level mathematics and basic sciences corresponds to 1.3 years of study, exceeding the one year of study required by ABET Criterion 4 (a).

Criterion 4(b) - Engineering Topics Criterion 4(b) states that the professional component must include one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study.

As part of the JEE program, each student must take courses in the engineering topics listed in Table B-20 shown below. The required courses include 3 mechanical engineering courses (Statics, Dynamics, and Thermodynamics) to provide a breath of engineering coverage. Note also that we have included two computer science courses (JCS1002 and JCS1260) that are prerequisites for electrical engineering since these courses cover subjects beyond college mathematics and basic science. The required courses listed in Table B-20 provide the student with a Breath of Knowledge in Electrical Engineering.

One difference between the day school and JEE evening school programs is that the Power, Energy and Polyphase Circuits (JEE3320) and Electrical Energy Laboratory (JEE4350) courses are required. This was done in order to provide each student with introduction to Electrical Power and Energy Systems to satisfy the needs of regional industry, namely, Ameren, the local electrical power supplier, Emerson Electric, manufacturer of motors and power control devices, and other electrical contractors and suppliers.

The curriculum also requires four elective courses in electrical engineering topics. These elective courses plus the choice of subject for the third engineering laboratory provide the student with the ability to obtain a Depth of Knowledge in two selected Areas of Electrical Engineering. Note also that a student may take a fourth laboratory as an elective in order to gain more "hands-on" experience.

While design is emphasized in most of the electrical engineering courses and some include major design projects, the curriculum also includes a capstone senior design course, namely, Electrical Engineering Design Projects (JEE4980).

Table B-20: Required Courses in Engineering Topics for BSEE Degree.

Subject (All are required; 4 electives are noted)	**Course**	**Units**
Statics	Engineering 2310	3
Dynamics	Engineering 2320	3
Thermodynamics	JME 3200	3
Probability and Statistics for Engineering	JEM 3260	2 of 3
Introduction to Computing Skills: MATLAB	JCS 1002	1
Introduction to Computer Programming	JCS 1260	3
Introduction to Electrical Networks	JEE 2300	3
Introduction to Electronic Circuits	JEE 2320	3
Electrical and Electronic Circuits Laboratory (Lab 1)	JEE 2330	3
Introduction to Digital Logic and Computer Design	JEE 2600	3
Engineering Electromagnetics Principles	JEE 3300	3
Power, Energy, and Polyphase Circuits	JEE 3320	3
Signals and Systems	JEE 3510	3
Electrical Energy Laboratory (Lab 2)	JEE4350	3
Control Systems	JEE 4410 or JME 4310	3
Electronics Laboratory or Digital Systems Laboratory or Systems Engineering Laboratory or Signals and Systems Laboratory (Lab 3)	JEE 3310 or JEE 4650 or JEE 4480 or JEE 4880	3
Electrical Engineering Elective (Elective 1)	See Table B-21	3
Electrical Engineering Elective (Elective 2)	See Table B-21	3
Electrical Engineering Elective (Elective 3)	See Table B-21	3
Electrical Engineering Elective (Elective 4)	See Table B-21	3
Electrical Engineering Design Projects	JEE 4980	3
Total Units (Credit Hours)		60

The total number of units required for the BS in Electrical Engineering is 127 units which is approximately 16 credit hours per semester if the curriculum is completed in 4 years. The total number of 60units attributable to engineering topics corresponds to 1.9 years of study, exceeding the one and one-half years of study required by ABET Criterion 4 (b).

As noted previously, the curriculum requires four elective courses in electrical engineering topics. These elective courses plus the choice of subject for the third engineering laboratory provide the student with the ability to obtain a Depth of Knowledge in two areas of electrical engineering. A fourth laboratory may be taken as an elective in order to gain more "hands-on" experience. The choice of electives is shown in Table B-21 below.

Table B-21 Elective JEE Courses (Four Courses or 12 Units Required for the Degree)

Subject (Note that a 4th lab can be an elective.)	**Course**	**Units**
Electronics Laboratory (If not taken as 3rd lab)	JEE 3310	3
Network Analysis	JEE 3340	3
Introduction to Systems Software	JEE 3610	3
Computer Architecture	JEE 3620	3
Independent Study (Limited to 3 units total)	JEE 4000	1 or 2 or 3
Computer Aided Systems Design	JEE 4020	3
Reliability and Quality Control	JEE 4050	3
Patent Law for Electrical Engineers	JEE 4090	3
Engineering Electromagnetics Applications	JEE 4300	3
RF and Microwave Technology for Wireless Systems	JEE 4330	3
Solid State Power Control Circuits and Applications	JEE 4340	3
Applied Optics (Physics 4323 at UMSL)	JEE 4380	3
Digital Control Systems	JEE 4420	3
Systems Engineering Lab (If not taken as 3rd lab)	JEE 4480	3
Switching Theory	JEE 4600	3
Digital IC Design and Architecture	JEE 4630	3
Digital Systems Engineering	JEE 4640	3
Digital Systems Laboratory (If not taken as 3rd lab)	JEE 4650	3
Embedded Computer Systems	JEE4670	3
Communication Theory and Systems	JEE 4710	3
Digital Signal Processing	JEE 4820	3
Signals and Systems Lab (If not taken as 3rd lab)	JEE 4880	3
Advanced Analog Electronics	JEE4920	3

As shown in Table B-21, there is a wide range of choices for the 4 electives required by the curriculum. As a result, the students can choose to enhance their Depth of Knowledge of (1) Electrical Power Systems, (2) Solid-State Devices and Circuits, (3) Control Components and Systems, (4) Computer Architecture, Hardware, and Software, (5) Communication Information Systems and Signals, and/or (6) Electromagnetic Engineering Techniques.

For each course offered in the JEE program with engineering topics, we have defined the units attributable to engineering science and engineering design. The Course Outlines provided in Appendix I.B include a breakdown of the credit given for engineering science and engineering design for each course.

The definitions for engineering science and engineering design are as follows. The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

The JEE curriculum is designed so that each student completes at least 15 units of engineering design.

Capstone Design Course As shown in Table B-20, the JEE program culminates in a capstone design course called Electrical Engineering Design Projects (JEE4980) that is taken the last semester before graduation. This course calls on the student to use the experience and knowledge gained during the JEE program to solve a significant design problem.

As indicated elsewhere in this report, the evening JEE courses follow the day school courses very closely in content and structure and, in fact, the capstone “Electrical Engineering Design Projects” course is often offered as a joint day school/evening school course. For the fall 2006, significant changes and improvements are planned for the day school course and the evening school JEE4980 capstone course will follow the lead of the day school course.

One other note is that the capstone “Electrical Engineering Design Projects” course is not the only course that includes significant design projects. The “Power, Energy, and Polyphase Circuits” course (JEE3320) that all JEE students are required to take includes a complex design project. JEE students are also required to take either the “Electronics Laboratory” (JEE3310) or the “Digital Systems Laboratory” (JEE4650) or the Systems Engineering Laboratory (JEE4480) of the Signals and Systems Laboratory (JEE4880). These laboratory courses, in which students work in groups, also provide significant design experience for students. JEE students usually take either JEE3310 or JEE4650. JEE3310 has a 3 week design/build/test/demo/report project while JEE4650 has a minimum of 3 software/system design projects.

Criterion 4(c) General Education Criterion 4(c) states that the professional component must include a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

The requirements for the general education component are set and monitored by UMSL. These requirements include English, Mathematics, Science, Humanities, Social Studies, etc. Also included in these general education requirements are topics such as English competency, cultural diversity, and valuing skills. Evaluation, Advising, and Monitoring of students for completion of these general education requirements is performed by an Advisor at UMSL, Ms. Mary McManus.

Acceptance into UMSL requires that students demonstrate several basic skills. All students must show from their high school or college transcript, by examination or appropriate courses, competency in basic communication and mathematical skills. Additional communication skills must be completed before graduation.

General education requirements at UMSL for the JEE program are as follows:

1. Freshman English Composition – Satisfied by English 1100;
2. Math Proficiency – Satisfied by Calculus Course (Math 1800, 1900, or 2000);
3. Goal #1 - Communication Requirement- Take History 1001, 1002, or 1004;
4. Goal #2 – Managing Information Skills – Satisfied by Chemistry I (Chem 1111);
5. Goal #3 – Valuing Skills – Satisfied by Anthropology 1011, Economics 1001, Music History & Literature 1090, Philosophy 1120 or 1125, or Political Science 1100;
6. Goal #4 – Social and Behavioral Science (3 courses required). One must be from History 1001, 1002, 1003, 1004 or Political Science 1100. The other 2 from Anthropology, Biology, Communication, Criminology, Economics, Geography, History, Political Science, or Sociology;
7. Goal #5 – Humanities (3 courses required). Take Philosophy 3380 (Philosophy of Science) and 2 others from Philosophy, Art History, English, French, German, Modern Greek, Media, Music Education, Music History & Literature, Philosophy, Spanish, Theater &Dance;
8. Goal #6 – Math and Natural Science (4 courses required). Satisfied by Chemistry I & II (Chem 1111 &1121) and Physics I & II (Physics 2111 & 2112);
9. A minimum of 42 hours is required to satisfy the general education requirements.

Note that some courses can be used to satisfy more than one requirement, for example, History 1001, 1002, of 1004.

Note also that requirements 1, 2, and 8 are automatically satisfied by completion of the Pre-Engineering Requirements.

One other comment is that an advance writing course is normally included in the UMSL general education requirements, but for the JEE Program, this course is included in the list of Core Engineering upper level requirements for courses taught at WU. This course, Engineering Communications (JEC3100) at WU may also be taken as Technical Writing (English 3130) at UMSL.

The college mathematics and basic science requirements for the BSEE degree were shown previously in Table B-19. Table B-22 below lists the additional general education requirements for the BSEE degree that were describe above with the addition of the advanced writing course.

Note that Engineering Ethics (Philosophy 2259) is a required course beginning in the fall 2006.

Table B-22 General Education Requirements Excluding College Math and Basic Science

Subject	Course	Units
English Composition	English 1100	3
Engineering Communication	English 3100 or English 3130 (UMSL)	3
Engineering Ethics	Philosophy 2259	3
Humanities	Free Electives	6
Social Studies	Free Electives	9
Total Units (Credit Hours)		24

The total number of units required for the BS in Electrical Engineering is 127 units which is approximately 16 credit hours per semester if the curriculum is completed in 4 years. The total number of 24 units attributable to general education topics corresponds to 0.8 years of study, providing the general education component required by ABET Criterion 4 (b).

One final note is that Table I-1 in Appendix I also lists the Pre-Engineering, Core Engineering, and Electrical Engineering Major courses. The list in Table I-1 of Appendix I also indicates which courses by the following categories: (1) Math and Science, (2) Engineering Topics, (3) General Education, and (4) Other. The information shown in Tables B-19 through B-22 is shown in a slightly different form for ease of explanation, but is consistent with the material shown in Table I-1 of Appendix I.

The Course Syllabi for all the required and elective engineering courses taken at WU for the JEE Program are included in Appendix I.B with the exception of two elective courses that have not been offered in the last several years.

The Course Syllabi for the pre-engineering courses taken at the University of Missouri-St. Louis (UMSL) are included in Appendix II. These courses are common to all three programs in the Joint Undergraduate Engineering Program.

The Faculty Curriculum Vitae for the professors and instructors teaching the JEE courses are included in Appendix I.C.

5. Faculty

Faculty Size - As Table B-23 on the next page shows, the ESE Department employs 18 full-time faculty members and 37 part-time faculty members. In other words the Department has 55 total faculty members. Part-time faculty are drawn primarily from industry, namely, Boeing and Ameren, where they are employed as engineers and engineering managers.

Table B-23 also shows that there are 57 BSEE students and 29 BSSSE students in the two day-time programs. Hence there are 86 BS students in the day-time ABET accredited degree programs. The faculty also teaches 68 students in the ABET-accredited night-time Joint Electrical Engineering (JEE) program, so there are 154 BS students enrolled in ABET accredited programs in the department. When only the full-time faculty is considered, the student faculty ratio for undergraduate students is only 8.56. These statistics do not include a few students in non ABET-accredited BS programs. When all full-time and part-time faculty members are considered on a prorated full-time equivalent basis, the overall student faculty ratio for undergraduate students drops to only 5.29.

When we count all 154 undergraduate and the 116 graduate students, the total number becomes 270 and the student faculty ratio increases to 15 students per full-time faculty, which is our target figure. However, when all faculty members are considered on a prorated full-time equivalent basis, the overall student faculty ratio drops to only 9.28. Our goal is a ratio less than 10, which we have achieved.

The task of advising JEE students is performed by Dr. J. Corrigan, an Affiliate Professor in the ESE department. The extent and quality of other faculty involvement varies in terms of interactions with students, advising, service, professional development, and interactions with industry. Different faculty members are involved in different aspects of interactions with students. Our target is to get all the faculty members involved in teaching undergraduates and in committee service. All the faculty members are committed to professional development and interactions with industry.

The Table I-2 in the Appendix I shows the average section sizes for different courses based on summer 2005, fall 2005, and spring 2006 enrollment figures. It reveals that all the courses have an average section size smaller than 30 except for two courses, namely, JEM3260, Probability and Statistics for Engineering, taught in the fall 2005 and JEE3320, Power, Energy, and Polyphase Circuits, taught in the spring 2006. These courses were large because they were offered jointly with the day-time classes, namely, ESE326 and ESE332, respectively. One consideration is that most JEE students take Applied Statistics I (Math1320) at UMSL instead of JEM3260 at WU, so only a few are affected by the size of the JEM3260/ESE326 course. However, all JEE students must take JEE3320. Consideration is being given to offering both JEM3260/ESE326 and JEE3320/ESE332 both semesters to reduce their average sizes.

Table I-3 in Appendix I provides a summary of the activity distributions of the individual faculty members. This table shows that the highest percentage attributed to teaching during the academic year is 50%. This high percentage is achieved by four faculty members. A typical full-time faculty member teaches 2 or 3 courses per academic year and attributes 25% or 37.5%.

These figures support our analysis that the faculty members are not overloaded with classroom teaching and that they have sufficient time for other activities such as research and interactions with students.

Table B-23 Student Faculty Ratio Statistics

Student/faculty		April 2006
Faculty	Full time (100%)	18
	Part time (30%)	37
	Total: full-time equivalent	29.10
	Total: head count	55
BS EE	Freshman	1
	Sophomore	11
	Junior	21
	Senior	24
	Total	57
BS SSE	Freshman	0
	Sophomore	8
	Junior	9
	Senior	12
	Total	29
Day BS students	Total	86
WU/UMSL BS EE	Freshman	0
	Sophomore	0
	Junior	32
	Senior	36
	Total	68
BS students	Total	154
BS Student/full-time faculty		8.56
BS student/faculty (full-time equivalent)		5.29
Graduate students (full-time)	MS EE	19
	MS SSM	2
	MCE	1
	DSc EE	31
	DSc SSM	16
	Total	69
	Double Count	3
	Real Total	66
Graduate students (part-time)	MS EE	37
	MS SSM	10
	MCE	3
	Total	50
Graduate students	Total	116
Students (undergrad & grad)		270
Student/full-time faculty		15.00
Student/faculty (full-time equivalent)		9.28

As can be seen in Table B-24, every undergraduate course except JEE 4090, Patents Law for Electrical Engineers, can be taught by one or more of the full-time faculty.

Table B-24 JEE Courses and Full-Time Faculty Who Can Teach Them

JEE	ESE or CSE	JEE Course Title	Full-time faculty available
2300	230	Introduction to Electrical Networks	M. Arthur (+ 5 others)
2320	232	Introduction to Electronic Circuits	R. Indeck (+ 3 others)
2330	233	Electrical and Electronics Laboratory	R. Indeck (+ 3 others)
2600	260	Introduction to Digital Logic and Computer Design	Home CSE Dept.
3170	317	Engineering Mathematics	I. N. Katz (+ 5 others)
3260	326	Probability and Statistics for Engineering	I. N. Katz (+ 5 others)
3300	330	Engineering Electromagnetics Principles	B. Spielman (+ 3 others)
3310	331	Electronics Laboratory	R. Indeck (+ 3 others)
3320	332	Power, Energy and Polyphase Circuits	B. Spielman (+ 3 others)
3340	334	Network Analysis	Not currently offered
3360	336	Principles of Electronic Devices	D. Rode (+ 2 others)
3370	337	Electronic Devices and Circuits	D. Rode (+ 2 others)
3510	351	Signals and Systems	H. Mukai (+ 4 others)
3610	361	Introduction to System Software	CSE is Home Dept.
3620	362	Computer Architecture	CSE is Home Dept.
4000	400	Independent Study	Various Professors
4020	402	Computer Aided Design of Electronic Systems	Not Currently Offered
4050	405	Reliability and Quality Control	H. Mukai (+ 2 others)
4090	409	Patents Law for Electrical Engineers	Law School Instructors
4300	430	Engineering Electromagnetics Applications	B. Spielman (+ 2 others)
4330	433	RF and Microwave Tech. for Wireless Systems	B. Spielman (+ 2 others)
4340	434	Solid-State Power Circuits and Applications	B. Morley (+ 2 others)
4350	435	Electrical Energy Laboratory	B. Morley (+ 2 others)
4380	438	Applied Optics	R. Indeck (+ 2 others)
4410	441	Control Systems	J. O'Sullivan (+ 3 others)
4420	442	Digital Control Systems	B. Ghosh (+ 3 others)
4480	448	Systems Engineering Laboratory	H. Mukai (+ 2 others)
4600	460	Switching Theory	CSE is Home Dept.
4630	463	Digital Integrated Circuit Design and Architecture	CSE is Home Dept.
4640	464	Digital Systems Engineering	CSE is Home Dept.
4650	465	Digital Systems Laboratory	CSE is Home Dept.
4670	467	Embedded Computer Systems	CSE is Home Dept.
4710	471	Communication Theory and Systems	D. Fuhrmann (+ 3 others)
4820	482	Digital Signal Processing	R.M. Arthur (+ 3 others)
4880	488	Signals and Systems Laboratory	R. Morley (+ 3 others)
4920	432	Advanced Analog Electronics	D. Rode (+ 2 others)
4980	498	Electrical Engineering Design Projects	M. Arthur (+ 3 others)

Faculty Education and Experience - The following Table B-25 shows the educational levels of attainment of the faculty. In particular 100% of the full-time faculty members have the PhD while about 68% of the part-time faculty members have the PhD. These statistics are satisfactory. We are currently recruiting three full-time faculty and the candidates must have a PhD in appropriate fields. In other words, we do not plan to lower the figure of 100% PhD among the full-time faculty.

Table B-25 Statistics about the background of the faculty

		Faculty			
		Full-time		Part-time	
Education	PhD	18	100.0%	25	67.6%
	MS	0	0.0%	10	27.0%
	BS	0	0.0%	2	5.4%
	Total	18	100.0%	37	100.0%
Professional Engineer		4	22.2%	6	16.2%
Average Years of Experience	Govt./ Industry Practice	3.74 yrs		13.58 yrs	
	Total Faculty	21.79 yrs		17.36 yrs	
	This Institution	20.53 yrs		14.47 yrs	

The same table shows their experience in industry and in teaching. We note that the number of professional engineers is 4 out of 18 or 22.2% among the full-time faculty and 6 out of 25 or 16.2% among the part-time faculty. These statistics are satisfactory.

Table B-25 also shows the average numbers of years of experience. The full-time faculty has only about 4 years of government or industry practice on the average while the part-time faculty has more experience clocking 14 years on the average. This reflects the national trend of recruiting full-time faculty among fresh PhDs or young post-docs.

As far as an ability to communicate, the faculty members are striving to be effective teachers. As an example, Professor Hiro Mukai was voted by daytime graduating engineering seniors as professors of year, primarily for his approach to teaching Signals and Systems (ESE351).

Prof. Mukai has written a 1100-page textbook manuscript for this required course, and he has also devised a more engaging teaching method in the same course. In this approach, the students were given a reading assignment of relevant sections ahead of each class, then in each class after a short 3-minute quiz to encourage their reading, students solve problems in groups of 3 or 4 students with the help of the instructor. The students' feedback is generally positive about this teaching method. Part-time instructors teaching JEE3510, Signals and Systems, are using this book as a guide for teaching this required evening class.

Professors Arthur, Rode, and Preza employ a more intensive approach in the Introduction to Electrical Networks (ESE 230) course. Each week they give a 20-minute quiz similar to the preceding week's homework problems. Professor Preza has also employed this technique in teaching Introduction to Electrical Networks (JEE2300) in the evening JEE program.

Professor Corrigan introduced significant use of PSpice while teaching Introduction to Electronic Circuits (ESE232/JEE2320) in the daytime and evening classes. In his role as JEE Program Coordinator, Professor Corrigan has insisted that PSpice to be introduced in the Introduction to Electrical Networks (JEE2300) course and used in several experiments in the Electrical and Electronic Circuits Laboratory (JEE2330) course. This has been facilitated by the fact that Professor Corrigan is also the editor of the Exercise Manual used in JEE2330.

Professors John Corrigan and Bill Dick cooperatively taught the Electronics Laboratory (ESE331/JEE3310) last fall semester and the Electrical Energy Laboratory (ESE435/JEE4350) during several past spring semesters with Professor Corrigan teaching the daytime ESE class and Professor Dick teaching the evening JEE class. Professor Corrigan is also the editor for both of the Exercise Manuals used in these two courses. In coordination with Professor Dick, a new exercise on three phase power was written and introduced in the Electrical Energy Laboratory.

There are many more examples of improvements in the ESE/JEE course and curriculum which could be sited. Many of these are described in the section on Changes Resulting from Outcomes Assessments starting on page 49 of this report.

The participation in activities in professional societies is also relatively high. These activities. range from serving as officer for a society, committee chair and member for a conference, editor of a journal, associate editor of a journal, and reviewer for a journal or a conference.

The level of scholarship among the full-time faculty is very high as seen in the list of their publications. Even among the part-time faculty, it remains high especially among younger engineers who are actively working on a full-time engineering job

Faculty Service - The responsibilities assigned to the faculty members in the ESE Department are typical of responsibilities assigned to faculty members at our peer institutions. Specifically, the full-time faculty members are expected to teach (both at the undergraduate and graduate levels), perform research (including the guidance of graduate students and the publication of research results), and perform service (both to the University and to the wider community outside of the University). At the University level, the faculty members attend the Faculty Senate and participate in various Faculty Senate Committees. For example Prof. O'Sullivan served as Chair of the Faculty Senate and Chair of the Faculty Senate Council (7/02 – 6/04).

At the School of Engineering and Applies Science (SEAS) level, the faculty members attend the Faculty Assembly and serve on the Faculty Assembly Committees. There are several ***Standing Committees***. For 2004-2006, the ESE faculty participation in these Committees has been:

- Executive Community – Prof. C. Byrnes (Dean) and Dept. Chair (Prof. Arthur, former Chair and Prof. Nehorai, Chair as of January 2006)
- Graduate Board – Prof. O'Sullivan
- Undergraduate Board – Prof. Mukai
- CEC Advisory Board – Prof. H. Mukai and then Prof. Morley
- Discipline Committee – Prof. Schattler
- Affirmative Action Committee – Prof. Spielman

In addition to these, there are ***Ad hoc Committees*** such as:

- SEAS Promotion Committees (3 faculty members are appointed for each promotion)
- Co-op Educational Committee

ESE Departmental service includes participation in the following committees/meetings:

- Undergraduate Curriculum Committee
- Graduate Curriculum Committee
- Instructional Lab Committee: Bob Morley and Hiro Mukai
- ABET Committee
- Seminar Committee: B. Gosh, Chair
- Doctoral Qualifying Exam Committee
- Doctoral Final Exam Committee for each student
- Graduate Admission Committee
- Departmental Faculty Meetings and Retreats
- External Advisory Meetings (these provide the opportunity for interactions with industrial and professional practitioners as well as prospective employers of our graduates)
- Student Advisory Meetings and Student Lunches (these provide additional interaction of faculty members with students)
- Departmental Open House Reception – to welcome new students and their families

The Departmental service requirement includes advising of undergraduate and graduate students, as described in Section B.1 of this report. Note that the task of advising JEE students is performed by Dr. John Corrigan, an Affiliate Professor in the ESE department. All faculty members maintain office hours as part of their course instruction. Many of our professors maintain an open door policy and/or use email frequently in order to be accessible to students and help them. In addition to the responsibilities listed above, the faculty members consult with industry, both locally and nationally.

The faculty members are active in various professional societies helping them set up standards, run conferences and manage the societies. For example, the following is the list of IEEE Fellows among the ESE faculty.

- R. Martin Arthur, Ph.D., Professor of Electrical and Systems Engineering
- Christopher I. Byrnes, Ph.D., Professor of Electrical and Systems Engineering and Dean, School of Engineering and Applied Science
- David L. Elliott, Ph.D., Professor Emeritus of Systems Science and Mathematics
- Bijoy K. Ghosh, Ph.D., Professor of Electrical and Systems Engineering
- Ronald Indeck, Ph.D.,Professor of Electrical and Systems Engineering
- Alberto Isidori, Ph. D.,Professor of Electrical and Systems Engineering
- Marcel Muller, Ph.D., Professor Emeritus of Electrical and Systems Engineering
- Arye Nehorai, Ph.D., Professor and Chair of Electrical and Systems Engineering
- William F. Pickard, Ph.D., Senior Professor of Electrical and Systems Engineering

- Donald L. Snyder, Ph.D., Senior Professor of Electrical and Systems Engineering
- Barry E. Spielman, Ph.D., Professor of Electrical and Systems Engineering
- Tzyh-Jong Tarn, Ph.D., Professor of Electrical and Systems Engineering
- Charles Wolfe, Ph.D., Professor Emeritus of Electrical Engineering
- John Zaborszky, D.Sc., Senior Professor of Electrical and Systems Engineering

Faculty Curriculum Vitae - A summary curriculum vitae for all faculty members is provided in Appendix I.C of this report along with Table I-4, Faculty Analysis, which summarizes the information about each faculty member.

6. Facilities

Classrooms

Classrooms are largely provided by the School and the University. The Department supplements these classrooms by providing use of two departmental rooms for lecture classes. Most of the School-provided larger classrooms have been equipped with state-of-the-art computers, network connections, and audio-visual projection equipment to support classroom activities. Rooms are assigned to particular courses based upon class size and type of equipment needed to conduct the course. We also sometimes use our departmental conference room, which is equipped like our School-provided classrooms as noted above. This room is used for classes with fewer than 30 students when assigned classrooms around the campus do not have appropriate support or when frequent demonstrations are part of the course. Classroom availability is not a problem. Facilities for fielding laboratory classes and other facilities are described in the next section.

Laboratories

Summary of Facilities

Our laboratories are well equipped with modern equipment. Students are offered ample opportunity to use the apparatus through both scheduled and open laboratory periods. An instructor station is located in each laboratory so that instructors are readily available for interaction with the students during lab periods. Every computer at every station is networked to the internet for accessing data sheets and for printing to laser printers. Computer software tools that are available in the laboratories include: MATLAB, PSpice, Lab VIEW, Mentor Graphic ModelSim and Synplicity (for designing digital systems in Field Programmable Gate Arrays, FPGAs), Microsoft Excel and Word for data analysis and report generation. Oscilloscopes are connected to the computers for the purpose of capturing measured waveforms into word processing documents.

Assessment of equipment and instrumentation

Descriptions of the equipment and instrumentation used for instructional purposes in each laboratory are given below.

Urbauer 115 is a 1092 square foot laboratory with ten bench-configured instrument equipped workstations. Each station contains one Dell Optiplex 2.6GHz Pentium 4 computer with 18.1" LCD color monitor. Computers all have internet connection for easy access to course materials and datasheets. Student files are backed up by the server and laser printers are available on the network for student use. Special-purpose, custom laboratory fixtures are present in the laboratory. The laboratory is also equipped with self serve cabinets stoked with electronic components, cables, cable-adapters, and a digital LCR Meter. Fifty-four combination-equipped lockers are assigned to students for the deployment of tools, parts, documentation, and work in progress. Five of the stations have the power infrastructure including a Variable DC supply, and 3-phase AC needed for the Electrical Energy Lab. The following courses are taught in this lab: ESE435, JEE4350, and JEE 4650. The equipment and software in this lab is shown in Table B-26 below.

Table B-26 Urbauer 115 Equipment, Software and Additional Apparatus

Equipment in Urbauer 115			
10 Stations with Rack Mounted Equipment			
Quantity	Equipment	Manufacturer	Model
10	8.75 x 19 x 13" Rack	Hammond Manufacturing	HM627
10	2.6GHz Pentium 4 computer	Dell	Optiplex
10	18.1” Color Flat Panel LCD Monitors	Dell	1905FP
10	Digital Dual DC Power Supply	Power Designs	6010D
10	Digital Oscilloscope	Agilent	54622D
20	Xilinx Programming Cables	Xilinx	Parallel IV, HW-USB
10	Xilinx Spartan 3 development boards	Nu-Horizons	Spartan-3 1500
23	Digital Multimeter	Fluke	8050A
8	Function Generators	HP	3310A
6	Digital Wattmeter	Extech	382860
7	Analog Wattmeter	Yokogawa	2041-02
5	Dynamometer	Magtrol	HD-705-1
5	Motor 3 Ph Induction	Gould	SC
4	Motor Commutator (Universal Motor)	Boehm	17269
1	Motor Commutator	Dayton	2M145
5	Motor Pancake 3 PH	MFM	TM90-.25
5	Inverter for MFM Motor	Custom Fixture	
7	Load Box for DC Power Connections	Custom Fixture	
5	Fluorescent Lamp	Custom Fixture	
8	Isolation Transformer	Custom Fixture	
7	Phase Sequence Indicator	Custom Fixture	
7	Thermoelectric Modules	Custom Fixture	
10	FET Switches for Thermoelectric Lab	Custom Fixture	
5	Static Inverter	Custom Fixture	
5	Floodlamps	Custom Fixture	
9	Autotransformer	Staco	3PN11010
5	Radiometer/Photometer	Li-Cor	SA
14	Temp Probe	Fluke	80T-150U
5	Fresnel Lens	Custom Fixture	
5	Photo Cell Apparatus	Custom Fixture	
7	Single Ph Transformer	Custom Fixture	
7	3 Ph Transformer	Custom Fixture	
7	AC/DC Clamp On Current Probe	FW Bell	CG-100A
10	AC Clamp On Current Probe	Fluke	Y8101
11	10 Amp 100mV DC Shunt	Fluke	80J10
2	Sodium Lamps		
1	Strobotac	General Radio	1531
5	Current Transformers	Weston	461
1	Current Transformers	General Radio	JP-1
25	6V/1AH Lead Acid Batteries	Power Sonic	PS610
11	6V/8.2AH Lead Acid Batteries	Power Sonic	PS682
7	Electrical Energy Monitors	Custom Fixture	
5	Incandescent Lamp Sockets	Custom Fixture	

5	Temperature Probe Stands		
10	Clamps for Stands		
6	Digital Multimetser	Fluke	8000A
1	LCR Meter	HP	4261A

Software:	Cygwin, Linux, Microsoft Office, Microsoft Visual Studio .Net Professional
	Microsoft Windows XP, Synplicity Amplify, Synplicity Synplify Pro, Xilinx ISE.

Additional Laboratory Apparatus			
54	Combination equipped lockers		
1	Laser Printer	HP	Laserjet 5M
2	Low Pressure Sodium Lamp	Custom Fixture	VR133
1	Strobotac	General Radio	1531
2	Battery Charger	Power Sonic	PSC-124000
1	Gen-Motor Set	Westinghouse	

Bryan 316 is an 872 square-foot laboratory with 8 rack-configured instrument equipped workstations. Each station contains 1 Dell Optiplex 3.4GHz Pentium 4 computer with 17" LCD color monitor. Computers all have internet access for easy access to course materials and datasheets. Student files are stored and backed up on a Windows 2003 server, and laser printers are available on the network for student use. Special purpose, custom laboratory fixtures are present in the laboratory. The laboratory is also equipped with self serve cabinets with electronic components, cables, cable-adapters, and a digital LCR Meter. Thirty-five combination-equipped lockers are assigned to students for the deployment of tools, parts, documentation, and work in progress. The following courses are supported in this facility: ESE 141, ESE233, JEE2330, ESE331, JEE3310, ESE498, and JEE4980. The equipment and software in this lab is shown in Table B-27 below.

Table B-27 Bryan 316 Equipment, Software and Additional Apparatus

Equipment in Bryan 316			
8 Stations with Rack Mounted Equipment			
Quantity	Equipment	Manufacturer	Model
8	Stantron 2-Bay Rack	Stantron	
8	3.4 GHZ Pentium 4 computers	Dell	Optiplex GX270
8	17" Color Flat Panel LCD Monitors	Dell	1703 FPs
8	Dual DC Power Supplies	Tektronix	PS280
8	Function Generators	HP	3312A
8	Function Generators	HP	33120A
8	Digital Multimeter	HP	3478A
16	Digital Multimeter	Protek	B-845
8	Digital Oscilloscope	Agilent	54622D
8	Spectrum Analyzer	HP	2580A
6	Frequency Counter	HP	5384A
8	Data Acquisition PCI Cards	National Instruments	PCI-6025E
8	Shielded Connector Blocks	National Instruments	SCB-100

Software:	Windows XP, Orcad Pspice Student Version, Matlab, Microsoft Office		
	Atmel AVR Tools		

Additional Laboratory Apparatus			
1	LCR Meter	HP	4216A
1	Laser Printer	HP	Laserjet 4000n
35	Combination equipped lockers		

Bryan 306 is a 910 square-foot laboratory with 8 rack-configured instrument equipped workstations. Each station contains 1 Rack Mount AMD based computer with 17" color monitor. Computers all have internet access for easy access to course materials and datasheets. Student files are stored and backed up on a Windows 2003 server, and laser printers are available on the network for student use. Special purpose, custom laboratory fixtures are present in the laboratory. The laboratory is also equipped with self serve cabinets with electronic components, cables, cable-adapters, and a digital LCR Meter. Eighteen combination-equipped lockers are assigned to students for the deployment of tools, parts, documentation, and work in progress. The following courses are supported in this facility: ESE488, JEE4880 and ESE102. The equipment and software in this lab is shown table B-28 below.

Table B-28 Bryan 306 Equipment, Software, and Additional Apparatus

Equipment in Bryan 306			
8 Stations with Rack Mounted Equipment			
Quantity	Equipment	Manufacturer	Model
8	Stantron 2-Bay Rack	Stantron	
8	Rack Mounted AMD PC Computers		
4	17" Color Monitors	Sony	Multiscan 220GS
4	17" Color Monitors	NEC	Mulitsync M700
8	Dual DC Power Supplies	Tektronix	PS280
8	Function Generators	HP	3312A
8	Digital Multimeter	Fluke	8050A
8	Digital Oscilloscope	Agilent	54645D
8	Data Acquisition PCI Cards	National Instruments	PCI-6025E
8	Shielded Connector Blocks	National Instruments	SCB-100
8	Lab Trainer© Fixtures	Custom	
8	Digital Trainers	Heathkit	3700

Software	Windows XP, Orcad Pspice Student Version	
	National Instruments LabVIEW, Matlab, Microsoft Office	

Additional Laboratory Apparatus			
1	Laser Printer	HP	Laserjet 4200n
3	Ball & Beam Apparatus	Quanser Eng.	
3	Shielded Connector Blocks	National Instruments	SCB-100
18	Combination equipped lockers		

Cupples II 113 is a 515 square foot laboratory with 3 bench-configured instrument equipped workstations. Each station contains 1 Dell Optiplex computer with 17” color monitor. Computers all have internet access for easy access to course materials and datasheets. Laser printers are available on the network for student use. 3 of the stations are equipped with the ECB Spring Mass Damper System for designing control systems. The following courses are supported in this facility: ESE251. The equipment and software in this lab is shown in Table B-29 below.

Table B-29 Cupples II, Room 113 Equipment and Software

Equipment in Cupples II, Room 113			
Quantity	Equipment	Manufacturer	Model
3	2.8GHz Pentium 4 computer	Dell	Optiplex
3	Desktop Computers	Dell	Optiplex Gx1P
3	Spring Mass Damper System	ECP	210
3	Control Box for ECP 210	ECP	
3	ADC/DAC PCI Card	ECP	
3	Printers	HP	2100M

Software:	ECP Exectutive 5.1 software to control ECP 210, Microsoft Windows XP	
	Microsoft Office, Microsoft Windows XP, Matlab, Simulink	

Urbauer 14 is a 543 square-foot laboratory with 4 bench-configured instrument equipped workstations. Each station contains 1 Dell computer with 17” color monitor. Computers all have internet access for easy access to course materials and datasheets. Laser printers are available on the network for student use. 4 of the stations are equipped with Quanser Turnkey Controls system and a custom Ball and Beam fixture and a custom Inverted Pendulum fixture. The following courses are supported in this facility: ESE447 and ESE448. The equipment and software in this lab is shown in Table B-30 below.

Table B-30 Urbauer 14 Equipment and Software

Equipment in Urbauer 14			
Quantity	Equipment	Manufacturer	Model
4	3.0 GHz Celeron Computers	Dell	
4	Computers		
4	Custom Ball and Beam Fixtures		
4	Custom Inverted Pendulum fixtures		
3	ADC/DAC PCI Card	Quanser	Multi-Q
1	ADC/DAC PCI Card	Quanser	Q4
4	Power Supply	Quanser	
4	DC Motor	Quanser	
2	Rhino Robots		
1	Printer	HP	2100

Software:	Microsoft Office, Matlab, Simulink, Quanser WinCom		
	Microsoft Windows XP		

Student Lounges - The Department offers two student lounges in R00m 302 Bryan and R00m 105 Cupples 2. Each of these lounges is equipped with big tables with chairs and 3 computers with Internet connections and a printer so that students can relax as well as work together for projects and homework. These lounges promote the program outcome (d): an ability to function on multi-disciplinary teams. The first lounge is also home to our student chapters of IEEE and Eta Kappa Nu (HKN) while the second lounge is home to our student chapters of SIAM and INFORMS.

Center for Engineering Computing - The School of Engineering and Applied Science provides an excellent computing center called the Center for Engineering Computing (CEC). This center is a School-level facility that makes a variety of computational and graphics tools available for use by all engineering students. CEC provides a help desk to assist students in the use of the tools it provides. The center meets the instructional needs of engineering students and it has no mission to support the research activities of the engineering school. The center has over 160 computers placed in its 8 rooms, which are spread over the engineering complex. Its detailed description can is provided in Appendix II.

Libraries - Both WU and UMSL have excellent libraries. Students in the JEE program are able to access either of these libraries as needed. A description of the library facilities at each of the universities is provided in Appendix II.

Recent improvements to the infrastructure - All of the laboratories, as well as the supporting infrastructure, have been upgraded within the past year. New printers and Xerox machines have been added to the Labs and the offices. The network has been upgraded to handle the transfer rate of one gigabit per second, a hardware firewall has been installed, and the merged SSM and EE departments are now on the same network. Three new computers have been added to the department to upgrade the mail, web, and file servers. The computers in all 5 of the teaching labs and the software running on them have been upgraded.

Additional test equipment was purchased and upgraded in Bryan 316. 2 new stations were added to Urbauer 115. The dynomometers used in Urbauer 115 were refurbished and new custom motor mountings were built. Also, the Peltier devices were replaced and the 3-phase motor controllers were all refurbished. 10 Nu-Horizons Xilinx FPGA Spartan-3 development boards were purchased. In Bryan 306, a custom test fixture (Lab Trainer) that works with new data acquisition hardware was upgraded. Several new labs were developed using this hardware. Also, new digital trainers were purchased to replace the old ones. All inventory was reorganized in Bryan 304. In Cupples II, 113, new ADC/DAC PCI cards were purchased to replace the old ones and the ECP Executive software was upgraded. In Urbauer 14, 1 new station was added to the 3 already there.

The Department has adequate space for all of its laboratory courses and the laboratories are all in excellent condition as a result of our recent improvements.

Opportunities for students to learn the use of modern engineering tools - Students have a variety of opportunities to learn the use of modern engineering tools. The use of modern software tools is built into numerous courses. For example, PSPICE is used in the first course ESE102 and subsequent courses on networks and circuits, specifically ESE 230/JEE2330 Introduction to Networks, ESE 232/JEE2320 Introduction to Electronic Circuits, and ESE331/JEE3310 Electronics Laboratory. Experience in the use of MATLAB is incorporated into a variety of courses, including our courses on signals and systems, ESE351 Signals and Systems and ESE482 Digital Signal Processing and in our control systems courses ESE441 and ESE442.

National Instruments LabView is used in several of our laboratory classes. Modern style VLSI design is taught using Verilog and VHDL with Xilinx, Synplicity and Mentor Graphics tools. The controls labs are taught using Matlab and proprietary plug-ins from the turnkey system manufacturers to interface to their hardware. Matlab and LabView are used in ESE 488 Signals and Systems Laboratory. Matlab, PSPICE, LabView and Altera for chip design are used in ESE 498 our Senior Capstone Design course

As mentioned earlier, the Center for Engineering Computing (CEC) is a School-level facility that makes a variety of computational and graphics tools available for use by all engineering students. Modern engineering tools of use to the JEE student such as MATLAB and PSpice are also hosted on CEC computers.

Plan and Sufficiency of Resources for Facilities and Equipment - The departmental plan for lab improvement and maintenance over the next 6 years are discussed in Section B-7 on Institutional Support and Financial Resources.

7. Institutional Support and Financial Resources

The overall undergraduate instructional activities require resources for faculty (including both regular and adjunct faculty), administrative and technical support (both from within the Department, School, and University), equipment costs, space utilization, building operational expenses. The total financial resources needed to support the cost for the overall undergraduate program are well provided by the combination of: our departmental budget allocations for academic, administrative, and technical support; the combination of budget allocations and three endowed funds for undergraduate instructional equipment; and budget allocations for space usage and building operations. The institutional support for this program is appropriate.

Financial Support - We have summarized the departmental support expenditures in Table I-5, which is found in Appendix I.A. as required. First, we would like to point out that the table shows the expenditures of the Department of Electrical and Systems Engineering and not the program in question. This is because the three programs (the BSEE Program, the UMSL/WU Joint BSEE Program, and the BS in Systems Science and Engineering Program) that the Department offers are integrated and thus it is not possible to attribute these expenditures into the three separate programs. Indeed the three programs share the same lab facilities and moreover the students in some courses are from all three programs plus programs from other departments.

During 2003-2004 space and equipment was reallocated between Electrical and Systems Engineering and Computer Science and Engineering following the consolidation of Computer Engineering in Computer Science and Engineering. These changes required replication of some equipment and afforded an opportunity to upgrade facilities in both Bryan Hall 306 and 316 and in Urbauer 115. After a year of planning, we instituted a renovation of Bryan 306 and 316. Old inventory and equipment was sold for salvage and new equipment was purchased as described under Facilities, Section B6. In addition we bought new motors and fixtures for our Electrical Energy Laboratory in Ubauer 115. The total investment was over $100,000.

The endowed equipment funds provided about $70,000 a year, which is more than enough to support and periodically upgrade the teaching laboratories as well as the technical infrastructure of the Department. In 2005, equipment in all of the undergraduate teaching laboratories was updated, as indicated in the facilities section of this report. New servers were installed for our email and websites. Fiber optic networking was put in for all of the faculty offices and laboratories in the Department.

Each of our departmentally-supported graduate research assistants is required to help a professor in a course. The expenditures attributable to this are listed as Graduate Teaching Assistants in the table. Finally the department hires graders to cover the rest of the courses and these expenditures are listed as Part-time Assistance in Table I-5.

Washington University provides to UM-St. Louis what is essentially a “turnkey” upper-division engineering program, the UM-St. Louis/Washington University Joint Undergraduate Engineering Program. All upper-division engineering courses and laboratories in our Joint Program with UM-St. Louis are held on the Washington University campus, not on the UM-St. Louis campus. Joint Program students are taught by the same engineering faculty members in the same classrooms and laboratories as the Washington University undergraduates. Joint Program students rely on the Washington University libraries and computing facilities and even use The Career Center at Washington University for their job searches.

To support that activity, UM-St. Louis pays an annual fee to the School of Engineering and Applied Science at Washington University. A portion of that fee is included in the operating appropriations shown for each of the three departments that participate in the Joint Program: civil engineering, electrical and systems engineering, and mechanical and aerospace engineering. Because these two student populations are essentially fully integrated insofar as their engineering education is concerned, we make no attempt to do a separate cost accounting for each population.

Program Leadership - Leadership at Washington University for the Joint Undergraduate Engineering Program is provided in the School of Engineering and Applied Science (SEAS) by both Dean Christopher I. Byrnes and Vice Dean William Darby, who is the Dean of the Joint Undergraduate Engineering Program. Note that Mary Sansalone will be replacing Christopher Byrnes as Dean on July 1, 2006.

Undergraduate program leadership within the Department of Electrical and Systems Engineering (ESE) is provided by the Department Chair by Arye Nehorai, the Associate Chair Hiro Mukai, by the departmental ABET Committee chaired by Hiro Mukai, and by the departmental Undergraduate Curriculum Committee chaired by Robert Morley. Other members of these two committees are listed in Figure B-1 of this report.

Leadership for the Joint Electrical Engineering (JEE) program itself within the ESE department is provided by Professor Hiro Mukai, the Associate Chair and Director of Undergraduate Programs, and by Affiliate Professor John Corrigan, JEE Program Coordinator and Advisor.

In conclusion, the resources for this program are adequate at present to enable accomplishment of the objectives. The leadership for the JEE Program is both constructive and active on a regular basis.

Professional development of our faculty is nurtured in several ways. New hires in our department are provided by the Department with sufficient funds to attend five conferences of their choice per year for the first two years of their career. This support helps to keep them abreast of the latest advances in their field, but also serves to set the tone for the importance of continued professional development.

More generally, the School of Engineering provides a professional development allotment to every member of the regular faculty in the School of Engineering and Applied Science. That allotment has recently been increased by our Dean to $1000 per year, with the possibility that this may be carried over each year for up to three years. Each regular faculty member has complete discretion over how they choose to utilize their own fund for professional development. Most faculty apply these funds either to attend conferences and workshops in their field of specialty or to augment their personal computer support resources. The Department also allocates resources to meet most needs for software development to provide improved instructional capability for all parts of our undergraduate programs. The Department also allocates a budget to improve the Department's Resources. In establishing that budget resources are identified for infrastructure requirements, software support, seminar speakers, and faculty travel to assist all faculty members in meeting their professional needs.

Plan and Sufficiency of Resources for Facilities and Equipment - At this moment, we see a need for more office spaces for the Department in the coming academic year due to new hires. Specifically we need a new office for each of the three faculty members joining us next year as well as more desk space for adjunct professors. Moreover we will need more research lab space for at least one new faculty member. As for instructional labs, we have a budget of $20,000 for equipment acquisition and maintenance. In the following table, Table B-31, we present our plan for lab equipment acquisition and maintenance.

As indicated in Table B-31, we plan to replace computers every three or four years. The other equipment has a slightly longer life but it is also replaced from time to time. These replacements are planned in order to keep the students abreast with the latest equipment that they will be using in their future positions in industry or in graduate schools.

Table B-31 Future Lab Equipment Maintenance Plan

	Equipment			Year					
Room	**Item**	**unit price**	**No**	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**
Soft-ware	Matlab License	$2,000		$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
	Labview License	$400		$400	$400	$400	$400	$400	$400
Bryan 316	computers	$1,200	8				$9,600		
	data acquisition cards	$1,000	8				$8,000		
	other equipment								
Bryan 306	computers	$1,200	8			$9,600			
	data acquisition cards	$1,000	4			$4,000			
	other equipment								
Cupples II 113	computers	$1,200	3		$3,600				$3,600
	data acquisition cards	$1,500	3		$4,500				$4,500
	Lego Mindstorm robots	$300	8	$2,400				$2,400	
	software update	$1,100	3					$3,300	
Urbauer 14	computers	$1,200	4		$4,800				$4,800
	data acquisition cards	$1,500	1		$1,500				$1,500
	double jointed pendulum	$1,500	4	$6,000					
	software update	$1,100	4					$4,400	
Urbauer 115	computers (CSE dept)								
	other equipment			$8,000		$4,000		$8,000	
	Subtotal for the year			$18,800	$16,800	$20,000	$20,000	$20,500	$16,800
	Budget			$20,000	$20,000	$20,000	$20,000	$20,000	$20,000

Technical Support - The ESE Department has two technical staff members working in dual roles as technicians as well as network and computer systems administrators. The department has a well equipped and well stocked electronics shop. In their role as technicians, the two staff members maintain and calibrate the electronic equipment used in undergraduate laboratories and also support the departmental computing resources mentioned above.

Both technical staff members are also talented network and computer-systems administrators. In this capacity, they maintain and upgrade the operational status of both software and hardware for our network and myriad of workstations and servers. These staff members are available as a resource to all departmental faculty members for both troubleshooting needs and for assistance in implementing new operating systems and applications.

Both of these technical staff members have computers connected to the department network. At this time, we feel our technical staff to be adequate.

The Department currently has a staff of 4 Administrative Aides and a Department Administrator to support faculty activities, including undergraduate education. Each of these staff members has on their desk an IBM PC-style computer that is connected to the departmental network. This facilitates interaction between the faculty and staff to a great degree. All the staff documents are stored on a server that is backed up nightly.

Professional Development - As part of professional development, the University provides a collection of resources around the topic of teaching with technology, ITeach, which is a collaborative effort by the Teaching and Technology Partnership—The Teaching Center, University Libraries, and The Teaching Lab in Arts & Sciences at (http://artsci.wustl.edu/iteach/about.html).

The first campus wide ITeach symposium was hosted in January 2002, attracting an audience of over 170 faculty members and offering a selection of presentations, panel discussions, hands-on workshops and informal opportunities to engage in discussions. Since then ITeach symposia have been held on a biannual basis during winter break and they are available to all faculty members free of charge. Special events focused on a particular department or discipline may also be arranged through ITeach.

The 2002 ITeach symposium focused on:

- Managing your courses and communicating with students* Finding, creating and using appropriate resources for your courses
- Tools you can use right away: PowerPoint, web pages, online discussions, web-based tests
- New Arts and Science curriculum and teaching resources.

The 2004 ITeach symposium focused on "Innovations in Teaching":

- Telesis, Washington University's new course management system* Help in dealing with Internet plagiarism
- Teaching writing effectively
- Using digital images in teaching

- Our hopes and fears about technology in teaching & more.

The 2006 ITeach symposium focused on "Designing and Refining our Teaching" and "The Digital Library of the Future". Selected talks from the symposium are:

- Bringing research to the classroom* Evaluations techniques for curriculum development
- What's new with Telesis
- Abuse of technology and academic integrity issues in the classroom.

Institutional Services - Several institutional services that facilitate our program to achieve its educational objectives are discussed in Appendix II, Section 10. Here we mention some of these services:

- The School of Engineering and Applied Science maintains a Tutoring Program that provides free tutoring to all engineering undergraduate students;
- The Engineering Machine Shop provides design, fabrication, welding, and repair services for parts, instruments, and equipment;
- The Center for Engineering Computing (CEC) provides educational computer services to the School of Engineering and Applied Science at Washington University. CEC services are available to all engineering students, as well as faculty, and staff. A detailed description of all the CEC services (network, wireless, labs, software, web services, video conferencing, help center) can be found in Appendix II, Section 10.d of this report.
- The Cooperative Education office provides individualized assistance in a job search for cooperative education and for summer, part-time, or full-time employment.

In addition to the services mentioned above, students in the School of Engineering & Applied Science have full access to:

- All fourteen libraries found on the Danforth, Medical, and West campuses at Washington University as the libraries located on the University of Missouri – St. Louis campus. The newly renovated Olin Library is a clear example of the transformation that Washington University Libraries have undergone over the last ten years.
- The resources and services of The Career Center at the University of Missouri – St. Louis to help them obtain full-time employment and opportunities after completing their undergraduate engineering degrees.

A detailed description of the libraries and the career center is included in Appendix II, Section 6 of this report.

Washington University offers excellent services to our students and our programs are well supported.

8. Program Criteria

The JEE Program is structured to provide both a breadth and depth of knowledge across the range of electrical engineering topics. The program was described in some detail in Section B.4. Here, we highlight how the JEE program satisfies the requirements of ABET Criterion (8) for Electrical Engineering.

The Joint Electrical Engineering (JEE) program curriculum is divided into two phases. The first is the Pre-Engineering Phase with courses taken at the University of Missouri-St. Louis (UMSL) or, in some cases, at local Community Colleges. The second phase is the Upper Level Electrical Engineering Phase with course taken primarily at Washington University in St. Louis (WU).

The Pre-Engineering phase includes English, Mathematics, Science, Humanities, Social Science, and the first two engineering courses, namely, Statics and Dynamics. This phase satisfies the requirement for knowledge of mathematics through differential and integral calculus and basic sciences. The courses taken during the Pre-Engineering phase are shown in Table B-32 below. Note that Engineering Ethics (Philosophy 2259) will be a required Humanities course beginning with the fall 2006 semester. Note also that elective Social Studies courses satisfy Missouri's requirements for a History and/or Government course and a Cultural Diversity course.

Table B-32 Pre-Engineering Curriculum

Subject	**UMSL Course Number**	**Units**
English Composition	English 1100	3
Humanities (Engineering Ethics)	Philosophy 2259 + 2 Elective Courses	9
Social Studies	3 Elective Courses (Satisfies Missouri's Requirements for History/Government and Cultural Diversity courses)	9
Analytic Geometry and Calculus I	Math 1800	5
Analytic Geometry and Calculus II	Math 1900	5
Analytic Geometry and Calculus III	Math 2000	5
Differential Equations	Math 2020	3
Introductory Chemistry I	Chemistry 1111	5
Introductory Chemistry II	Chemistry 1121	5
Physics: Mechanics & Heat	Physics 2111	5
Physics: Electricity, Magnetism, & Optics	Physics 2112	5
Statics	Engineering 2310	3
Dynamics	Engineering 2320	3
Total Units (Credit Hours)		65

The Upper Level Electrical Engineering curriculum in this program is divided into two categories: (1) Core Engineering courses and (2) Electrical Engineering Major courses. This phase satisfies the requirement for knowledge of computer science and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components appropriate the field of electrical engineering.

The Core Engineering courses are so named because they are common courses taken by most Civil, Electrical and Mechanical Engineering students in the Joint Undergraduate Engineering Program. The Core Engineering courses shown in Table B-33 below are those required for both Electrical Engineering (EE) and Mechanical Engineering (ME) students. As shown, in addition to Engineering Communications (Technical Writing), these courses provide a breath of knowledge across several fields, including mathematics, probability and statistics, and computer science. The Electrical Networks (JEE2300) and the Electrical and Electronic Circuits Laboratory (JEE2330) provide and introduction to electrical engineering for both EE and ME students. Statics and Dynamics, taken as part of the Pre-Engineering Curriculum, together with Thermodynamics (JME3200) provide an introduction to mechanical engineering for EE and ME students. Control Systems (JEE4410/JME4310) is common to both EE and ME curriculums.

Table B-33 Core Engineering Courses (Electrical and Mechanical Engineering)

Subject	**Course**	**Units**
Engineering Communications	JEC 3100 or English 3120 (UMSL)	3
Thermodynamics	JME 3200	3
Engineering Mathematics	JEM3170	4
Probability and Statistics for Engineering	JEM 3260 or Math 1320 (UMSL)	3
Introduction to Computer Programming	JCS 1260 or CS 1250 (UMSL)	3
Introduction to Computing Skills: MATLAB	JCS 1002	1
Introduction to Electrical Networks	JEE 2300	3
Electrical and Electronic Circuits Laboratory (Lab 1)	JEE 2330	3
Control Systems	JEE4410 or JME4310	3
Total Units (Credit Hours)		26

The additional required Electrical Engineering Major courses are defined in Table B-34 below. As shown, students must also take courses in (1) digital logic, (2) electronic circuits, (3) electromagnetics, (4) power, energy, and polyphase circuits, and (5) signals and systems. They also must complete two laboratory courses in addition to the Electrical and Electronic Circuits Laboratory (JEE2330) taken as part of the Core Engineering curriculum. Students must take the Electrical Energy Laboratory (JEE4350) as the second laboratory course and may choose the third (and fourth) laboratory course to correspond to their desired area of specialization. In addition, students must choose 4 electives in the electrical engineering and are also required to take the capstone senior design course called Electrical Engineering Design Projects (JEE4980).

The Upper Level Electrical Engineering curriculum provides the breath of knowledge through the list of required courses Core and Major engineering courses. As described later in more detail, depth of knowledge in at least 2 areas of specialization in electrical engineering is required of each student. The six specializations supported by the JEE program are: (1) Electrical Power Systems; (2) Solid-State Devices and Circuits; (3) Control Components and Systems; (4) Computer Architecture, Hardware, and Software; (5) Communications and Information Systems; and (6) Electromagnetic Engineering Techniques.

Table B-34 Electrical Engineering Major Courses

Subject	Course	Units	Where Taken
Intro to Digital Logic and Computer Design	JEE2600	3	WU
Intro to Electronic Circuits	JEE2320	3	WU
Engineering Electromagnetics Principles	JEE3300	3	WU
Power, Energy, and Polyphase Circuits	JEE3200	3	WU
Signals and Systems	JEE3510	3	WU
Electrical Energy Laboratory	JEE4350	3	WU
Electronics Laboratory or Digital Systems Laboratory or Systems Engineering Laboratory or Signals and Systems laboratory	JEE3310 or JEE4650 or JEE4480 or JEE4880	3	WU
Electrical Engineering Elective #1	See Table B-35	3	WU
Electrical Engineering Elective #2	See Table B-35	3	WU
Electrical Engineering Elective #3	See Table B-35	3	WU
Electrical Engineering Elective #4	See Table B-35	3	WU
Electrical Engineering Design Projects	JEE4980	3	WU
Total Units (Credit Hours)		36	

The Elective Electrical Engineering courses are shown in Table B-35 below.

Table B-35 Elective Electrical Engineering Courses

Subject	Course	Units	Where Taken
Network Analysis	JEE3340	3	WU
Principles of Electronic Devices	JEE3360	3	WU
Electronic Devices and Circuits	JEE3370	3	WU
Intro to Systems Software	JEE3610	3	WU
Computer Architecture	JEE3620	3	WU
Computer Aided Design of Electronic Systems	JEE4020	3	WU
Reliability and Quality Control	JEE4050	3	WU
Patent Law for Electrical Engineers	JEE4090	3	WU
Engineering Electromagnetics Applications	JEE4300	3	WU
RF and Microwave Technology for Wireless Systems	JEE4330	3	WU
Solid-State Power Circuits & Applications	JEE4340	3	WU
Applied Optics	JEE4380	3	WU
Digital Control Systems	JEE4420	3	WU
Switching Theory	JEE4600	3	WU
Digital Integrated Circuit Design and Arch.	JEE4630	3	WU
Digital Systems Engineering	JEE4640	3	WU
Embedded Computer Systems	JEE4670	3	WU
Communication Theory and Systems	JEE4710	3	WU
Digital Signal Processing	JEE4820	3	WU
Advanced Analog Electronics	JEE4920	3	WU

Criterion (8) requires that students receive both a breath of knowledge and a depth of knowledge in electrical engineering. The depth of knowledge is provided by being sure that students complete courses in at least two areas of specialization. An area of specialization is defined for the JEE program as an area of study having (1) a required course in the area, (2) a laboratory course in the area, and (3) one or more electives in the area. JEE Program Areas of Specialization are shown in Table B-36.

Table B-36 JEE Program Areas of Specialization

Area of Specialization	Type Course	Course Number	Course Title
Power Systems	Required	JEE3320	Power, Energy, and Polyphase Circuits
	Laboratory	JEE4350	Electrical Energy Laboratory
	Elective	JEE4340	Solid-State Power Control Circuits & Applications
Solid-State Devices & Circuits	Required	JEE2320	Intro to Electronic Circuits
	Laboratory	JEE3310	Electronics Laboratory
	Elective	JEE3360	Principles of Electronic Devices
	Elective	JEE3370	Electronic Devices and Circuits
	Elective	JEE4340	Solid-State Power Control Circuits & Applications
	Elective	JEE4380	Applied Optics
	Elective	JEE4640	Digital Systems Engineering
	Elective	JEE4920	Advanced Analog Electronics
Control Components & Systems	Required	JEE4410	Control Systems
	Laboratory	JEE4480	Systems Laboratory
	Elective	JEE4420	Digital Control Systems
Computer Architecture, Hardware, & Software	Required	JEE2600	Intro to Digital Logic & Computer Design
	Laboratory	JEE4650	Digital Systems Laboratory
	Elective	JEE3610	Intro to Systems Software
	Elective	JEE3620	Computer Architecture
	Elective	JEE4600	Switching Theory
	Elective	JEE4630	Digital Integrated Circuit Design & Architecture
	Elective	JEE4640	Digital Systems Engineering
	Elective	JEE4670	Embedded Computer Systems
Communication & Information Systems	Required	JEE3510	Signals and Systems
	Laboratory	JEE4880	Signals and Systems Laboratory
	Elective	JEE4710	Communication Theory and Systems
	Elective	JEE4820	Digital Signal Processing
Electromagnetic Engineering Techniques	Required	JEE3300	Engineering Electromagnetics Principles
	Laboratory	JEE3310	Electronics Laboratory
	Elective	JEE4300	Engineering Electromagnetics Applications
	Elective	JEE4330	RF & Microwave Technology for Wireless Systems
Other Elective Courses	Elective	JEE3340	Network Analysis
	Elective	JEE4020	Computer Aided Design of Electronic Systems
	Elective	JEE4050	Reliability and Quality Control
	Elective	JEE4090	Patent Law for Electrical Engineering

Most JEE students obtain Electrical Power Systems as an area of specialization by taking Solid-State Power Control Circuits and Applications (JEE4340) as an elective. As shown in Table B-36, other areas of emphasis are: Solid-State Devices and Circuits; Control Components and Systems; Computer Architecture, Hardware, and Software; Communications and Information Systems; and Electromagnetic Engineering Techniques.

ABET Criterion (8) also requires that Electrical Engineering Programs demonstrate that graduates have a knowledge of probability and statistics, advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics. These are all included in the JEE program as described herein.

Probability and Statistics – All JEE students are required to take Probability and Statistics for Engineering (JEM3260) at WU. Applied Statistics I (Math 1320) at UMSL may be substituted.

Differential Equations – All JEE students are required to take Differential Equations (Math 2020) at UMSL or the equivalent course at a Community College.

Advanced Mathematics – All students are required to take Engineering Mathematics (JEM3170) at WU. This course covers Laplace transforms and applications; series solutions of differential equations, Bessel’s equation, Legendre’s equation, special functions; matrices, eigenvalues, and eigenfunctions; boundary value problems and spectral representations; Fourier series and Fourier integrals; and solution of partial differential equations.

Linear Algebra – Linear algebra is covered in Engineering Mathematics (JEM3170) under the subject of matrix analysis. In addition, linear algebra is used extensively in the solution of node voltage and mesh loop equations in the Intro to Electrical Networks (JEE2300) course.

Complex Variables – Complex variables are included in Engineering Mathematics (JEM3170) in considering Fourier series and Fourier integrals as well in the subject of Laplace transforms and their applications. In addition, complex variables are used extensively in the Introduction to Electrical Networks (JEE3170) course in the definition of impedances and admittances and the stead-state solution of AC circuits using Phasors. Complex variables are also used extensively in the Signals and Systems (JEE3510) course where Fourier series and integrals are considered.

Discrete Mathematics - Discrete mathematics is covered in several of the JEE program required courses as well as in many of the JEE electives. Among required courses, JEM3260, Probability and Statistics for Engineering, deals with elementary set theory and combinatorics; JEE2600, Introduction to Digital Logic and Computer Design, teaches Boolean algebra, digital logic, and logic minimization techniques; JEE3510, Signals and Systems, discusses discrete-time systems and z-transforms. Among elective courses, discrete math is used in JEE4020, Computer-Aided Design of Electronic Systems; JEE4420, Digital Control Systems; JEE4710, Communication Theory and Systems; JEE4820, Digital Signal Processing; JEE4880, Signals and Systems Laboratory; and JEE4640, Digital Systems Engineering.

We believe that the JEE program completely satisfies ABET Criterion (8) requirements.

9. General Advanced-Level Program

The Joint Electrical Engineering (JEE) program is an undergraduate engineering program leading to the BSEE degree granted by the University of Missouri-St. Louis (UMSL). There is no advanced graduate program directly associated with this program, so this section is not applicable to the JEE program.

We do note that there are two programs offered locally that JEE graduates can attend to obtain a Master Degree in Electrical Engineering (MSEE). One is the MSEE program offer by the University of Missouri-Rolla (UMR) Extension Center located on the University of Missouri-St. Louis campus. The other is the MSEE degree program offered at Washington University in St. Louis (WU).

Washington University also offers a Doctor on Science in Electrical Engineering program.

Note that a fully accredited BSEE degree is a requirement for acceptance into either of these programs, so graduates of the JEE program are eligible.

Appendix I - ADDITIONAL PROGRAM INFORMATION

A. TABULAR DATA FOR PROGRAM

Table 1. BASIC LEVEL CURRICULUM

Table 2. COURSE SIZE AND SECTION SIZE SUMMARY

Table 3. FACULTY WORKLOAD SUMMARY

Table 4. FACULTY ANALYSIS

Table 5. SUPPORT EXPENDITURES

B. COURSE SYLLABI

C. FACULTY CURRICULUM VITAE

D. JEE STUDENT ADVISORY BOARD MEETING IN NOV. 2005

E. MINUTES OF THE EXTERNAL ADVISORY BOARD MEETING IN NOV 2005

F. MINUTES OF THE EXTERNAL ADVISORY BOARD MEETING IN JUNE 2006

A. TABULAR DATA FOR PROGRAM

Tables I-1, I-2, I-3, I-4, and I-5 are included on the following pages.

Table I-1. Basic-Level Curriculum
BS Electrical Engineering-Joint Electrical Engineering Program

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours) Math & Basic Sciences	Engineering Topics *Check if Contains* *Significant Design (✓)*	General Education	Other
Phase[3]**:** Pre-engineering	English 1100, Composition		( )	3.00	
	Mathematics 1800 Analytic Geometry/ Calculus I	5.00	( )		
	Mathematics 1900 Analytic Geometry/ Calculus II	5.00	( )		
	Mathematics 2000 Analytic Geometry/ Calculus III	5.00	( )		
	Mathematics 2020 Differential Equations	3.00	( )		
	Chemistry 1111 Introductory Chemistry I	5.00	( )		
	Chemistry 1121 Introductory Chemistry II	5.00	( )		
	Physics 2111 Physics: Mechanics and Heat	5.00	( )		
	Physics 2112, Physics: Electricity, Magnetism and Optics	5.00	( )		
	Engineering 2310, Statics		3.00 ( )		
	Engineering 2320, Dynamics		3.00 ( )		
	Phil 2539, Engineering Ethics		( )	3.00	

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[3] Because this is a non-traditional part-time program for place-bound students who often go to class over an extended period of time, it is unrealistic to categorize by **Year/Semester**. Instead we break the courses into three **Phases** denominated: Pre-engineering, Engineering Core, and Engineering Major.

Table I-1. Basic-Level Curriculum (continued)
BS Electrical Engineering-Joint Electrical Engineering Program

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics *Check if Contains Significant Design (✓)*	General Education	Other
Phase[4]**:** Pre-engineering	Humanities: Free Electives		( )	6.00	
	Social Sciences: Free Electives		( )	9.00	
Phase: Engineering Core	JCS 1002, Introduction to Computing Skills: MATLAB		1.00 ( )		
	JCS 1260, Introduction to Computer Programming		3.00 (✓)		
	JEMT 3170 Engineering Mathematics	4.00	( )		
	JEC 3100 Engineering Communications		( )	3.00	
	JME 3200 Thermodynamics		3.00 ( )		
	JME 4310/JEE 4410 Control Systems I		3.00 (✓)		
	JEE 2300 Introduction to Electrical Networks		3.00 (✓)		
	JEE 2330, Electrical and Electronic Circuits Laboratory		3.00 (✓)		

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[4] Because this is a non-traditional part-time program for place-bound students who often go to class over an extended period of time, it is unrealistic to categorize by **Year/Semester**. Instead we break the courses into three **Phases** denominated: Pre-engineering, Engineering Core, and Engineering Major.
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Table I-1. Basic-Level Curriculum
BS Electrical Engineering-Joint Electrical Engineering Program

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours): Math & Basic Sciences	Engineering Topics *Check if Contains __Significant__ Design (✓)*	General Education	Other
Phase[5]: Engineer-ing Major	JEMT 3260, Probability and Statistics for Engineering	1.00	2.00 ( )		
	JEE 2600, Intro. to Digital Logic and Computer Design		3.00 (✓)		
	JEE 2320, Intro. to Electronic Circuits		3.00 (✓)		
	JEE 3300, Engineering Electromagnetics Principles		3.00 (✓)		
	JEE 3320, Power, Energy, and Polyphase Circuits		3.00 (✓)		
	JEE 3510, Signals and Systems		3.00 (✓)		
	JEE 4350, Electrical Energy Laboratory		3.00 (✓)		
	JEE 3310, Electronics Laboratory, or JEE 4650, Digital Systems Laboratory, or JEE 4480, Systems Engineering Laboratory, or JEE 4880, Signals and Systems Laboratory		3.00 (✓)		

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[5] Because this is a non-traditional part-time program for place-bound students who often go to class over an extended period of time, it is unrealistic to categorize by **Year/Semester**. Instead we break the courses into three **Phases** denominated: Pre-engineering, Engineering Core, and Engineering Major.
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Table I-1. Basic-Level Curriculum (continued)
BS Electrical Engineering-Joint Electrical Engineering Program

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Science	Engineering Topics *Check if Contains Significant Design (✓)*	General Education	Other
Phase[6]: Engineer-ing Major	JEE 4980, Electrical Engineering Design Projects		3.00 (✓)		
	JEE www Elect. Engineering Elective #1		3.00 (✓)		
	JEE xxx Elect. Engineering Elective #2		3.00 (✓)		
	JEE yyy Elect. Engineering Elective #3		3.00 (✓)		
	JEE zzz Elect. Engineering Elective #4		3.00 (✓)		
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		43	60	24	
OVERALL TOTAL FOR DEGREE	127				
PERCENT OF TOTAL		33.9%	47.2%	18.9%	
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs		
	Minimum percentage	25%	37.5 %		

[6] Because this is a non-traditional part-time program for place-bound students who often go to class over an extended period of time, it is unrealistic to categorize by **Year/Semester**. Instead we break the courses into three **Phases** denominated: Pre-engineering, Engineering Core, and Engineering Major.

Table I-2. Course and Section Size Summary

B.S. Electrical Engineering-Joint Electrical Engineering Program

Course No.	Title	No. of Sections offered in Current Year[7]	Avg. Section Enrollment[1]	Type of Class			
				Lecture	Laboratory	Recitation	Other
JME3200	Thermodynamics	1 (SP)	29[2]	100%			
JEM3170	Engineering Mathematics	3 (FL, SP, SU)	17 (31, 13, 7)[8]	100%			
JEM3260	Probability & Statistics for Engineering	2 (FL, SU)	40 (68,12)[2]	100%			
JEE2300	Introduction to Electrical Networks	3 (FL, SP, SU)	21 (25, 17, 20)[2]	100%			
JEE2320	Introduction to Electronic Circuits	2 (FL, SP)	10 (16, 4)	100%			
JEE2330	Electrical and Electronic Circuits Laboratory	2 (FL, SP)	22 (23, 20)[2]	33%[9]	67%		
JEE2600	Introduction to Digital Logic and Computer Design	2 (SP, SU)	10 (14, 5)[2]	100%			
JEE3300	Engineering Electromagnetics Principles	2 (FL, SP, SU)	17 (37, 8, 6)	100%			
JEE3310	Electronics Laboratory	1 (FL)	17	25%	75%		
JEE3320	Power, Energy and Polyphase Circuits	1 (SP)	34[2]	100%			
JEE3340	Network Analysis	0		100%			
JEE3360	Principles of Electronic Devices	2 (SP)	15[2]	100%			

(Continued on the next page)

[7] Fall 2005 (FL), Spring 2006 (SP), and Summer 2006 (SU)
[8] Number includes day school students and/or students that are not EE majors
[9] Based on scheduled time

Table I-2. Course and Section Size Summary

BS Electrical Engineering-Joint Electrical Engineering Program

Course No.	Title	No. of Sections offered in Current Year[10]	Avg. Section Enrollment	Type of Class			
				Lecture	Laboratory	Recitation	Other
JEE3370	Electronic Devices and Circuits	1 (FL, SU)	17 (28, 5)[6]	100%			
JEE3510	Signals and Systems	1 (SU)	25[6]	100%			
JEE3610	Introduction to System Software	0		20%	80%		
JEE3620	Computer Architecture	0		100%			
JEE4000	Independent Study	1 (SU)	0				100%
JEE4020	Computer Aided Design Systems	0		100%			
JEE4050	Reliability and Quality Control	1 (FL)	17[6]	100%			
JEE4090	Patent Law for Electrical Engineers	1 (SP)	28[6]	100%			
JEE4300	Engineering Electromagnetics Applications	0		100%			
JEE4330	RF and Microwave Technology for Wireless Systems	0		100%			
JEE4340	Solid-State Power Circuits and Applications	1 (FL)	22[6]	100%			
JEE4350	Electrical Energy Laboratory	1 (SP)	18	33%	67%		
JEE4380	Applied Optics	0		100%			

(Continued on the next page)

[10] Fall 2005 (FL), Spring 2006 (SP), and Summer 2006 (SU)

Table I-2. Course and Section Size Summary
BS Electrical Engineering-Joint Electrical Engineering Program

Course No.	Title	No. of Sections offered in Current Year[11]	Avg. Section Enrollment	Type of Class			
				Lecture	Laboratory	Recitation	Other
JEE4410	Control Systems (same as JME4310 in the FL & SU 2005)	2 (FL, SU)	26 (24, 27)[8]	100%			
JEE4420	Digital Control Systems	1 (SP)	11[8]	100%			
JEE4480	Systems Engineering Laboratory	0		25%	75%		
JEE4600	Switching Theory	0		100%			
JEE4630	Digital Integrated Circuit Design and Architecture	0		100%			
JEE4640	Digital Systems Engineering	1 (SP)	27[8]	100%			
JEE4650	Digital Systems Laboratory	1 (FL)	8	20%	80%		
JEE4670	Embedded Computer Systems	0		100%			
JEE4710	Communication Theory and Systems	1 (SP)	15[8]	100%			
JEE4820	Digital Signal Processing	0		100%			
JEE4880	Signals and Systems Laboratory	0		20%	80%		
JEE4920	Advanced Analog Electronics	0		100%			
JEE4980	Electrical Engineering Design Projects	2 (FL, SP)	13 (10, 16)[8]	20%	80%		

[11] Fall 2005 (FL), Spring 2006 (SP), and Summer 2006 (SU)
[8] Number includes day school students or students that are not EE majors

Table I-3. Faculty Workload Summary
B.S. Electrical Engineering Joint Program

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) **AY** = Fall 05 and Spring 06 and **SU** = Summer 06	Total Activity Distribution					
			Teaching		Research		Other	
			AY	SU	AY	SU	AY	SU
R. Martin Arthur	FT	ESE230/3 hrs	12.5%	0	55%	30%	32.5%	70%
Kurt Baudendistel	PT	ESE351/3 hrs	12.5%	0	0	0	87.5%	100%
Philip Beck	PT	JEE2600/3 hrs	12.5%	0	0	0	87.5%	100%
Christopher Byrnes	FT		0	0	40%	15%	60%	85%
Eftychios Christoforou	PT	ESE 309/3 hrs; ESE 448/3 hrs	25%	0	0	0	75%	100%
Thomas Collins	PT	ESE434/JEE4140/3 hrs; ESE 332/JEE 3320/3hrs.	25%	0	0	0	75%	100%
John Corrigan	PT	ESE232/3hrs; ESE331/1,LabA/3hrs; ESE232/3hrs	37.5%	0	0	0	62.5%	100%
William Dick	PT	JEE2330/1.5hrs, LabA/2.5hrs; JEE3310/1.5hrs, LabS/2.5 hrs; ESE435/1.5hrs, LabA/3hrs; JEE4350/1.5hrs, LabS/3hrs; ESE230/JEE2300/3.25hrs	50%	37.5%	0	0	50%	62.5%
James Dille	PT	ESE407/3hrs	12.5%	0	0	0	87.5%	100%

(Continued on the next page)

Table I-3. Faculty Workload Summary
B.S. Electrical Engineering

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) **AY** = Fall 05 and Spring 06 and **SU** = Summer 06	Total Activity Distribution					
			Teaching		Research		Other	
			AY	SU	AY	SU	AY	SU
Daniel Fuhrmann	FT	ESE102-01/2hrs; ESE102-02/2hrs, LabA/2hrs, LabB/2hrs, LabC/2hrs; ESE584/3hrs; ESE596/1.5hrs	37.5%	0	55%	30%	7.5%	70%
Narayanan Ganesan	PT	ESE447/3hrs, LabA/3hrs, LabB/3hrs	12.5%	0	0	0	87.5%	100%
Bijoy K. Ghosh	FT	ESE501/3hrs; ESE502/4.5hrs	25%	0	55%	30%	20%	70%
Xian-Zhong Guo	PT	ESE411/3hrs; ESE415/4.5hrs; ESE 411/3hrs; ESE512/4.5hrs	37.5%	37.5%	0	0	62.5%	62.5%
Ronald Indeck	FT	ESE535/3hrs.	12.5%	0	45%	20%	42.5%	80%
Alberto Isidori	PT	ESE553/3hrs	12.5%	0	10%	25%	77.5%	75%
Thomas Jolley	PT	ESE260/JEE2600/3hrs	0	37.5%	0	0	100%	62.5%
I. Norman Katz	FT	ESE317/4hrs; ESE 326/3hrs; ESE317/4hrs	45.5%	0	25%	0	29.5%	100%
Kenneth Krause	PT	JEE3300/4hrs; ESE330/JEE3300/3hrs	12.5%	37.5%	0	0	87.5%	62.5%

(Continued on the next page)

Table I-3. Faculty Workload Summary
B.S. Electrical Engineering

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) **AY** = Fall 05 and Spring 06 and **SU** = Summer 06	Total Activity Distribution					
			Teaching		Research		Other	
			AY	SU	AY	SU	AY	SU
David Kuefler	PT	JEE4650/1.5hrs, LabS/2.5hrs; JEE2330/1.5hrs, LabS/2.5hrs; ESE351/JEE3510/3.25hrs	25%	37.5%	0	0	75%	62.5%
Vladimir Kurenok	PT	ESE501/3hrs; ESE502/3hrs	0	75%	0	0	0	25%
Richard Livingston	PT	ESE498/JEE4980/1.5hrs, LabA/2.5hrs; ESE498/JEE4980/1.5hrs, LabA/2.5hrs	25%	0	0	0	75%	100%
Edward Loucks	PT	ESE556/3hrs	12.5%	0	0	0	87.5%	100%
Gregory Mayhew	PT	ESE471/JEE4710/3hrs	12.5%	0	0	0	87.5%	100%
Timothy McBride	PT	ESE409/JEE4090/3hrs	12.5%	0	0	0	87.5%	100%
Michael McCoy	PT	ESE404/3hrs	12.5%	0	0	0	87.5%	100%
Nathan McGregor	PT	JEM3170/4hrs; ESE405/JEE4050/3hrs; JEM3170/4hrs; ESE326/JEM3260/3hrs	37.5%	37.5%	0	0	62.5%	62.5%
James Meany	PT	ESE578/3hrs	12.5%	0	0	0	87.5%	100

(Continued on the next page)

Table I-3. Faculty Workload Summary
B.S. Electrical Engineering

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) **AY** = Fall 05 and Spring 06 and **SU** = Summer 06	Total Activity Distribution					
			Teaching		Research		Other	
			AY	SU	AY	SU	AY	SU
Paul Min	FT	ESE230/3hrs; ESE571/3hrs; ESE230/3hrs; ESE572/3hrs	50%	0	25%	0	25%	100%
Robert Morley	FT	ESE102/2hrs, LabA/2hrs, LabB/2hrs; ESE498/3hrs, LabA/3hrs	25%	0	25%	0	50%	100%
Hiro Mukai	FT	ESE141/2hrs; ESE251/2hrs, LabA/2hrs, LabB/2hrs; ESE351/3hrs; ESE141/2hrs; ESE516/3hrs	37.5%	0	25%	10%	37.5%	90%
Marcel Muller	PT		0	0	0	0	100%	100%
Arye Nehorai	FT		0	0	25%	66%	75%	34%
Joseph O'Sullivan	FT	ESE523/3hrs; ESE597/2hrs; ESE524/3hrs; ESE597/2hrs	25%	0	55%	30%	20%	70%
Emir Osmanagic	PT	JEE2320/3hrs; JEE2320/3hrs	25%	0	0	0	75%	100%
William Pickard	PT		0	0	15%	15%	85%	85%
Chrysanthe Preza	FT	ESE230/3hrs; JEE2300/3hrs; JEE2330/3hrs	37.5%	0	20%	50%	42.5%	50%

(Continued on the next page)

Table I-3. Faculty Workload Summary
B.S. Electrical Engineering

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) **AY** = Fall 05 and Spring 06 and **SU** = Summer 06	Total Activity Distribution					
			Teaching		Research		Other	
			AY	SU	AY	SU	AY	SU
Edward Richter	PT	ESE488/JEE4880/1.5hrs, LabA/3hrs	25%	0	0	0	75%	100
Daniel Rode	FT	ESE337/JEE3370/3hrs; ESE436/3hrs; ESE230/3hrs; ESE336/JEE3360/3hrs; ESE337/JEE3370/3hrs	50%	37.5%	25%	0	25%	62.5%
Ervin Y. Rodin	FT	ESE403/3hrs; ESE 517/3hrs; ESE414/3hrs.	37.5%	0	25%	100%	37.5%	0
Heinz Schaettler	FT	ESE499/3hrs; ESE520/3hrs; ESE309/3hrs; ESE521/3hrs	37.5%	0	25%	20%	37.5%	80%
Barbara Shrauner	PT		0	0	0	0	100%	100%
Donald Snyder	PT		0	0	10%	10%	90%	90%
Barry Spielman	FT	ESE330/JEE3300/3hrs; ESE538/3hrs; ESE 330/3hrs; ESE433/JEE4330 3hrs.	50%	0	25%	0	25%	100%
Karl Spuhl	PT	ESE441/JEE4410/3hrs.	0	37.5%	0	0	0	62.5%
Eric Sutton	PT	ESE442/JEE4420/3hrs	12.5%	0	0	0	87.5%	100%

(Continued on the next page)

Table I-3. Faculty Workload Summary
B.S. Electrical Engineering

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) **AY** = Fall 05 and Spring 06 and **SU** = Summer 06	Total Activity Distribution					
			Teaching		Research		Other	
			AY	SU	AY	SU	AY	SU
Tzyh-Jong Tarn	FT	ESE551/3hrs.;ESE446/3hrs; ESE552/3hrs.	37.5%	0	25%	20%	37.5%	80%
Jason Trobaugh	FT	ESE482/3hrs; ESE 483/3hrs; ESE587/3hrs	37.5%	0	30%	30%	32.5%	70%
Ilker Tunay	PT	ESE441/3hrs; ESE441/3hrs	25%	0	0	0	75%	100%
Alan Wheeler	PT	ESE326/JEE3260/3hrs; ESE317/4hrs; ESE326/3hrs; ESE317/JEM3170/4hrs	41.5%	41.5%	0	0	58.5%	58.5%
Kevin Wise	PT	ESE443/3hrs; ESE425/3hrs	25%	0	0	0	75%	100%
John Zaborsky	PT		0	0	0	0	100%	100%

(Continued on the next page)

Table I-4. Faculty Analysis
B.S. 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
Arthur, R. Martin	Prof.	FT	Ph.D.	Univ. of Pa., 1968	--	36	36	MO	SIM(H) IEEE(M) AIUM(L)	High	None
Aucamp, Donald C.	Adj. Prof.	PT	D.Sc.	Washington Univ., 1971		5	5		None	None	None
Baudendistl, Kurt	Adj. Prof.	PT	Ph.D.	Georgia Institute of Technology, 1992	16	<1	<1		IEEE(L) IEEE-SPS(L)	Low	High
Beck, Philip Joseph	Adj. Prof.	PT	M.S.	Washington Univ., 1991	8	8	8		None	None	High
Byrnes, Christopher	Prof./Dean	FT	Ph.D.	Univ. of MA., 1975		30	16	MO	SIAM IEEE AMS ASEE AIAA AAAS	High	Low
Christoforou, Eftychios	Adj. Prof.	PT	Ph.D.	Univ. of Canterbury, New Zealand, 2000	10	2	1		IEEE(L) ISMRM(L)	High	Med
Collins, Thomas P.	Adj. Prof.	PT	M.S.	Washington Univ., 1974	33	24	24	MO/IA/IL	IEEE EKN NFPA ACM	Low	High
Corrigan, John D.	Affiliate Prof.	PT	Ph.D.	Univ. of Mo.-Rolla, 1973	33	25	25		IEEE (L) AIAA(M)	None	None
Dick, William K.	Adj. Prof.	PT	M.S.	Univ. of Mo., 1952	46	42	37	MO	IEEE(L)	None	None
Dille, James	Adj. Prof.	PT	Ph.D.	Harvard Univ., 1988	20	17	17		None	Low	Medium
Fuhrmann, Daniel R.	Prof.	FT	Ph.D.	Princeton Univ., 1984	2	21	21		IEEE(H)	High	Low
Ganesan, Narayan	Instructor	PT	MS	Washington Univ., 2002		2	2				

Table I-4. Faculty Analysis
B.S. Electrical Engineering

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience: Govt./ Industry Practice	Years of Experience: Total Faculty	Years of Experience: This Institution	State in which Registered	Level of Activity (high, med, low, none): Professional Society (Indicate Society)	Level of Activity: Research	Level of Activity: Consulting/ Summer Work in Industry
Ghosh, Bijoy K.	Prof.	FT	Ph.D.	Harvard Univ., 198[illegible]		22	22		IEEE(H)	High	None
Guo, Xian-Zhong	Adj. Prof.	PT	Ph.D.	Univ. of Md., 1992	13	11	11		IEEE(L)	High	FT Industry
Indeck, Ronald S.	Prof.	FT	Ph.D.	Univ. of Mn., 1987	3	18	18		IEEE(H)	Medium	Low
Isidori, Alberto	Prof.	PT	Libera Docenza	Univ. of Rome, 1969		30	16		IEEE(L)	High	None
Johnston, Alan B.	Adj. Prof.	PT	Ph.D.	Lehigh Univ., 1994	13	1	1		ITEF(H) IEEE(L)	High	NA
Jolley, Thomas P.	Adj. Prof.	PT	BSEE	Univ. of Mo.-Rolla, 1983	22	5	5		ACM(L) SIGGRAPH(L)	None	High
Joseph, Jenner	Instructor	PT	MS	Washington Univ., 2002		1	1				
Katz, I. N.	Prof.	FT	Ph.D.	M.I.T., 1959	8	41	38		SIAM(H) AMS(L) MAA(M)	High	None
Krause, Kenneth Edward	Adj. Prof.	PT	D.Sc.	Washington Univ., 1995	18	8	8		IEEE(L)	None	High
Kuefler, David A.	Adj. Prof.	PT	M.S.	Washington Univ., 1994	9	7	7		None	None	High
Livingston, Richard A.	Adj. Prof.	PT	D.Sc.	Washington Univ., 1998	27	7	7	MO	IEEE(L) OSA(L)	Medium	NA

Table I-4. Faculty Analysis
B.S. 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
Loucks, Edward P.	Adj. Prof.	PT	D.Sc.	Washington Univ., 1994		8	8		SIAM MAA		
Mayhew, Gregory	Adj. Prof.	PT	Ph.D.	Univ. of Southern California, 1988	27	<1	<1		IEEE(H) SAE(L) AFCEA(L) AOC (L)	High	High
McBride, Timothy B.	Adj. Prof.	PT	J.D.	Indiana University, 2001	4	2	2		BAMSL(M) MOBAR(L)	None	High
McCoy, Michael	Adj. Prof.	PT	Ph.D.	St. Louis Univ., 1995	21	25	<1		AIAA(H) INFORMS(M)	Low	High
McGregor, Nathan	Instructor	PT	MS	Washington Univ.,		1	1		None	High	None
Meany, James J.	Adj. Prof.	PT	Ph.D.	Univ. of Mo, 1989	25	9	6		IEEE(L) IEEE-SPS(L)	Medium	High
Min, Paul S.	Assoc. Prof.	FT	Ph.D.	Univ. of Mi., 1987	18	15	15		IEEE(M) HKN(M)	High	NA
Morley Jr. Robert E.	Assoc. Prof.	FT	D.Sc.	Washington Univ., 1977	5	24	24		IEEE(L)	Low	Low
Mou, Zhi-Zhong	Adj. Prof.	PT	BSME	Northeastern Univ., China, 1967	24	29	13		None	None	None
Mukai, Hiroaki	Prof./Assoc. Chair	FT	Ph.D.	Univ. of Ca.-Berkeley, 1974		30	30	MO	IEEE(M)	High	Low
Muller, Marcel	Senior Prof.	PT	Ph.D.	Stanford Univ., 1957	4	40	39		None	None	None

Table I-4. Faculty Analysis
B.S. Electrical Engineering

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience: Govt./ Industry Practice	Years of Experience: Total Faculty	Years of Experience: This Institution	State in which Registered	Level of Activity (high, med, low, none): Professional Society (Indicate Society)	Level of Activity: Research	Level of Activity: Consulting/ Summer Work in Industry
Murphy, William J.	Adj. Prof.	PT	D.Sc.	Washington Univ., 1967	29	40	39			Low	Low
Nehorai, Arye	Prof./Chair	FT	Ph.D.	Stanford Univ., 1983		10	<1		IEEE-SPS(H)	High	None
Osmanagic, Emir	Instructor	PT	MS	Washington Univ., 2000	2	2	2	MO	IEEE(L) ALA(L)	Medium	High
O'Sullivan, Joseph A.	Prof.	FT	Ph.D.	Notre Dame, 1986		19	19	MO	IEEE(H) SPIE(M) AAAS(L) SIAM(L)	High	Low
Pickard, William F.	Senior Prof.	PT	Ph.D.	Harvard Univ., 1962		39	39	MO	APS(L), ASPB(L), BEMS(L)	High	None
Preza, Chrysanthe	Instructor/ Res. Assoc.	FT	D.Sc.	Washington Univ., 1998		7	7		IEEE(L) SPIE(M) OSA(M)	High	Low
Richter, Edward J.	Research Assoc.	PT	M.S.	Washington Univ., 2001		1	1		None	High	None
Rode, Daniel L.	Prof.	FT	Ph.D.	Case Western Univ.,	12	25	25		None	Medium	Low
Rodin, Ervin Y.	Prof.	FT	Ph.D.	Univ. of Tx.,-Austin, 1964	2	43	39		SIAM(M), INFORMS(M)	High	Low
Schaettler, Heinz M.	Assoc. Prof.	FT	Ph.D.	Rutgers Univ., 1986		19	18		SIAM(H)	High	None
Shrauner, Barbara	Senior Prof.	PT	Ph.D.	Harvard Univ., 1962		48	39		APS(M) AGU(L) AAUP(L) IEEE(L)	High	None
Snyder, Donald	Senior Prof.	PT	Ph.D.	M.I.T., 1966		39	36		IEEE(L) IEEE-ITS(L) IEEE-SPS(L)	Low	None

Table I-4. Faculty Analysis
B.S. Electrical Engineering

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience: Govt./ Industry Practice	Years of Experience: Total Faculty	Years of Experience: This Institution	State in which Registered	Level of Activity (high, med, low, none): Professional Society (Indicate Society)	Level of Activity: Research	Level of Activity: Consulting/ Summer Work in Industry
Spielman, Barry E.	Prof.	FT	Ph.D.	Syracuse Univ., 1971	17	20	20		IEEE-MTTS(H)	High	None
Spuhl, Karl	Adj. Prof.	PT	M.S.	St. Louis Univ., 1970	46	21	21	MO	IEEE(M) IMAGE(H)	NA	H/L
Sutton, Eric	Adj. Prof.	PT	Ph.D.	Univ. of IA, 1996	8	9	<1		IEEE(L) ASEE(L) ION(L)	High	High
Tarn, Tzyh-Jong	Prof.	FT	D.Sc.	Washington Univ., 1968		36	36		IEEE(H) SIAM(L)	High	Low
Trobaugh, Jason	Instructor/ Res. Assoc.	FT	D.Sc.	Washington Univ., 2000	4	4	4		IEEE(L) AIUM(L) IEEE-UFFCS(M)	High	None
Tunay, Ilker	Adj. Prof	PT	D.Sc.	Washington Univ., 1999	4	6	5		IEEE(M) SIAM(L)	Medium	High
Wheeler, Alan	Adj. Prof.	PT	Ph.D.	Stanford Univ., 1968	4	37	33		ASA(L) MAA(L) INFORMS(M) SX(L)	None	None
Wise, Kevin A.	Adj. Prof.	PT	Ph.D.	Univ. of Il., 1987	23	15	9		AIAA(H) IEEE(H)	High	High
Zaborszky, John	Senior Prof.	PT	D.Sc.	Royal Hungarian Technical Univ., 1943		58	50			Medium	None

Table I-5. Support Expenditures
Department of Electrical and Systems Engineering

Fiscal Year	1 2003-2004 Actual	2 2004-2005 Actual	3 2005-2006 Estimate	4 2006-2007 Estimate
Expenditure Category				
Operations[1] (not including staff)	148,000	233,000	200,000	210,000
Travel[2]	41,000	49,000	47,000	49,000
Equipment[3]	72,000	118,000	19,000	72,000
Institutional Funds	0	10,000	19,000	20,000
Grants and Gifts	72,000	108,000	0	52,000
Graduate Teaching Assistants[4]	63,000	71,000	61,000	69,000
Part-time Assistance[5] (other than teaching)	51,000	71,000	75,000	77,000

1. Consumables, Supplies and other expenditures.
2. All departmental travel.
3. Equipment reported is any permanent device in our laboratories used for educational purposes only.
4. Compensation for grading and teaching assistance.
5. Compensation to part-time graders of undergraduate courses and certain graduate courses taken by undergraduate students.

The department Electrical and Systems Engineering (ESE) administers three undergraduate instructional programs in parallel sharing resources, so expenses for any of these programs are more reasonably viewed as part of the overall expenses required to field the three undergraduate instructional programs. This situation exists because the resources for the programs (e.g. faculty, laboratory facilities, space, and technical support staff) are shared or are in common with all three undergraduate programs. Updated tables will to be provided at the time of the visit.

B. Course Syllabi

The Course Syllabi for all the required and elective engineering courses taken at WU for the JEE Program are included on the following pages with the exception of two elective courses that have not been offered in the last several years. These two courses are JEE3340 and JEE4020.

ENGR 2310 – STATICS
FALL 2004

CLASS SCHEDULE:	**Mondays and Wednesdays, 11:00AM-12:15PM**
INSTRUCTOR:	**Jonathan Sigman, PE** **Jonsig13@yahoo.com**
OFFICE HOURS:	**B-236; x-6804** **Monday and Wednesday, 12:30-1:30 PM** **and by appointment**

COURSE DESCRIPTION:

Solving engineering problems involving particle and systems in equilibrium via the principles of mechanics. Topics to be covered include: statics of particles and rigid bodies. Equivalent systems of forces. Distributed forces: centroids. Applications to trusses, frames, machines, beams and cables. Friction. Moments of inertia. Principle of virtual work and applications.

COURSE OBJECTIVE:

To apply the principles of mechanics and equilibrium to engineering situations.

COURSE INFORMATION:

There will be readings that correspond to each lecture. It would be good if you did them ahead of time. There will be one problem set handed out per week. Homework will be collected and graded. While everything in life may be neogotiable, homework must be turned in on its due date, unless discussed with me ahead of time. It is also expected that you attend lecture. If you MUST be absent, please inform me ahead of time. Or at least let me know afterwards why you missed lecture. Habitual absence will rear its ugly head on your final grade.

TEXT:

Engineering Mechanics: Statics by R.C. Hibbeler, 10th ed., published by Prentice Hall.

COURSE PREREQUISITE:

MATH 1900 – Analytic Geometry and Calculus II; PHYS 2111 – Physics: Mechanics and Heat

GRADING:

Tests:	50%
Final:	25%
Homework:	15%
Quizzes/Participation:	10%

TESTS:

Tests and pop quizzes will be open book and closed notes. Quizzes may be given at any time. Show all work – partial credit will be given. Please approach me as soon as possible if you require any special testing arrangements or if you absolutely cannot make a test.

You WILL need a calculator for the exams. Graphing calculators and calculators with stored formulas may not be used.

Make up tests will only be given if there is a prior arrangement. Make up tests must be taken within one week of the original exam. Arrangements will made with the Campus Assessment Center to administer the test.

CLASS POLICIES:

In accordance with college policy, this class will be a smoke, food, and drink-free zone. Sorry. If you REALLY need your morning Starbucks, we can discuss it.

Please shut off cellular phones and beepers during class.

I will do everything in my power to get to class on time, please try to do the same. But you are still encouraged to come to class if you are late.

Students requiring special accommodations should meet with me during office hours so we can discuss how to meet your needs this semester. Prior to our meeting, be sure to meet with someone in disability Access Services (MSC 144).

TENTATIVE SCHEDULE

Week	Topics	Assignments
1	General Principles/Force Vectors	
2	Force Vectors	PS 1 out
3	Equilibrium of a Particle	PS 1 in; PS 2 out
4	Labor Day ! / Equilibrium of a Particle	PS 2 in; PS 3 out
5	Force Systems Resultants	**Test 1 – Wed 9/15**
6	Force Systems Resultants	PS 3 in; PS 4 out
7	Equilibrium of a rigid body	PS 4 in; PS 5 out
8	Equilibrium of a rigid body	PS 5 in; PS 6 out
9	Structural Analysis	PS 6 in; PS 7 out
10	Structural Analysis	**TEST 2 – Wed 10/18**
11	Internal Forces	PS 7 in; PS 8 out
12	Friction	PS 8 in; PS 9 out
13	Center Gravity and Centroid	PS 9 in; PS 10 out
14	Moments of Inertia	**TEST 3 - /Wed 11/17**
15	Moments of Inertia/Thanksgiving	PS 10 in
16	Virtual Work	PS 11 out
17	Review	PS 11 in

ENGR 2320 – DYNAMICS
FALL 2004

CLASS SCHEDULE:	**Mondays and Wednesdays, 9:30-10:45 AM**
INSTRUCTOR:	**Jonathan Sigman, PE** **Jonsig13@yahoo.com**
OFFICE HOURS:	**B-236; x-6804** **Monday and Wednesday, 12:30-1:30 PM** **and by appointment**

COURSE DESCRIPTION:

Solving engineering problems involving particle and rigid body motion via the principles of mechanics and kinetics. Topics to be covered include: review of vector algebra and calculus. Kinematics of a particle. Newtown's laws and the kinetics of a particle. Work and energy. Impulse and momentum. Kinematics of rigid bodies. General theorems for systems of particles. Kinetics of rigid bodies. The inertia tensor.

COURSE OBJECTIVE:

To apply the principles of mechanics and kinetics to engineering situations.

COURSE INFORMATION:
There will be readings that correspond to each lecture. It would be good if you did them ahead of time. Thee will be one problem set handed out per week. Homework will be collected and graded. While everything in life may be neogotiable, homework must be turned in on its due date, unless discussed with me ahead of time. It is also expected that you attend lecture. If you MUTST be absent, please inform me ahead of time. Or at least let me know afterwards why you missed lecture. Habitual absence will rear its ugly head on your final grade.

TEXT:

Engineering Mechanics: Dynamics by R.C. Hibbeler, 10^{th} ed., publixhed by Prentice Hall.

COURSE PREREQUISITE:

ENGR 2310 – Statics

GRADING:

Tests:	50%
Final:	25%
Homework:	15%
Quizzes/Participation:	10%

TESTS:

Tests and pop quizzes will be open book and closed notes. Quizzes may be given at any time. Show all work – partial credit will be given. Please approach me as soon as possible if you require any special testing arrangements or if you absolutely cannot make a test.

You WILL need a calculator for the exams. Graphing calculators and calculators with stored formulas may not be used.

Make up tests will only be given if there is a prior arrangement. Make up tests must be taken within one week of the original exam. Arrangements will made with the Campus Assessment Center to administer the test.

CLASS POLICIES:

In accordance with college policy, this class will be a smoke, food, and drink-free zone. Sorry. If you REALLY need your morning Starbucks, we can discuss it.

Please shut off cellular phones and beepers during class.

I will do everything in my power to get to class on time, please try to do the same. But you are still encouraged to come to class if you are late.

Students requiring special accommodations should meet with me during office hours so we can discuss how to meet your needs this semester. Prior to our meeting, be sure to meet with someone in disability Access Services (MSC 144).

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TENTATIVE SCHEDULE

Week	Topics	Assignments
1	Introduction/Rectilinear Motion	
2	Erratic/Curvilinear/Projectile Motion	PS 1 out
3	Normal, Tangential, Cylindrical Components	PS 1 IN; PS 2 out
4	Labor Day ! / Dependent Motion	PS 2 in; PS 3 out
5	Relative Motion	**Test 1 – Wed 9/15**
6	Newton's Laws, Equations of Motion	PS 3 in; PS 4 out
7	Work and Energy/Power and Efficiency/ Conservation of Energy	PS 4 in; PS 5 out
8	Impulse and Momentum/Conservation Of linear Momentum/Impact	PS 5 in; PS 6 out
9	Angular Momentum/Angular Impulse	PS 6 in; PS 7 out
10	Rigid Body Translation and Rotation	**TEST 2 – Wed 10/18**
11	Relative Motion/Instantaneous Center of Zero Velocity	PS 7 in; PS 8 out
12	Relative Motion: Acceleration/Rotating Axes	PS 8 in; PS 9 out
13	Mass Moment of Inertia/Equations of Motion	
14	Rotation	**TEST 3 - /Wed 11/17**
15	General Plan Motion / Thanksgiving	PS 10 in
16	Work and Energy/Impulse and Momentum	PS 11 out
17	Review	PS 11 in

JCS1002 Introduction to Computing Tools: MATLAB Skills

Required/Elective Course:	**Elective**
Credit:	1 Unit
2004-2005 Catalog Data:	This course is aimed at the acquisition of MATLAB skills through hands-on familiarization and practice. Students practice the array, vector, and mesh grid representations, use programming and plotting, and apply these skills to solve numerical problems and generate reports.
Prerequisite:	None
Textbooks:	N/A
Reference:	
Coordinator:	Ronald P. Loui, Associate Professor of Computer Science and Engineering
Course Objectives:	By the end of this course, students should be comfortable and self-sufficient using Matlab.

Topics Covered:

1. **Variables, Matrices**
2. **Calling functions**
3. **Plotting, 2D and 3D plotting**
4. **Writing functions**
5. **Debugging**

Class/Lab Schedule: 1 session – 2 hours

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	1 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:
(k)

Prepared By: Roger Chamberlain **Prepared On:** June 2006

JCS1260 Introduction to Computer Programming

Required/Elective Course: **Elective**

Credit: 3 Units

2004-2005 Catalog Data: This is a one-semester introduction to programming and using the object-oriented Java language. A structured approach to programming covers the software life cycle: problem definition, algorithm/program design and program coding and debugging. Topics include: abstraction, decomposition, classes and inheritance, applets, data structures, recursion, graphics, numerical computation, and simulation. Basic computer hardware and software architectures are briefly presented.

Prerequisite: The course assumes no previous programming experience.

Textbooks: Sanders, K. & van Dam, A., Object-Oriented Programming in Java: A Graphical Approach, Preliminary Edition, Addison Wesley, 2005.

Reference:

Coordinator: Paul Gross, Graduate Research Assistant in Computer Science

Course Objectives: The course provides an introduction to fundamental software concepts. It is ideal for students considering a major or minor in computer science, as well as for students who want to learn about computing for use in another discipline.

Topics Covered:

1. **Data Types and Expressions**
2. **Variables and Naming Abstraction**
3. **Procedural Abstraction**
4. **Instructions and Memory**
5. **Compilation and Execution**
6. **Compound Data**
7. **Documentation, Testing, and Debugging**
8. **Data Abstraction**
9. **Recursion and Recursive Algorithms**
10. **Iteration and Iterative Algorithms**
11. **Introduction to Data Structures**
12. **Introduction to Software Design**

Class/Lab Schedule: 2 sessions - 90 minutes per session plus 90 minute lab

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:

(a), (c), (e)
The following outcomes are mentioned with limited coverage:
(f), (g), (k)

Prepared By: Roger Chamberlain **Prepared On:** June 2006

JEC 3100 – Engineering Communications
Fall Semester 2005 / Spring Semester 2006

Required/Elective: Required

Credits: 3 Units

2004-2006 Catalog Data: Persistent concerns of grammar and style. Analysis and discussion of clear sentence and paragraph structure and of organization in complete technical documents. Guidelines for effective layout and graphics. Examples and exercises stressing audience analysis, graphic aids, editing, and readability. Videotaped work in oral presentation of technical projects. Writing assignments include descriptions of mechanisms, process instructions, basic proposals, letters and memos, and a long formal report.

Prerequisites: Satisfaction of the English Composition proficiency requirement (English 1100 at UMSL) and junior standing (Admittance to the Joint Undergraduate Engineering Program).

Textbook: Michael H. Markel, Technical Writing: Situations and Strategies, 7th edition, Bedford St. Martin's Press, 2004.

Reference: None

Coordinator: James C. Ballard, Associate Professor of Engineering and Policy. Director of Technical Communications.

Course Objectives: This course seeks to develop the practical technical communication skills of junior and senior year engineering students who already possess adequate English proficiency. Proficiency should be demonstrated in written, graphic, and oral technical communication. Graduates of this course should have a career advantage in presenting their engineering work clearly and effectively.

Prerequisites by topic:

1. Prior satisfaction of the English Composition proficiency requirement of the School of Engineering and Applied Science (English 1100 at UMSL).
2. Admittance to the Joint Undergraduate Engineering Program.

Topics Covered:

1. Identifying and adapting to various audiences. (3 class-hours)
2. Grammar, sentence structure, mechanics, style, tone, editing. (6 class-hours)
3. Mechanism description. (5 class-hours)
4. Page design and graphics in technical communication. (4 class-hours)
5. Process description, instructions. (5 class-hours)
6. Proposals. (3 class-hours)
7. Memos, informal reports, letters. (7 class-hours)
8. Oral reports. (6 class-hours)
9. Resumes. (1 class-hour)
10. Formal reports. (5 class-hours)

Computer usage: All students use computers to execute their assignments.

Laboratory projects: Not applicable.

Estimated ABET category content:	Engineering Science:	0 credits or 0%
	Engineering Design:	0 credits or 0%
	Engineeering Topics:	0 credits or 0%
	Other:	3 credits or 100%

Prepared by: J. C. Ballard Date: June 7, 2006

JEE 2300 - Introduction to Electrical Networks
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Elements, sources, and interconnects. Ohm's and Kirchhoff's laws, superposition and Thevenin's theorem; the resistive circuit, transient analysis, sinusoidal analysis, and frequency response.

Prerequisite: Physics 2112 (UMSL)-Physics: Electricity, Magnetism, and Optics, Math 2020 (UMSL)-Introduction to Differential Equations

Textbooks: J. W. Nilsson and S. A. Riedel, Electric Circuits, 7th ed., Addison-Wesley (required)

J. W. Nilsson and S. A. Riedel, Introduction to PSpice: Manual Using OrCAD Release 9.2, (accompanies text)

Reference: IEEE Standards Coordinating Committee 14, Standard for Use of the International System of Units (SI): The Modern Metric System [IEEE/ASTM SI 10-1997], Institute of Electrical and Electronics Engineers (recommended)

Coordinator: R. Martin Arthur, Professor of Electrical and Systems Engineering

Course Objectives: To provide the students with a working knowledge of elementary networks so that they may successfully analyze simple circuits and successfully execute simple designs.

Prerequisites by topic:
1. General Physics. Ohm's Law and related material.
2. Circuit theory and Kirchhoff's laws.
3. Direct current instruments.
4. College Algebra. Simultaneous linear equations.
5. Determinants.
6. Quadratic equations.
7. Complex numbers.
8. Logarithms.
9. Trigonometry. Basic identities.
10. Euler's theorem.
11. Calculus. Fundamental concepts.
12. Elementary differentiation and integration.
13. Taylor series.

Topics Covered:
1. Circuit variables and elements (4 lectures)
2. Kirchhoff's laws (2 lectures)
3. Simple resistive networks (2 lectures)

4. Fundamentals of node and mesh analysis (4 lectures)
5. Equivalent sources and superposition (2 lectures)
6. Behavior in the time domain: RL, RC, and RLC networks (5 lectures)
7. Rise-time, overshoot, ringing, and droop (2 lectures)
8. Behavior in the frequency domain: elements of phasor analysis (2 lectures)
9. Frequency response and resonance (2lectures)
10. Complex power (1 lectures)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 2 midterm examinations, 1 final exam

Computer Usage: PSpice is used for some homework assignments

Laboratory:

1. DC Circuits - Measurement and Analysis (1 week)
2. The Oscilloscope and RC, RL and RLC Transient Analysis (2 weeks)
3. AC Circuits (1 week)
4. Characteristics of Periodic Waveforms (1 week)
5. Circuits Containing Inductance (1 week)
6. Bipolar Junction Transistor Characteristics (1 week)
7. Design of a Single Transistor Amplifier (2 weeks)
8. Power Supplies (1 week)
9. Operational Amplifiers (1 week)
10. TTL and CMOS Digital Logic Circuits (1 week)

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2.25 credits or 75%
Engineering Design:	0.75 credits or 25%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems.
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: R. Martin Arthur **Prepared On:** 15 August 2005

JEE 2320 - Introduction to Electronic Circuits
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Introduction to contemporary electronic devices and their circuit applications. Terminal characteristics of active semiconductor devices. Incremental and D-C models of junction diodes, bipolar transistors (BJTs), and metal-oxide semiconductor field effect transistors (MOSFETs) are developed and used to design single- and multistage amplifiers. Models of the BJT and MOSFET in cutoff and saturation regions are used to design digital circuits.

Prerequisite: JEE 2300-Introduction to Electrical Networks

Textbooks: A. S. Sedra and K. C. Smith, Microelectronic Circuits, 5th Edition, Oxford University Press, 2004

Reference: Electronic Circuits, third edition, D. L. Schilling, C. Belove, T. Apelewicz and R.J. Saccardi, McGraw-Hill, New York, 1989

Analog and Digital Electronics: a first course, P. H. Beards, Prentice Hall, second edition, Englewood Cliffs, NJ, 1991

Electronic Devices and Circuits, J. J. Cathey, Schaum's Outline Series, McGraw-Hill, New York, 1989.

Electronic Principles, A. P. Malvino, Glencoe, Macmillan /McGraw-Hill, Columbus, OH, 1993

Introduction to Electronics Design, F. H. Mitchell, Jr. and F. H. Mitchell, second edition, Prentice-Hall, Englewood Cliffs, NJ, 1992.

Microelectronic Circuits & Devices, M. Horenstein, 2nd edition, Prentice Hall, 1996

Coordinator: John Corrigan, Affiliate Professor of Electrical and Systems Engineering

Course Objectives: The objective of this required sophomore course is to describe the operation of common electronic devices and introduce elementary piecewise linear circuit models to represent these devices for the analysis, design, and simulation of electronic circuits. Examples are drawn from both analog and digital applications. Electronic circuit simulation skills using PSpice are also developed.

Prerequisites by topic:
1. Steady-state DC and AC circuit analysis,
2. Thevenin and Norton equivalent circuits,
3. Single time constant circuit transient analysis,

4. DC and multiple AC signals in a linear circuit,
5. PSpice simulation program usage for linear circuits.

Topics Covered:
1. Review of signal sources, Fourier representation, and frequency spectra. (1/2 week)
2. Amplifier standard models and digital logic inverter characteristics (1/2 week)
3. Operational amplifier operation, input impedance and gain characteristics, amplifier and integrator circuits, PSpice simulation. (2 weeks)
4. Semiconductor diodes: theory, models, and rectifier, clamping and detector circuits, PSpice simulation. (2 1/2 weeks)
5. Bipolar Junction Transistors: theory, circuit models, amplifier biasing, amplifier designs (common emitter, common base, common collector), small signal analysis, hybrid-h parameters, basic logic inverter circuits, PSpice simulation. (3 weeks)
6. Power amplifiers (Class A, Class B, Class AB, Class C) and thermal characteristics (1/2 week)
7. Field Effect Transistors: theory, enhancement and depletion types, circuit models, amplifier biasing, amplifier designs (common source, common gate, common drain), small signal analysis, basic logic inverter circuits, PSpice simulation. (3 weeks)
8. Single stage BJT and FET Integrated Circuit amplifiers (1/2 week)
9. Differential and multistage BJT and FET amplifiers (1/2 week)
10. Digital logic functions and Boolean algebra. (1/2 week)
11. CMOS digital logic circuits: inverter, noise margin, AND/OR/NAND/NOR gates. (1/2 week)
12. Latches and flip-flops, multivibrator circuits, CMOS memory circuits. (1/2 week)

Class/Lab Schedule: 2 lectures /week; 90 minutes per session

Tests: 2 tests (1 in class, 1 take home), 1 final exam

Computer Usage: ORCAD PSpice, Release 9.2 (Provided with text book); MicroSim PSpice (Available in the Center for Engineering Computing)

Laboratory:
1. DC Circuits - Measurement and Analysis (1 week)
2. The Oscilloscope and RC, RL and RLC Transient Analysis (2 weeks)
3. AC Circuits (1 week)
4. Characteristics of Periodic Waveforms (1 week)
5. Circuits Containing Inductance (1 week)
6. Bipolar Junction Transistor Characteristics (1 week)
7. Design of a Single Transistor Amplifier (2 weeks)
8. Power Supplies (1 week)
9. Operational Amplifiers (1 week)
10. TTL and CMOS Digital Logic Circuits (1 week)

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2.25 credits or 75%
Engineering Design:	0.75 credits or 25%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems.

Prepared By: John Corrigan, Ph.D.E.E. **Prepared On:** 8/7/05

JEE 2330 - Electrical and Electronic Circuits Laboratory
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Lectures and laboratory exercises related to topics in introductory electrical networks and electronic circuits.

Prerequisite: JEE2300-Introduction to Electrical Networks (Prerequisite); JEE2320-Introduction to Electronic Circuits (Co-requisite)

Textbooks: Electrical And Electronic Circuits Laboratory, "Exercise Manual," edited by Dr. John D. Corrigan, Affiliate Professor, Washington University.

Reference: J. W. Nilsson and S. A. Riedel, Electric Circuits, 7th ed., Prentice Hall; Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 5th ed., Oxford University Press.

Coordinator: John Corrigan, Affiliate Professor of Electrical and Systems Engineering

Course Objectives: To provide students with a practical and theoretical knowledge of basic measurement techniques, network analysis and design, and electronic components and test instrumentation plus expertise in designing, executing, and reporting a laboratory exercise.

Prerequisites by topic:
1. Steady-state DC and AC circuit analysis,
2. Thevenin and Norton equivalent circuits,
3. RC, RL, and RLC circuit transient analysis,
4. Op-Amp, Semiconductor Diode, and Bipolar Junction Transistor Characteristics,

Topics Covered:
1. DC circuits and measurements - Use of multimeters, loading effects, current measurement using a voltmeter, Thevenin equivalent circuits (1 week)
2. Measurement of time-varying signals - Use of the oscilloscope, RC, RL and RLC circuit transient response, relays (2 weeks)
3. AC circuits - RC and RLC circuit steady state sinusoidal response, frequency response, Bode diagrams (1 week)
4. Periodic waveforms - Fourier series, DC and AC power, effective and RMS voltage, Parseval's equation (1 week)
5. Inductance and resonance - Models for imperfect inductors, series resonance, parallel resonance (1 week)
6. BJT transistors - Large signal characteristics, small signal characteristics (1 week)
7. Common emitter amplifier - Amplifier design, biasing, small signal model, frequency response, implications of design choices (2 weeks)
8. Power supplies - Half-wave and full-wave rectification, filtering, ripple, regulation (1 week)
9. Operational amplifiers - Inverting and non-inverting gain stages, summation, integration, differentiation, square and triangle wave generation (1 week)

10. Electrical properties of TTL and CMOS digital logic inverter circuits - Voltage swing, voltage transfer characteristics, delay time, noise margin, power consumption (1 week)

Class/Lab Schedule: 2 sessions/week: 90 minutes lecture, 180 minutes laboratory

Tests: 1 midterm and 1 final exam

Computer Usage: Laboratory computers are used to collect screen images from the oscilloscopes. PSpice is used for circuit analysis. Students are encouraged (but not required) to use MATLAB or Excel for data analysis (e.g., graphing) and word processing for report generation.

Laboratory:
1. DC Circuits - Measurement and Analysis (1 week)
2. The Oscilloscope and RC, RL and RLC Transient Analysis (2 weeks)
3. AC Circuits (1 week)
4. Characteristics of Periodic Waveforms (1 week)
5. Circuits Containing Inductance (1 week)
6. Bipolar Junction Transistor Characteristics (1 week)
7. Design of a Single Transistor Amplifier (2 weeks)
8. Power Supplies (1 week)
9. Operational Amplifiers (1 week)
10. TTL and CMOS Digital Logic Circuits (1 week)

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(b) Ability to: design & conduct experiments; analyze and interpret data;
(c) Ability to design a system, component, or process to meet desired needs;
(d) Ability to function on multi-disciplinary teams;
(e) Ability to identify, formulate, and solve engineering problems;
(f) Understanding of professional and ethical responsibility;
(g) Ability to communicate effectively;
(h) Understanding of the global and societal role of engineering;
(i) Recognition of need for and ability to engage in lifelong learning;
(j) Knowledge of contemporary issues;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
(l) Preparation for participation in industry, academia, or governmental laboratories

Prepared By: John Corrigan **Prepared On:** 8/11/05

JEE 2600 - Introduction to Digital Logic and Computer Design
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Digital computers and digital information-processing systems; Boolean algebra, principles and methodology of logical design; machine language programming; register transfer logic; microprocessor hardware, software, and interfacing; fundamentals of digital circuits and systems; computer organization and control; memory systems; arithmetic unit design. Occasional laboratory exercises.

Prerequisite: JCS 1260 at Washington University or CSMP 1250 at University of Missour-St. Louis

Textbooks: Mano and Kime, Logic and Computer Design, Prentice Hall, 3rd Edition.

Reference: Lecture Notes by Jolley (available from class web site)

Coordinator: Thomas Jolley, Instructor of Electrical and Systems Engineering

Course Objectives: This course provides a thorough foundation for designing digital systems. The basic elements of combinational and sequential logic design are presented with design components taken across the range of technology classes (SSI, MSI, PLD/FPGA and VLSI). Higher level approaches requiring use of register transfer languages, VHDL, digital logic and system simulation, and microprocessors are included.

Prerequisites by topic:
1. Binary arithmetic
2. Elementary programming and flow charting
3. Ohm's and Kirchhoff's Laws
4. Transient circuit analysis

Topics Covered:
1. Digital Computers and Information; Elements of computer architecture; Programming a simple computer; Number systems; Arithmetic operations; Information coding (2 classes)

2. Combinational Logic Circuits; Binary logic and gates; Boolean algebra; Schematic capture and logic simulation; Standard forms; Logic simplification using Karnaugh maps; NAND, NOR gates; EXOR gates and parity generation; Integrated circuits (4 classes)

3. Combinational Logic Design; Hierarchical design; Analysis of combinational circuits; Design procedures; Encoders and decoders; Multiplexers and demultiplexers; Binary arithmetic circuits; Representing negative numbers; Introduction to VHDL (3 classes)

4. Sequential Circuits; Latches and flip flops; Sequential circuit analysis; Designing sequential circuits; Designing sequential circuits with VHDL (5 classes)

5. Registers and Counters; Registers with serial and parallel IO; Serial addition; Basic synchrononous counters; Counters with carry lookahead; Designing non-standard counters (2 classes)

6. Memory and Programmable Logic Devices; Random access memory; Tristate buffers; Static RAM organization; Reading and writing static RAMs; Building larger memory arrays; Dynamic RAM; Read-only memory; PLAs and PALs; Field programmable gate arrays (3 classes)

7. Register Transfers and Datapaths; Datapath specification; Datapath micro-operations; Data transfer using buses; Arithmetic/Logic Units; Datapath pipelining (3 classes)

8. Sequencing and Control; Algorithmic state machines; Binary multiplier; Hardwired control; Microprogrammed control; Simple computer architecture (3 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 7 to 10 quizzes, 1 midterm exam, one final exam

Computer Usage: Usage of VHDL simulators is required. Students may use supplied lab software (Xilinx Student Edition, Mentor Graphics) or choose their own.

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	1.5 credits or 50%
Engineering Design:	1.5 credits or 50%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Thomas Jolley **Prepared On:** 8/11/05

JEE 3300 - Engineering Electromagnetics Principles
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Electromagentic theory as applied to electrical engineering: vector calculus, electrostatics and magnetostatics; Maxwell's equations, including Poynting's theorem and boundary condistions; uniform plane-wave progagation; transmission lines - TEM modes, including treatment of general lossless line,and pulse progagation; introduction to guided waves; introduction to radiation and scattering concepts.

Prerequisite: JEM 3170-Engineering Math and JCS 100Z-Introduction to Computing: MATLAB Skills or equivalent

Textbooks: Fawwaz T. Ulaby, Applied Electromagnetics 2004 Media Edition, Pearson Prentice-Hall, Upper Saddle River, NJ, 2004

Reference: None

Coordinator: Barry E. Spielman, Professor of Electrical and System Engineering

Course Objectives: To introduce undergraduate to the fundamental qualities and principles which underlie the stude of electromagnetic fields and to acquaint them with important applications of these quantities and principles.

Prerequisites by topic:
1. Differential and integral calculus
2. Differential Equations
3. Vector Algebra
4. Coordinate systems and vector calculus
5. General physics with elementary mechanics, electrostatics, and magnetostatics
6. Complex algebra
7. Basic circuits with phasor techniques

Topics Covered:
1. Review of mathematics - vector addition and multiplication, coordinate systems, circulation and flux, divergence, gradient, curl, vector identities, divergence theorem, Stoke's Theorem. (1.5 weeks)

2. Electrostatics/Magenetostatics - charge configurations, Coulomb's law, E field, electrostatic potential, Gauss's law, dielectrics, boundary conditions, Poisson's and Laplace's equations, electric current, Biot-Savart law, H field, Ampere's law, magnetic materials, force and torque, capacitors, and inductors. (3.5 weeks)

3. Dynamics - Field quantities, Faraday's law, curl H, Maxwell's equations, boundary conditions, potential and wave functions, time harmonic fields. (2.0 weeks)

4. Plane Waves - Undamped uniform plane waves, wavelength, phase velocity, power density, Poynting's theorem, wave impedance, Poyntings's theorem, uniform damped plane waves, reflection (normal incidence). (2.0 weeks)

5. Transmission Lines - Parallel plate waveguide, general lossless line, equivalent circuit, V-I solutions for the lossless line, VSWR, impedances, matching, pulses on a lossless line. (3.0 weeks)

6. Waveguides - Characteristics of guided waves expressed in terms of parallel-plate and rectangular wave guide. (1.0 week)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 1 midterm exam, 1 final exam (may all be take home)

Computer Usage: None required. Student are encouraged to use applications such as MATLAB or Mathematica to solve problems given in the course.

Laboratory:

1. Instrument Capabilities
2. Spectrum Analyzer
3. Non-Ideal Op Amps
4. Grounding and Shielding
5. CMOS Chopper Stabilized Amplifier
6. AM Modulation
7. FM Modulation
8. Random Noise
9. Active Filters
10. Transmission Line Pulse Response

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Barry E. Spielman **Prepared On:** July 14, 2005

JEE 3310 - Electronics Laboratory
Fall Semester 2004

Required/Elective Course: Required - or must take JEE 4650.

Credit: 3 units

2004-2005 Catalog Data: Laboratory exercises for juniors covering topics in measurements, instrumentation, and electronic circuits.

Prerequisite: JEE 2320-Introduction to Electrical and Circuits, JEE 2330 Electrical and Electronics Laboratory.

Textbooks: Electonics Laboratory Mannual

Reference: A.S. Sedra and K.C. Smith, Microelectronic Circuits, 5th edition, Oxford University press, 2004.

Coordinator: Ronald S. Indeck, Professor of Electrical and Systems Engineering

Course Objectives: To introduce undergraduates to the fundamentals of laboratory instrumentation and experimentation.

Prerequisites by topic:
1. Circuit analysis
2. Instrumentation
3. Field theory

Topics Covered:
1. Instrument Capabilities

2. Spectrum Analyzer

3. Non-Ideal Op Amps

4. Grounding and Shielding

5. CMOS Chopper Stabilized Amplifier

6. AM Modulation

7. FM Modulation

8. Active Filters

9. Transmission Line Pulse Response

10. Design Project

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 5 quizzes

Computer Usage: Design and analysis of experiments

Laboratory:

1. Instrument Capabilities
2. Spectrum Analyzer
3. Non-Ideal Op Amps
4. Grounding and Shielding
5. CMOS Chopper Stabilized Amplifier
6. AM Modulation
7. FM Modulation
8. Active Filters
9. Transmission Line Pulse Response
10. Design Project

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	1.5 credits or 50%
Engineering Design:	1.5 credits or 50%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(b) Ability to: design & conduct experiments; analyze and interpret data;
(c) Ability to design a system, component, or process to meet desired needs;
(d) Ability to function on multi-disciplinary teams;
(e) Ability to identify, formulate, and solve engineering problems;
(g) Ability to communicate effectively;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Ronald S. Indeck **Prepared On:** 09/23/05

JEE 3320 - Power, Energy, and Polyphase Circuits
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Fundamental concepts of power and energy; electrical measurements; physical and electrical arrangement of electrical power systems; polyphase circuit theory and calculations; principal elements of electrical systems such as transformers, rotating machines, control, and protective devices, their description and characterisitics; elements of industrical power system design.

Prerequisite: JEE 2300-Introduction to Electrical Networks

Textbooks: Stephen J. Chapman, Electric Machinery and Power System Fundamentals, McGraw-Hill, 2002

Reference: None

Coordinator: Thomas Collins, P.E., Adjunct Assistant Professor of Electrical and Systems Engineering

Course Objectives: This course provides an introduction to power systems and machines. Power resources, energy usage, efficiency and energy storage are covered. Magnetic circuits, single-phase and three-phase transformers in circuits with generators and loads are analyzed. DC, synchronous and induction machines are modeled by simple circuits. Techniques of protection and grounding are introduced. Applications of IEEE standards and the NEC are introduced where applicable.

Prerequisites by topic:
1.Basic AC circuit analysis
2.Differential equations
3.Single-phase power instantaneous and average.

Topics Covered:
1. Energy resources, usage and storage, power and the exponential function with growth rates (2 lectures)
2. Energy conversion and thermodynamics (1 lecture)
3. Batteries and DC systems (1 lecture)
4. Complex, real and reactive power, power factor correction (1 lecture)
5. Three-phase circuit analysis: delta and wye connections, power factor, complex power, single line diagrams, phase sequence, balanced and unbalanced loads, per unit systems (3 lectures)
6. Magnetic circuits (1 lecture)
7. Power transformers: single-phase idela and practical transformer models, losses and efficiency, voltage regulation, three-phase transformers, single-line diagrams, tests and third harmonics (3 lectures)
8. DC machines: generators and motors; emf, torque and speed equations; armature windings, equivalent circuits (3 lectures)
9. Synchronous and Induction machines: generators and motors, rotating magnetic field, synchronous speed, slip, torque, pole pairs, efficiency and power balance, equivalent circuits (6 lectures)

10. Transmission lines and their parameters (1 lectures)
11. Protection devices and schemes: fuses, circuit breakers, and GFCIs; calculations, design, and applications (2 lectures)
12. Grounding: principles, design, and applications (1 lecture)
13. Exams (2 lectures)

Class/Lab Schedule: 2 sessions per week; 90 minutes per session

Tests: 3 regular 1 hour exams

Computer Usage: None required. Packages introduced as possible tools

Laboratory: Design project required as part of final grade. This course consists of 12 laboratory experiments. All experiments except the one on synchronous machines must be set up by the students working in teams of two or three. The students are required to do significant design in order to properly set up the experiment to collect the correct data. Decisions as to the correct current measuring device, the correct oscilloscope connections, frequency of measurement, etc. must be made by each student team. In addition, each student is required to design a useful laboratory on a subject of interest that is not currently included in the course and provide a report in a format similar to that used in laboratory manual.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	1.8 credits or 60%
Engineering Design:	1.2 credits or 40%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;

Prepared By: Thomas Collins **Prepared On:** 4-16-05

JEE 3360 - Principles of Electronic Devices
Spring Semester 2005

Required/Elective Course:	Elective
Credit:	3 units
2004-2005 Catalog Data:	Energy bands, charge carriers and excess carriers in semiconductors; pn junctions and applications to diodes and electronic devices; field-effect and bipolar transistors; integrated circuits, optoelectronics and microwave devices.
Prerequisite:	Physics 2112 (UMSL)-Physics: Electricity, Magnetism, and Optics
Textbooks:	B. G. Streetman and S. Banerjee, Solid State Electronic Devices, 5th ed., Prentice Hall, 2003.
Reference:	W. Shockley, Electrons and Holes in Semiconductors, Van Nostrand, 1950; A. S. Grove, Physics and Technology of Semiconductor Devices, John Wiley and Sons, 1967; D. L. Rode, "Charge-Injection Theory of Bipolar Junction Transistors," J. Appl. Phys. 76, 4173-83 (1 October 1994); R. F. Pierret, Semiconductor Device Fundamentals, Addison-Wesley, 1996; D. Neamen, An Introduction to Semiconductor Devices, McGraw-Hill, 2006.
Coordinator:	Daniel L. Rode, Professor of Electrical and Systems Engineering
Course Objectives:	Fundamental physical understanding of the electronic properties of semiconductor devices including methods for semiconductor crystal growth, microfabrication of devices, and operation and applications of electronic devices. Successful execution of homework assignments, projects, and examination problems involving the design and analysis of electronic devices for specified characteristics.

Prerequisites by topic:
1. Atomic & quantum Physics Concepts
2. Computer-based analysis programs
3. Elementary differential equations
4. Elementary chemistry & physics

Topics Covered:
1. Crystalline lattices and orientations; crystal growth; review of pertinent quantum-mechanical systems. Energy bands and forbidden gaps; electron and hole states; effective-mass theory; intrinsic and extrinsic semiconductors; equilibrium free-carrier probability distribution functions. (6 classes)
2. Free-carrier transport; electron and hole mobilities and electrical conductivity; hot electrons, Hall Effect; excess carrier probability distribution functions; excess carrier generation, recombination and minority-carrier lifetimes. Steady-state excess carrier generation and quasi-Fermi levels; photoconductivity; carrier diffusion and diffusion lengths; transient excess carrier distributions; the Haynes-Shockley experiment. (6 classes)
3. PN homojunctions and heterojunctions; built-in potential and junction depletion regions; space-charge and carrier concentration profiles. Biased pn junctions; carrier injection and electrical currents, transient

characteristics of junctions, junction capacitances and reverse recovery transients. Deviations from simple theory; including high-injection conditions, surface recombination and generation effects; ohmic effects; metal-semiconductor Schottky junctions. Fabrication and applications of pn junction devices; rectification, switching, and variable reactance; tunnel diodes; Schottky diodes, regulator diodes, current-limiting diodes, photodiodes and light-emitting diodes. (7 classes)
4. Bipolar transistors; overview of switching and amplification; bipolar transistor fabrication; minority-carrier concentration profiles and terminal currents; current transfer ratios and generalized biasing; Collector and Emitter collection efficiencies, surface effects, and high-injection effects. Bipolar transistor switching, stored charge and switching transients. Diode clamping and snubbing; deviations from simple theory; base narrowing, breakdown, injection efficiency; heterojunction bipolar transistors; high-frequency operation. (7 classes)
5. Field-Effect transistors; junction field-effect transistors, JFETs; MESFETs; metal-oxide-semiconductor MOS capacitors, MOSFETs and CMOS digital circuits; surface and oxide effects and threshold voltages. FET channel conductance and channel pinch-off; short-channel and hot-carrier effects; heterojunction FETs, HFETs and MODFETs. (7 classes)
6. Integrated circuits; advantages of integration; IC fabrication techniques; device design for IC's; MOS capacitor dynamics and charge coupled devices. (3 classes)
7. LEDs and semiconductor lasers; resonant cavities; stimulated emission; population inversion; homojunction lasers; heterojunction lasers. (3 classes)
8. IMPATT and Gunn microwave sources; p-n-p-n switching devices. (3 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 3 equal-weight examinations

Computer Usage: analysis, graphs

Laboratory: In-class device demonstrations

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Daniel L. Rode **Prepared On:** January 2005

JEE 3370 - Electronic Devices and Circuits
Fall Semester 2004

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Introduction to semiconductor electronic devices: transistors and diodes. Device electrical DC and high-frequency characteristics. Bipolar transistors, field-effect transistors, and MOS transistors for analog electronics applications. Transistor fabrication as discrete devices and integrated-circuit chips. Large-signal analysis of transistor amplifiers: voltage gain, distortion, input resistance and output resistance. Analysis of multi-transistor amplifiers: Darlington, Cascode and Coupled-Pair configurations. Half-circuit concepts, differential-mode gain, common-mode gain, and differential-to-single-ended conversion. Transistor current sources, active loads, and high-gain amplifier stages. Applications to operational amplifiers and feedback circuits.

Prerequisite: JEE 2320-Introduction to Electronic Circuits

Textbooks: P. R. Gray & R. G. Meyer, Analysis and Design of Analog Integrated Circuits, 3rd ed., Wiley, 1993.

Reference: S. Soclof, Design and Applications of Analog Integrated Circuits, Prentice Hall, 1991; D. L. Rode, Output Resistance of the Common-Emitter Amplifiers, IEEE Trans. On Electron Devices, September 2005; D. A. Johns and K. Martin, Analog Integrated Circuit Design, John Wiley and Sons, 1997; R. S. Muller and T. I. Kamins, Device Electronics for Integrated Circuits, Second ed., John Wiley and Sons, 1977.

Coordinator: Daniel L. Rode, Professor of Electrical and Systems Engineering

Course Objectives: Study of the principles of diode and transistor devices, computer simulations of their operation and applications to analog electronic circuits. Problems involving the design of analog electronic circuits using discrete and integrated-circuit devices for specified characteristics provide the design content of this course.

Prerequisites by topic:
1. Introductory network theory
2. Elementary active-circuit operation
3. Elementary differential equations

Topics Covered:
1. Energy bands and forbidden gaps in semiconductors; effective mass; electron and hole transport; intrinsic and extrinsic semiconductors; equilibrium carrier distributions and fermi level. Carrier mobility, carrier diffusion and electrical conductivity. Hot electrons, excess carriers and quasi-fermi levels; carrier generation and recombination; majority and minority carriers. (4 classes)
2. Schottky and p-n homojunctions and heterojunctions; built-in potentials, depletion approximation; depletion region space charge and carrier concentrations. Biased p-n junctions; carrier injection and currents, transient characteristics of junctions, junction capacitances and reverse recovery transients. Fabrication and application of diodes to rectification. (4 classes)
3. Bipolar transistor operating principles and device fabrication in discrete and integrated-circuit forms; minority-carrier concentrations and currents; current transfer ratio; biasing circuits. Load-line concepts and amplification. Stored charge and switching transients. Transistor models for computer simulation.

Small-signal models. Base narrowing, breakdown, and high-frequency operation. Review of commercial literature and nomenclature. (6 classes)

4. Field-effect transistors; JFETs and MOSFETs. Junction leakage and depletion. FET channel conductance, pinch-off and current saturation. Drain and gate characteristics. Metal-oxide capacitors, surface and oxide charges, and threshold voltage. Frequency limitations of FETs. Transistor models for computer simulation. Small-signal models. (7 classes)

5. Integrated circuits; advantages of integration; IC fabrication techniques; device design for ICs. Review of generic types of analog integrated circuits and amplifiers. Overview of market volumes and segments, manufacturers, distributors, packaging, costs and prices. Review of commercial literature and nomenclature. (2 classes)

6. Single and two-transistor amplifiers. Principles of device-model selection. Equivalent-circuit models, large and small-signal techniques. Input and output resistance, current and voltage gain. Differential and common-mode gain, and common-mode rejection. Introduction to computer simulation techniques for amplifier design. Non-ideal effects including input offsets, distortion and saturation, and frequency limitations. (7 classes)

7. Transistor current sources and current mirrors. Current-source biasing and supply-independent biasing. Device matching considerations and temperature-dependent effects. Current sources as active loads. Large-signal analysis of transfer functions and comparison to results derived from small-signal analysis. (6 classes)

8. Applications of analog circuits; discrete, hybrid and integrated circuits. Inverting and non-inverting linear amplifiers. Non-linear amplifiers, equalization, and companding. Differentiators and AC integrators. Non-ideal effects, frequency/speed limitations, and slew rate effects. Frequency compensation, phase shift and integrator responses. General-purpose op amps, wideband video op amps, precision op amps and power boosters. (6 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 3 equal examinations

Computer Usage: Numerical analysis, graphing, electronic circuit simulation (PSPICE)

Laboratory: In-class device & circuit demonstrations

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67 %
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Daniel L. Rode **Prepared On:** August 2004

JEE 3510 - Signal and Systems
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Elementary concepts of continuous-time and discrete-time signals and systems. Linear time-invariant (LTI) systems, impulse response, convolution. Fourier series, Fourier transforms, and frequency-domain analysis of LTI systems. Laplace transforms, Z-transforms, and rational function descriptions of LTI systems. Principles of sampling and modulation. Students participate weekly in recitation sections to develop oral communication skills using class materials.

Prerequisite: JEE 2300-Introduction to Electrical Networks, JEM 3170- Engineering Mathematics

Textbooks: Alan V. Oppenheim and Alan S. Willsky, Signals and Systems, Second Edition, Prentice-Hall, Inc., 1997.

Reference: None

Coordinator: Hiro Mukai, Professor of Electrical and Systems Engineering

Course Objectives: To introduce electrical engineering undergraduate students to the fundamental principles that underlie systems that acquire and process signals and to acquaint them with the use of the principles in designing such systems.

Prerequisites by topic:
1. Differential and integral calculus
2. Differential equations
3. Electrical circuits
4. Engineering mathematics

Topics Covered:

1. Introduction to continuous-time, discrete-time, complex-valued, causal signals and to complex-exponential signals. Introduction to basic system properties – memory, invertibility, causality, stability, linearity, and time invariance. (1 week)

2. Linear Time Invariant systems. Unit sample and impulse response. Convolution. Systems described by differential and difference equations. (3 weeks)

3. Fourier series representation of signals in continuous and discrete time. Convergence issues and Fourier series properties. Response of LTI systems to periodic signals. Filters and frequency response. (1.5 weeks)

4. Continuous-time Fourier transform – definition, convergence, properties, convolution and modulation properties, Parseval's relation, use in solving differential equations, Bode plots. Discrete-time Fourier

transform – definition, convergence, properties, convolution and modulation properties, Parseval's relation, use in solving difference equations. (3 weeks)

5. Sampling of continuous-time signals. Reconstruction from samples.
Discrete-time processing of continuous-time signals. (1 week)

6. Introduction to amplitude modulation and its use in broadcast radio. (1 week)

7. State-space topics. Mathematical modeling of engineering systems using state-space techniques. Conversion between different models. State transition matrices and the time response of the state-space model. (2.5weeks)

Class/Lab Schedule: 2 classes (90 minutes each) per week

Tests: Two in-class examinations during the semester and one final examination.

Computer Usage: Computer exercises on homework using MATLAB

Laboratory:
1. Instrument Capabilities
2. Spectrum Analyzer
3. Non-Ideal Op Amps
4. Grounding and Shielding
5. CMOS Chopper Stabilized Amplifier
6. AM Modulation
7. FM Modulation
8. Random Noise
9. Active Filters
10. Transmission Line Pulse Response

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Hiro Mukai **Prepared On:** Aug. 14, 2005

JEE3610 Introduction to Systems Software

Required/Elective Course: **Required**

Credit: 3 Units

2004-2005 Catalog Data: Introduction to the hardware and software foundations of computer processing systems. Examines the process whereby computer systems manage, interpret, and execute applications. Covers fundamental algorithms for numerical computation, memory organization and access, storage allocation, and the sequencing and control of peripheral devices. Weekly laboratories, exercises, and a final laboratory project are required.

Prerequisite: Prerequisites: JCS1260/JEE125.

Textbooks: Bryant, R. & O'Hallaron, D., Computer Systems: A Programmer's Perspective, 1st edition, Prentice Hall, 2002

Reference:

Coordinator: Patrick Crowley, Assistant Professor in Computer Science and Engineering

Course Objectives: This course examines the lower levels of the system hierarchy, enabling an understanding of the process whereby computer processing systems manage, interpret, and execute applications. This course provides students with a background in both systems level programming and the fundamental hardware and software architecture of computing systems.

Topics Covered:

1. **assembly language, C**
2. **information representation (text, numbers, endianness)**
3. **instruction set architecture (ISA)**
4. **fetch/decode/execute cycle**
5. **x86 ISA**
6. **pointers, compound data structures**
7. **call/return protocols**
8. **performance driven code transformation**
9. **memory, cache**
10. **linking, loading**
11. **exceptional control**
12. **virtual memory**
13. **memory management**

Class/Lab Schedule: 2 sessions - 90 minutes per session

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:
(a), (b), (c), (d), (e), (k)
The following outcomes are mentioned with limited coverage:
(f), (j)

Prepared By: Roger Chamberlain **Prepared On:** June 2006

JEE 3620 - Computer Architecture
Fall Semester 2004

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Study of interaction and design philosophy of hardware and software for digital computer systems. Machine organization, data structures, I/O considerations. Comparison of microcomputer architectures.

Prerequisite: JEE 2600-Introduction to Digital Logic and Computer Design

Textbooks: Vincent P. Heuring and Harry F. Jordan, Computer Systems Design and Architecture, Addison-Wesley, 1997

Yalamanchili, Introductory VHDL from Simulation to Synthesis.

Reference: None

Coordinator: Thomas Jolley, Instructor of Electrical and Systems Engineering

Course Objectives: To introduce the fundamental concepts associated with modern computer architecture, including the von Neuman architecture, machine organization, buses, I/O subsystems, etc., and methods for accurately describing computer system operation, e.g., register transfer notation. Assembly language programming is introduced, and students write several programs for the CPU described in the text which are run using a emulator and VHDL simulation.

Prerequisites by topic:
1. Boolean algebra
2. Logic design (combinational and sequential circuit design)
3. Programming competence in a high-level language
4. Elementary computer organization

Topics Covered:
1. Course introduction, modern personal computer components demo (1 class)
2. Instruction set architecture; buses; example bus architectures (1 class)
3. Accumulator, stack, and general register machine definitions (1/2 class)
4. Instruction types, addressing modes (1/2 class)
5. Introduction to the SRC (Simple RISC Computer) (1/2 class)
6. SRC assembly syntax and assembly language (1 class)
7. Register transfer notation (RTN); RTN description of the SRC (1 class)
8. SRC assembler and simulator overview (with handout) (1/2 class)
9. Buses: tri-state bus, open-collector bus (1/2 class)
10. Abstract RTN vs. concrete RTN (1/2 class)
11. Introduction to the 1-bus SRC architecture (1 class)
12. The 1-bus SRC architecture-detailed analysis (1 class)
13. The SRC controller: ad hoc design and formal approaches (1 class)
14. SRC 2- and 3-bus architectures (1 class)

15. SRC reset issues, exceptions (1 class)
16. SRC Pipeline architecture, data path, hazards (4 classes)
17. Instruction parallelism, microprograming (1 class)
18. Memory system components, EPROM, DRAM, SRAM (1 class)
19. RAM structure (1 class)
20. Memory hierarchy (1 class)
21. Cache memory (1 class)
22. Virtual memory, memory subsystem (1 class)
23. I/O subsystem (1 class)
24. Programmed I/O (1 class)
25. Interrupts (1 class)
26. DMA (1 class)
27. Exams (2 classes)
28. Exam reviews (2 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 7 to 10 Quizzes, 1 VHDL project, 1 Midterm, 1 Final

Computer Usage: An emulator is used to run code on the example processor, the SRC (Simple RISC Computer), described in the text. A VHDL model of the SRC in multiple architectures is developed and simulated.

Laboratory: Five laboratory assignments demonstrating the topics listed above.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Thomas Jolley **Prepared On:** 8/12/05

JEE 4050 - Reliability and Quality Control
Fall Semester 2004

Required/Elective Course:	Elective
Credit:	3 units
2004-2005 Catalog Data:	An integrated analysis of reliability and quality control function in manufacturing. Statistical process control, acceptance sampling, process capability analysis, reliability prediction, design, testing, failure analysis and prevention, maintainability, availability, and safety are discussed and related. Qualitative and quantitative aspects of statistical quality control and reliability are introduced in the context of manufacturing.
Prerequisite:	JEMT 3260-Proability and Statistics for Engineering or Math 1320 (UMSL)-Applied Statistics I
Textbooks:	D.C. Montgomery, Introduction to Statistical Quality Control, 3rd Edition, John Wiley & Sons, 1997.
Reference:	Reliability Engineering Handbook, by Dimitri Kececioglu, Prentice Hall, 1991.
Coordinator:	Hiro Mukai, Professor of Electrical and Systems Engineering
Course Objectives:	This course is designed as an elective course for seniors in electrical engineering. The objective is to familiarize students with statistical quality control and reliability techniques and show how this can be integrated with the total quality management.

Prerequisites by topic:
1. Engineering statistics or engineering probability

Topics Covered:
1. Basic concepts of quality control

2. Review of probability

3. Probability distributions

4. Review of statistics

5. Graphic methods for quality improvement

6. Control charts for attributes

7. Control charts for variables

8. Process capability analysis

9. Acceptance sampling for attributes

10. Acceptance sampling for variables

11. Basic concepts of reliability

12. Reliability prediction and design

13. Reliability analysis (FMEA and FTA)

14. Life testing and reliability evaluation

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: None

Computer Usage: On topics 6, 7, 8, 9, and 10 homework

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	3 credits or 100%
Engineering Design:	0 credits or 0%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Hiro Mukai **Prepared On:** Aug.14, 2005

JEE 4090 - Patents and Other Ways to Protect Inventions
Spring Semester 2005

Required/Elective Course:	Elective
Credit:	3 units
2004-2005 Catalog Data:	Analysis of the practical and legal steps with which an engineer should be familiar regarding patent protection for electrical and electronic inventions. The course focuses primarily on the patent protection provided under the U.S. patent laws. Recent U.S. patents relating to electrical and electronic inventions are examined to better understand patents and the protection provided by patents. Copyrights, trademarks, trade secret, unfair competition and mask work protection are also discussed. The protection and marketing of ideas is also considered. The course provides a pragmatic review of intellectual property from an electrical engineering perspective to prepare for the issues commonly faced in industry and business today.
Prerequisite:	None
Textbooks:	Schechter, Roger E., & Thomas, John R., INTELLECTUAL PROPERTY THE LAW OF COPYRIGHTS, PATENTS AND TRADEMARKS, West Group (2003) ISBN 0-314-06599-7.
Reference:	None
Coordinator:	Timothy B. McBride, Adjunct Professor, School of Engineering and Applied Science, Washington University; Attorney, Senniger Powers
Course Objectives:	To provide a pragmatic review of intellectual property from an electrical engineering perspective in order to prepare students for the issues commonly faced in both industry and business today.

Prerequisites by topic:
None

Topics Covered:
1. Trade Secret Law - legal concepts associated with protecting inventions and proprietary information as trade secrets.

2. Patent Law - legal concepts associated with protecting inventions via domestic and foreign patent law systems.

3. Copyright Law - legal concepts associated with copyright law with an emphasis on protecting computer programs and written documents using the U.S. copyright system.

4. Trademark Law - legal concepts associated with federal and state trademark law with an emphasis on under-standing the nature and scope of trademark protection.

5. Contract Law - a brief overview of several common legal issues facing engineers as employees.

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 2 exams, 1 final

Computer Usage: None

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	3 credits or 100%
Engineering Topics:	0 credits or 0%
Engineering Science:	0 credits or 0%
Engineering Design:	0 credits or 0%

Relationship of Course to Program Outcomes:

(h) Understanding of the global and societal role of engineering;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Timothy B. McBride **Prepared On:** August 23, 2005

JEE 4300 - Engineering Electromagnetics Applications
Spring Semester 2006

Required/Elective Course:	Elective
Credit:	3 units
2004-2005 Catalog Data:	Study of important applications of electromagnetic theory. Included are:uniform plane wave propagation with reflection and transmission characteristics, including effects due to losses; transmission lines covering TEM, quasi-static TEM, and lossy behavior; guided waves including rectangular and optical waveguides; study of antennas including an exposure to terminology and thin-wire antennas.
Prerequisite:	JEE 3300-Engineering Electromagnetics Principles or equivalent
Textbooks:	Fawwaz T. Ulaby, Applied Electromagnetics 2004 Media Edition, Pearson Prentice-Hall, Upper Saddle River, NJ, 2004
Reference:	None
Coordinator:	Barry E. Spielman, Professor of Electrical and Systems Engineering
Course Objectives:	To understand the application of Maxwell's Equations to practical, time-varying (dynamic) electromagnetic field problems.

Prerequisites by topic:
1. Vector analysis
2. Electrostatic and magnetostatic fields
3. Material properties
4. Boundary Conditions
5. Acquaintance with Maxwell's Equations

Topics Covered:
1. Electrostatic/Magnetostatic Problem Solving (3 weeks)
Conditions for solution uniqueness; imaging techniques; boundary value problems - construction of solutions in rectangular and cylindrical coordinates.

2. Maxwell's Equations (4 weeks)
Time-dependent differential and integral equation forms; boundary conditions; potential functions and the wave equation; time-harmonic electromagnetics; plane electromagnetic waves; wave polarization; power flow and complex power; wave and energy propagation velocity; standing waves; waves in lossy materials; reflection of waves –normal and oblique incidence at conducting and dielectric-dielectric boundaries; reflection and transmission coefficients.

3. Guided Waves (2 weeks)
General wave behavior along uniform guiding structures, distinguishing between TEM, TM, and TE waves, TM waves in parallel-plate waveguides and rectangular waveguides; resonators; propagation in dielectric waveguides.

4. S-Parameters and Transmission Networks (2 weeks)

Definition of S-parameters; properties of S-parameters; use of S-parameters for microwave transmission lines and networks. Time-domain behavior of transmission lines (time permitting).

5. Antennas and Radiating Systems (2 weeks)
Fields from elemental electric and magnetic dipoles; teminology - near field, far (radiation) field, antenna pattern, beamwidth, sidelobe, directivity, gain, radiation efficiency; dipole antenna; introduction to array concepts.

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 1 midterm exam, 1 final exam

Computer Usage: None required, Students may use computers to solve problems on homework. Computers may also be used on take-home exams and quizzes.

Laboratory: In-class device demonstrations

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Barry E. Spielman **Prepared On:** July 14, 2005

JEE 4330 - RF and Microwave Technology for Wireless Systems
Spring Semester 2005

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Focus is on the components and associated techniques employed to implement analog and digital radio frequency (RF) and microwave (MW) transceivers for wireless applications, including: cell phones; pagers; wireless local area networks; global positioning satellite based devices; and RF identification systems. A brief overview of system-level considerations is provided, including modulation and detection approaches for analog and digital systems; multiple-access techniques and wireless standards; and transceiver architectures. Focus is on RF and MW: transmission lines; filter design; active component modeling; matching and biasing networks; amplifier design; and mixer design.

Prerequisite: JEE 3300-Engineering Electromagnetics Principles

Textbooks: R. Ludwig and P. Bretchko, "RF Circuit Design, Theory and Applications," Prentice-Hall, Upper Saddel River, NJ, 2000.

Reference: B. Razavi, "RF Microelectronics," Prentice-Hall PTR, Upper Saddle River, NJ, 1998one

Coordinator: Barry E. Spielman, Professor of Electrical and System Engineering

Course Objectives: To engender an awareness of system-level considerations, including modulation and detection approaches for analog and digital systems; multiple-access techniques and wireless standards; and transceiver architectures for a variety of commercial wireless applications. To review the use of transmission lines as circuit elements. To teach design methods for RF/ MW filters, amplifiers, biasing networks, impedance matching and biasing networks, and mixers.

Prerequisites by topic:
1. Electromagnetic wave behavior
2. Voltage and current waves
3. Basic circuit concepts

Topics Covered:
1. Introduction to RF & Wireless Technology

2. Complexity Comparison – RF/MW and Baseband Applications

3. Modulation & Detection

4. Multiple Access Techniques & Wireless Standards

5. Transceiver Architectures

6. RF & MW Transmission Lines

7. RF & MW Filter Design

8. Matching and Biasing Networks

9. RF & MW Amplifier Design

10. RF & MW Mixer Design

Class/Lab Schedule: Either two 90 minutes sessions per week or three 60 minute sessions per week.

Tests: One exam, two significant design projects

Computer Usage: The two design projects require substantive use of mathematic software (e.g. MATLAB).for both computation and visualization

Laboratory: Not applicable

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Barry E. Spielman **Prepared On:** July 18, 2005

JEE 4340 - Solid-State Power Circuits and Applications
Fall Semester 2004

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Study of the strategies and applications of power control using solid-state semiconductor devices. Survey of generic power electronic converters. Applications to power supplies, motor drives, and consumer electronics. Introduction to power diodes, thyristors, and MOSFETs.

Prerequisite: JEE 2320-Introduction to Electronic Circuits, JEE 3510-Signals and Systems

Textbooks: N. Mohan, T.M. Undeland, and W.P. Robbins, Power Electronics: Converters, Applications, and Design (Media Enhanced 3nd. ed.), John Wiley & Sons, 2003

Reference: None

Coordinator: Thomas P. Collins, P.E., Adjunct Assistant Professor of Electrical and Systems Engineering

Course Objectives: This is a senior level elective course which introduces the student to the chief strategies of modern electronic power control, explains several important specific applications, and teaches the physical electronic bases of the more important device families upon which this technology depends.

Prerequisites by topic:
1.Elementary linear, time-invarient electric circuits in both the time and frequency domains.
2.Elementary electronics, including the physics and behavior of diodes and FETs.
3.Physics of heat transfer.
4.Basic concepts of signal analysis.

Topics Covered:
1. Electrical Transients (1 lecture)
R-L, R-C, and L-C transients with DC and AC excitation
2. Review of heat transfer (1 lecture)
3. Overview of power semiconductor switches (2 lectures)
Diodes, Thyristors, MOSFETs, and BJTs
4. Line frequency diode rectifiers (3 lectures)
Basic half-wave rectifiers, Single-phase diode-bridge rectifiers, Polyphase full-bridge rectifiers, Inrush currents and over-voltages, Questions of harmonic content and power factor
5. DC-to-DC Switch-Mode Converters (3 lectures)
Basic concepts, Buck converters, Boost converters, Compound converters
6. Switch-mode DC-to-AC Inverters (3 lectures)
Basic concepts, Single-phase inverters, Polyphase inverters, Practicalities
7. Resonant Converters (2 lectures)
Classification and basics of operation, Practicalities
8. Applications (4 lectures)

Uninterruptible power supplies, Driving DC motors, Inductive heating, VAR control, Suppression of harmonics and interference
9. Review of the P-N junction and Power Diodes (2 lectures)
I-V characteristics, Switching characteristics, Losses, Practicalities
10. Thyristors (3 lectures)
Basic structure and physics of operation, I-V characteristics, Switching characteristics, Fundamental limitations, Thyristor gating circuits
11. Power MOSFETs (2 lectures)
Basic structure and physics of operation, I-V characteristics, Switching characteristics, Gate drive circuits, Practicalities
12. Exams (2 lectures total)

Class/Lab Schedule: 2 sessions per week; 90 minutes per session

Tests: 3 regular 1 hour exams

Computer Usage: On most homework and design problems, extensive use is suggested for using 1) Mentor Graphics' high level network modeling package, 2)Electronics Workbench, or 3)Spice as tools.

Laboratory: A design project is required as part of the final grade.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice.

Prepared By: Thomas Collins **Prepared On:** 3-27-05

JEE 4350 - Electrical Energy Laboratory
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Experimental studies of principles important in modern electrical energy systems. Topics include: power measurements, single phase transformers, batteries, three phase circuits and transformers, static frequency converters, thermoelectric cooling, solar cells, electrical lighting, induction, commutator, and brushless motors, and synchronous machines.

Prerequisite: JEE 2330-Electrical and Electronic Circuits and JEE 2300-Introduction to Electrical Networks, and JEE 3320-Power, Energy, and Polyphase Circuits

Textbooks: The Electrical Energy Laboratory Manual was developed for this course by Drs. R. O. Gregory, William F. Pickard and Charles M. Wolfe of Washington University. It is updated yearly by Dr. John D. Corrigan with inputs from Mr. William Dick. The appropriate section of the manual is handed out each week at the lecture which precedes the laboratory experiment.

Reference: The Laboratory Manual provides appropriate introductory information on each topic and includes a list references for each lecture. In addition, the following reference text book is required: Stephan J. Chapman, Electric Machinery and Power Systems Fundamentals, 1st ed., McGraw Hill.

Coordinator: John Corrigan, Affiliate Professor of Electrical and Systems Engineering

Course Objectives: This course is designed to introduce Juniors and Seniors in Electrical Engineering to a number of traditional topics as well as newer technologies in the generation, conversion, usage, and control of electrical energy. Topics are chosen for their general importance to give a breadth of knowledge to the graduating electrical engineer who may someday find himself working in the design and/or production end of a manufacturing or an electrical power generation/distribution industry.

Prerequisites by topic:
1. Circuit analysis including the use of Phasors and Thevenin equivalent circuit models,
2. Electronic circuits including components such as diodes and transistors,
3. Electromagnetic concepts,
4. Basic laboratory procedures, including construction of the experiment, proper measurement techniques, data recording, and report writing.

Topics Covered:
1. Power measurement techniques (1 lecture & 1 laboratory)
2. Batteries (1 lecture & 1 laboratory)
3. Solar Cells (1 lecture & 1 laboratory)
4. Commutator Motors (1 lecture & 1 laboratory)
5. Single Phase Transformers (1 lecture & 1 laboratory)

6. Three Phase Circuits and Transformers (1 lecture & 1 laboratory)
7. Induction Motors (1 lecture & 1 laboratory)
8. Synchronous Machines (1 lecture & 1 laboratory demonstration)
9. Electrical Lighting (1 lecture & 1 laboratory)
10. Solar Cells (1 lecture & 1 laboratory)
11. Brushless Motors (1 lecture & 1 laboratory)
12. Static Power Inverters (1 lecture & 1 laboratory).

Class/Lab Schedule: 2 sessions/week: 90 minutes lecture, 180 minutes laboratory

Tests: One midterm test and one final exam. Problems from major topics covered during the semester are included.

Computer Usage: Computer programs such as Excel and MATLAB are used to generate clear and accurate plots for each report. A word processing program such as Microsoft Word is used to write the actual report and the graphical material is merged with the text to present a well formatted and readable report.

Laboratory: This course consists of 12 laboratory experiments. All experiments except the one on synchronous machines must be set up by the students working in teams of two or three. The students are required to do significant design in order to properly set up the experiment to collect the correct data. Decisions as to the correct current measuring device, the correct oscilloscope connections, frequency of measurement, etc. must be made by each student team. In addition, each student is required to design a useful laboratory on a subject of interest that is not currently included in the course and provide a report in a format similar to that used in laboratory manual.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	1.5 credits or 50%
Engineering Design:	1.5 credits or 50%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(b) Ability to: design & conduct experiments; analyze and interpret data;
(c) Ability to design a system, component, or process to meet desired needs;
(d) Ability to function on multi-disciplinary teams;
(e) Ability to identify, formulate, and solve engineering problems;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
(l) Preparation for participation in industry, academia, or governmental laboratories

Prepared By: John Corrigan **Prepared On:** 8/12/05

JEE 4380 – Applied Optics
Spring Semester 2005

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Topics relevant to the engineering and physics of conventional as well as experimental optical systems and applications explored. Items addressed include geometrical optics, Fourier optics such as diffraction and holography, polarization and optical birefringence such as liquid crystals, and nonlinear optical phenomena and devices.

Prerequisite: JEE3300 - Engineering Electromagnetics Principles

Textbooks: E. Hecht, Optics, 4th ed., Benjamin Cummings, 2002.

Reference: None

Coordinator: Ronald S. Indeck, Professor of Electrical and Systems Engineering

Course Objectives: None

Prerequisites by topic:
1. Electromagnetic field theory

Topics Covered:
1. Electromagnetic theory of light (1)

2. Reflection and refraction (1)

3. Geometrical optics and imaging (2)

4. Polarization, interference and diffraction (3)

5. Fourier optics (2)

6. Holography (1)

7. Non-linear optics (MO, EO, SHG)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 1 midterm, 1 final

Computer Usage: Helpful for problem analysis.

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2.5 credits or 100%
Engineering Design:	0.5 credits or 0%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice.

Prepared By: Ronald S. Indeck **Prepared On:** 09/23/05

JEE 4410 Control Systems I
Summer 2005

2005 Catalogue Data: **JEE 4410 Control Systems I.** Prerequisite: JEE3510, JEE 2300 (same as JME 4310). Introduction to automatic control concepts. Block diagram representation of single- and multi-loop systems. Multi-input and multi-output systems. Control system components. Transient and steady-state performance; stability analysis; Routh, Nyquist, Bode, and root locus diagrams. Compensation using lead, lag, and lead-lag networks. Synthesis by Bode plots and root-locus diagrams. Introduction to state-variable techniques, state transition matrix, state-variable feedback. Credit 3 units.

Textbook: **Dorf, Richard C.** *Modern Control Systems*, Addison-Wesley 10th Edition

Coordinator: Karl Spuhl, Adjunct Professor of Mechanical Engineering

Goals:
1. Modeling physical systems mathematically
2. Developing tools and skills to analyze these models to determine if the system performs within specification and to determine necessary design strategies to meet specification.

Prerequisites by topic:

- Good working knowledge of Algebra
- Calculus
- Fundamentals of the physics of mechanics systems
- Fundamentals of DC and AC Circuits including operational amplifiers
- Matrix Algebra
- Laplace Transforms

Topics:

- Block diagram representation of single- and multi-loop systems.
- Multi-input and multi-output systems.
- Control system components.
- Transient and steady-state performance; stability analysis; Routh, Nyquist, Bode, and root locus diagrams.
- Compensation using lead, lag, and lead-lag networks.
- Synthesis by Bode plots and root-locus diagrams.
- Introduction to state-variable techniques, state-transition matrix, state-variable feedback.

Computer Usage: Computer aided design tools are used for homework and design projects. MatLab, a commercial software package, provides a c omputer aided engineering system or designer's workbench. Students us MatLab for matrix analysis, control system design, system analysis and the preparation of graphics for project reports..

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 2.0 credits **Engineering design:** 1.0 credits

Prepared by: Karl Spuhl **Date:** Dec. 5, 2005

JEE 4420 - Digital Control Systems
Spring Semester 2005

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Introduction to the analysis and synthesis of linear discrete time systems with applications in digital (sampled-data) control systems. The Z-transform theory. State-space description of discrete time systems. Solutions of the dynamic equations. Systems with hybrid elements. Time and frequency response of discrete time control systems. Multivariable and optimal control. Algebraic synthesis techniques. Design of discrete time control systems.

Prerequisite: JEE 4410-Control Systems or JME 4310-Control Systems I.

Textbooks: Digital Control of Dynamic Systems” by Gene Franklin, J. David Powell, and Michael Workman ISBN: 0201820544, 3rd Ed., 1997, Addison Wesley

Reference: None

Coordinator: William J. Murphy, Affiliate Professor of Electrical Engineering

Course Objectives: Course is designed to give seniors in Electrical Engineering and related disciplines the ability to analyze and design discrete and sampled-data control systems.

Prerequisites by topic:
1. Mathematics through differential equations, advanced calculus, Laplace transforms and linear algebra.
2. Introductory course in linear, continuous-time control systems.

Topics Covered:
1. Linear Discrete Dynamic Systems Analysis: the Z-transform. (5 classes)

2. Sampling and Reconstruction: A/D and D/A Conversion. (2 classes)

3. Sampled-Data Systems: Time and Frequency Response Characteristics, Stability Analysis. (4 classes)

4. Design of Digital Control Systems Using Classical Techniques - Emulation, Root Locus and Frequency Response Methods. (8 classes)

5. Design of Digital Control Systems Using State-Space Methods - State Estimation. (8 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 1 in-class, 2 take-home, 1 final exam

Computer Usage: Use of MATLAB computer program as a tool in solving design problems (root locus, frequency response, state-space analysis, state-variable feedback, state estimation).

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;
(e) Ability to identify, formulate, and solve engineering problems;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice.
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: William Murphy **Prepared On:** 6/30/05

JEE 4480 –Systems Engineering Laboratory
Spring Semester 2005

Required/Elective Course:	Elective for BSEE and Required for BSSSE
Credit:	3 units
2004-2005 Catalog Data:	Experimental study of real and simulated systems and their control. Identification, input-output analysis, design and implementation of analog controls. Noise effects. Design and implementation of control laws for specific engineering problems.
Prerequisite:	JEE3510 Signals and Systems; JCS1002, Introduction to Computing Tools: MATLAB Skills; JEE 4410, Control Systems
Textbooks:	None.
Reference:	R.H. Bishop, Modern Control Systems, Analysis & Design using MATLAB & Simulink, Addison-Wesley, 1997.
Coordinator:	Hiro Mukai, Professor of Electrical and Systems Engineering
Course Objectives:	Course is designed to give juniors in Systems Science and Engineering and related disciplines the ability (1) to mathematically model and simulate control systems using modern simulation software and (2) to design and implement PC-based feedback control systems in a laboratory setting.

Prerequisites by topic:
1. Mathematics through differential equations, Laplace transforms and linear algebra.

Corequisites by Topic:
1. Introductory course in linear, continuous-time control systems

Topics Covered:
1. Introduction to Simulink simulation software. (1 laboratory session)

2. Modeling and simulation of nonlinear, fluid flow systems. Linearization. Introduction to feedback control. (2 laboratory sessions)

3. Modeling and simulation of an automatic blood pressure control system using proportional-plus-integral-plus-derivative (PID) control. Steady-state error. Transient performance criteria. The effects of disturbances, sensor dynamics, and sensor noise. (2 laboratory sessions)

4. Modeling, identification and computer (digital) control of a DC motor. Analog-to-digital and digital-to-analog conversion, Open-loop versus feedback control. (3 laboratory sessions)

5. Computer control of a ball and beam balancing system. Practical application of PID control. (3 laboratory sessions)

6. Control of a legged, walking robot through simulation. (3 laboratory sessions)

7. Laboratory reports and demonstrations. (5 reports plus in-laboratory demonstrations of experimental results)

Class/Lab Schedule:	1 class (60 minutes) and 1 lab (180 minutes) per week
Tests:	None
Computer Usage:	Use of MATLAB and Simulink computer programs as tool in obtaining and simulating control system designs. Computer control requires the use of a PC and Quanser programs for Matlab.
Laboratory:	4 stations, each of which consists of a Dell computer with Matlab and Simulink, and a Quanser ball and beam system with a power source and AD/DA connections to the computer.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	.5 credits or 17%
Engineering Design:	2.5 credits or 83%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(b) Ability to: design & conduct experiments; analyze and interpret data;
(c) Ability to design a system, component, or process to meet desired needs;
(d) Ability to function on multi-disciplinary teams;
(e) Ability to identify, formulate, and solve engineering problems;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Hiro Mukai **Prepared On:** Aug. 24, 2005

JEE4600 Switching Theory

Required/Elective Course: **Elective**

Credit: 3 Units

2004-2005 Catalog Data: Advanced topics in switching theory as employed in the analysis and design of various information- and material-processing systems. Combinational techniques: minimization, logic elements, bilateral devices, multiple output networks, state identification and fault detection, hazards, and reliable design. Sequential techniques: synchronous circuits, state tables, machine minimization, state assignment, asynchronous circuits, finite state machines.

Prerequisite: JEE2600 or equivalent.

Textbooks: Hachtel, G. & Somenzi, F., Logic Synthesis and Verification Algorithms, 1st edition, Springer, 1996.

Reference:

Coordinator: John Lockwood, Associate Professor in Computer Science and Engineering

Course Objectives: This course develops a comprehensive understanding of combinational and sequential theory for applications to analyze and design digital circuits, both conventional and non-conventional.

Topics Covered:

1. **Lattice theory and related mathematical topics applied to switching**
2. **Minimization and decomposition of Boolean functions: comparison of several methods including the Q-M algorithm**
3. **Fault detection and reliable design**
4. **Static and dynamic hazards**
5. **Analysis, minimization, and synthesis of synchronous sequential machines**
6. **Synthesis of asynchronous sequential machines**
7. **Testing of sequential systems**
8. **Concepts of built-in self test**

Class/Lab Schedule: 2 sessions – 1.5 hours

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:
(a), (c), (e)
The following outcomes are mentioned with limited coverage:
(k)

Prepared By: Roger Chamberlain **Prepared On:** June 2006

JEE4630 Digital Integrated Circuit Design and Architecture

Required/Elective Course: **Elective**

Credit: 3 Units

2004-2005 Catalog Data: Brief review of device characteristics important to digital circuit operation, followed by detailed evaluation of steady-state and transient behavior of logic circuits. Implications of and design techniques for very large-scale integrated circuits including architecture, timing, and interconnection. Students must complete detailed design and layout of a digital circuit. Major emphasis on MOS digital circuits with some comparisons to other technologies.

Prerequisite: JEE2320 and JEE3620.

Textbooks: Weste, N. & Harris, D., CMOS VLSI Design: A Circuits and Systems Perspective, 3rd edition, Addison Wesley, 2004.

Reference:

Coordinator: Fred Rosenberger, Associate Professor in Computer Science and Engineering

Course Objectives: Ability to design elementary CMOS logic elements at the electrical and physical level. Understanding of tradeoffs between circuit styles, design methods, feature size, fabrication and performance.

Topics Covered:

1. **Simple CMOS design**
2. **FET characteristics**
3. **Delay characterizations**
4. **Fabrication**
5. **Design rules**
6. **Scaling**
7. **Clocking**
8. **Layout strategies**
9. **Routing**
10. **CAD tools**
11. **Testing**
12. **Dynamic logic**
13. **Memory**
14. **System design examples**

Class/Lab Schedule: 2 sessions – 1.5 hours

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:
(a), (c), (e)
The following outcomes are mentioned with limited coverage:
(k)

Prepared By: Roger Chamberlain **Prepared On:** June 2006

CSE 464M Digital Systems Engineering

Required/Elective Course: **Elective**

Credit: 3 Units

2004-2005 Catalog Data: Design and characterization of digital circuits, reliable and predictable interconnection of digital devices, and information transfer over busses and other connections. Topics include: Review of MOSFET operation; CMOS logic gate electrical characteristics; System and single-point noise margin and noise budgets; Figures of merit for noise- margin and power-delay product, and trade-off between noise margin and propagation delay; Transmission-line driving including reflection, termination, non-zero transition time, lumped and distributed capacitance loads, non-linear terminations, and applicable conditions for lumped approximations; Coupled transmission lines, forward and backward crosstalk, short line approximations, ground bounce, and simultaneous switching noise; Timing, clocking, and clock distribution for digital circuits; Prediction of metastability error rates and design for acceptable probability of failure. Examples and design exercises using systems and interconnections selected from current Computer Engineering practice such as RAMBUS, PCI bus, GTL, LVDS, and others.

Prerequisite: JEE2320

Textbooks: Dally, W. & Poulton, J. Digital Systems Engineering. Cambridge University Press, 1998.

Reference:

Coordinator: David Zar, Instructor in Computer Science and Engineering

Course Objectives: The enable students to design digital systems that work correctly in the presence of worst case noise and timing parameters. To design and utilize efficient and robust signaling methods and signaling paths.

Topics Covered:

1. **Packaging of digital systems**
2. **Worst case (predictable) design**
3. **Figures of merit: power-delay product and noise-margin/delta-V**
4. **Noise sources**
5. **Lossless and lossy transmission lines with pulse excitation**
6. **Coupled transmission lines**
7. **Power distribution and packaging, package parasitics**
8. **Signaling conventions and circuits**
9. **Metastability**

Class/Lab Schedule: 2 sessions – 1.5 hours

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences: 0 credits or 0%

Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:
(a), (c), (e)
The following outcomes are mentioned with limited coverage:
(k)

Prepared By: Roger Chamberlain **Prepared On:** June 2006

JEE 4650 - Digital Systems Laboratory
Fall 2005

Required/Elective Course: Required or must take JEE 3310

Credit: 3 units

2004-2005 Catalog Data: Procedures for reliable digital design, both combinational and sequential; understanding manufacturers´ specifications; use of special test equipment; characteristics of common SSI, MSI, and LSI devices; assembling, testing, and simulating design; construction procedures; maintaining signal integrity. Several single-period laboatory exercises, several design projects, and application of a microprocessor in digital design. One lecture and one laboratory period a week.

Prerequisite: ESE/CSE 260-Intro to Digital Logic and Computer Design, CSE 361S-Intro to Systems Software.

Textbooks: None

Reference: The C Programming Language
Introduction to VHDL from Simulation and Synthesis

Coordinator: David Kuefler, Instructor of Electrical and Systems Engineeing

Course Objectives: To expose students to designing digital systems employing a SPARC microprocessor and to investigate the tradeoffs between hardware and software implementations of various functions.

Prerequisites by topic:
1. Boolean algebra
2. Combinational and sequential synthesis techniques
3. Machine and assembly language programming
4. Computer organization and control
5. General lab equipment use
6. Lab report writing

Topics Covered:
1. Mixed logic and documentation standards (1 week)

2. Operational requirements and structured design (1 week)

3. C language programming and use of the compiler (2 weeks)

4. Basic computer architecture concepts (1 week)

5. Bus timing and peripheral interfacing (1 week)

6. Introduction to VHDL (2 weeks)

7. Design projects' requirements (5 weeks)

Class/Lab Schedule: One 90 minute lecture and one 150 minute lab session per week

Tests: One final exam

Computer Usage:
1.C programming exercises
2.VHDL programming
3. Debugging and simulation tools

Laboratory: Five laboratory assignments demonstrating the topics listed above.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	.75 credits or 25%
Engineering Design:	2.25 credits or 75%

Relationship of Course to Program Outcomes:
(a) Ability to apply math, science, and engineering;
(b) Ability to design & conduct experiments; analyze and interpret data;
(c) Ability to design a system, component, or process to meet desired needs;
(d) Ability to function on multi-disciplinary teams;
(e) Ability to identify, formulate, and solve engineering problems;
(f) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: David Kuefler **Prepared On:** August 15, 2005

CSE 467S Embedded Computing Systems

Required/Elective Course: **Elective**

Credit: 3 Units

2004-2005 Catalog Data: Design of computing systems that are embedded in a larger system (e.g., a control system, a cell phone, an MP3 player, etc.). The emphasis is on aspects of the design that are distinct for most embedded systems. Hardware topics include: Harvard architecture, microcontrollers, digital signal processors, power management code compression, I/O. Software topics include: languages, run-time environments, code optimization for performance, power and memory footprint. System-level topics include: real-time operating systems, scheduling, correctness, performance, multiple processor systems.

Prerequisite: JEE3620.

Textbooks: Wolf, W., Computer as Components: Principles of Embedded Computing System Design. Morgan Kaufmann, 2005.

Reference:

Coordinator: Chenyang Lu, Assistant Professor in Computer Science and Engineering

Course Objectives: The course introduces the issues, challenges, and methods for designing embedded computing systems.

Topics Covered:

1. **Digital Signal Processors**
2. **Tiny OS**
3. **Power Management**
4. **Program Optimization**
5. **Scheduling**
6. **I/O**
7. **Real time middleware**
8. **Sensor networks**

Class/Lab Schedule: 2 sessions – 1.5 hours

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%

Relationship of Course to Program Outcomes:
The following outcomes are explicitly covered:
(a), (c), (e)
The following outcomes are mentioned with limited coverage:
(d), (k)

Prepared By: Roger Chamberlain **Prepared On:** June 2006

JEE 4710 - Communication Theory and Systems
Spring Semester 2005

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Introduction to the concepts of transmission of information via communication channels. Amplitude and angle modulation for the transmission of continuous-time signals. Analog-to-digital conversion and pulse code modulation. Transmission of digital data. Introduction to random signals and noise and their effects on communication. Optimum detection systems in the presence of noise. Elementary information theory. Overview of various communication technologies such as radio, television, telephone networks, data communication, satellites, optical fiber, and cellular radio.

Prerequisite: JEE 3510-Signals and Systems and JEM 3260-Engineering Probability or Math 1320 (UMSL)-Applied Statistics I

Textbooks: B. P. Lathi, Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press, 1998

Reference: Couch, L. W. II, "Digital and Analog Communication Systems", Prentice Hall

Coordinator: R. Martin Arthur, Professor of Electrical and Systems Engineering

Course Objectives: This course is designed to give seniors in electrical engineering an understanding of how communications systems work, and how they perform in the presence of noise. Develop tools and metrics used to characterize communications systems, develop techniques useful for comparative analysis of digital communications systems performance and designs.

Prerequisites by topic:
1. Fourier Transforms
2. Linear Systems Analysis
3. Probability Theory

Topics Covered:
1. Analysis and transmission of signals (6 lectures)

2. Amplitude Modulation (4 lectures)

3. Angle Modulation (4 lectures)

4. Sampling and Pulse Code Modulation and Digital transmission (4

5. Review Probability/ introduce random processes (4 lectures)

6. Analog systems in presence of noise (2 lectures)

7. Digital systems in the presence of noise (2 lectures

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 2 exams 55%, homework 25%, project 15%, instructor 5%

Computer Usage: None required; Matlab useful for some of the assignments.

Laboratory: Student picks a communications application topic to study in depth. After a review of the literature, the student presents the topic to the instructor for acceptability. The project provides an opportunity to study a system of interest and show how the tools and analyses developed in class are used to analyze a design. A Power Point presentation is developed, presented to the class and submitted to the instuctor for posting on a class website.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs ;
(e) Ability to identify, formulate, and solve engineering problems.
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: R. Martin Arthur **Prepared On:** 15 August 2005

JEE 4820 - Digital Signal Processing
Fall Semester 2004

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: Introduction to analysis and synthesis of discrete-time linear time-invariant (LTI) systems. Discrete-time convolution, discrete-time Fourier transform, z-transform, rational function descriptions of discrete-time LTI systems. Sampling, analog-to-digital conversion, and digital processing of analog signals. Techniques for the design of finite impulse response (FIR) and infinite impulse response (IIR) digital filters. Hardware implementation of digital filters and finite-register effects. The Discrete Fourier Transform and the Fast Fourier Transform (FFT) algorithms.

Prerequisite: JEE 3510-Signals and Systems

Textbooks: Discrete-Time Signal Processing, Second Edition, by A. V. Oppenheim and R. W. Schafer, Prentice-Hall, 1999

Reference: Digial Signal Processing, Third Edition, by Proakis and Manolakis, Prentice Hall, 1996

Coordinator: R. Martin Arthur, Professor of Electrical and Systems Engineering

Course Objectives: To give seniors in electrical engineering an understanding of discrete-time linear systems and their relationship to continuous-time signals and systems, so that they can analyze and design linear systems with computers.

Prerequisites by topic:
1. Impulse response and convolution
2. Eigenfunctions and eigenvalues
3. Matrix formulation and manipulation
4. Fourier series, Fourier integral, and Laplace transform
5. System and transfer functions
6. Bode and Nyquist plots.

Topics Covered:
1. Digital signal processing applications. (1 class)
2. Discrete-time systems -- Description of signals and linear, shift-invariant systems. (2 classes)
3. Convolution -- Unit-sample response and the convolution sum. (2 classes)
4. Fourier and inverse Fourier transforms of discrete-time signals. (1 class)
5. Sampling and reconstruction of continuous-time signals. The sample theorem and aliasing. (2 classes)
6. Z transforms -- Right- and left-sided sequences, region of convergence. Inverse transform techniques. (3 classes)
7. Discrete Fourier series and transforms -- Spectral analysis. Circular convolution. (2 classes)
8. Fast Fourier transform algorithms. (2 classes)
9. Chirp Z transform. (1 class)
10. Signal-flow graphs. (1 class)

11. Design of digital filters -- Digital versions of analog filters. Window functions for IIR filters. Linear-phase FIR filters. Optimal FIR filters using the REMEZ exchange algorithm. (6 classes)
12. Quantization effects -- Analog to digital conversion. Truncation and roundoff noise. (3 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: midterm test, quizzes, project, final exam

Computer Usage: Students design and write programs to perform convolution and Fourier transformation, implement difference equations, infer system response from the location of poles and zeros in the Z plane, and determine the effects of time-domain windows on spectral estimation. Computerized aids are used for the design of filters. Students use workstations available in the Center for Engineering Computing of the engineering school.

Laboratory: A design project is required. In the fall of 1999 the problem was: DESIGN a zero-phase SYSTEM to recover a signal after it had been low-pass filtered then contaminated with additive white noise. The degrading, low-pass filter must have a cutoff frequency between 1/4 and 1/2 of the maximum frequency. The exact value is determined by the fourth and fifth digits of your social security number as a percent of the range between 1/4 and 1/2. Passband ripple must be less than 1 dB. The stopband must be down xx dB from the magnitude of the frequency response at zero frequency, where xx = 24 + digit 6 of your social security number. The standard deviation of the noise added must be nn percent of the standard deviation of the degraded signal power, where nn is between 50 and 100 percent. The exact value is determined by the seventh and eighth digits of your social security number as a percent of the range between 50 and 100. Your recovery system is within specifications if its magnitude response is within 2% of the maximum of the desired magnitude response. Determine the system nature (FIR or IIR) and select approximations and implementations to MINIMIZE the number of arithmetic operations which must be performed to generate the output. Fully document your DESIGN with rationale and methods for each step of your DESIGN. Be sure to include appropriate graphical representations of system performance. Calculate the exact number of additions and multiplications which must be carried out by your system for a real input to produce a new output value. Demonstrate overall behavior by degrading (filtering and adding noise) and recovering the signal in vowels on the course web site. What is the noise in the output of your degradation filter due to quantization of the input to b bits?

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired

needs;
(e) Ability to identify, formulate, and solve engineering problems.

Prepared By: R. Martin Arthur **Prepared On:** 15 August 2005

JEE 4880 - Signals and Systems Laboratory
Fall Semester 2004

Required/Elective Course: Elective

Credit: 3 units

2004-2005 Catalog Data: A laboratory course designed to complement the traditional EE course offerings in signal processing and communication theory. Signals and systems fundamentals: continuous-time and discrete-time linear time-invariant systems, impulse and step response, frequency response, A/D and D/A conversion. Digital signal processing: FIR and IIR digital filter design, implementation and application of the Fast Fourier Transform. Communication theory: baseband, digital communication, amplitude modulation, frequency modulation, bandpass digital communication. Computer workstations and modern computational software used extensively for system simulation, data acquisition, and real-time signal processing.

Prerequisite: JEE 3510-Signals and Systems and Corequisite: JEE 4710-Communication Theory and Systems or JEE 4820-Digital Signal Processing.

Textbooks: None

Reference: Class notes.

Coordinator: Robert E. Morley, Associate Professor of Electrical and Systems Engineering

Course Objectives: To reinforce student understanding of required theoretical topics in signals and systems and advanced undergraduate topics in signal processing and communications through a series of laboratory modules.

Prerequisites by topic:
1. Signals and Systems Fundamentals
2. Digital Signal Processing (optional corequisites:)
3. Communication Theory (optional corequisites:)

Topics Covered:
1. Laboratory Module 1: LabVIEW Intro and DTMF Decoder Design (2 wks)

2. Laboratory Module 2: Sampling Theorem Simulation (2 wks)

3. Laboratory Module 3: QPSK Modem: Theory, Simulation and Performance Verification (3-4 wks)

4. Laboratory Module 4: Delta Sigma Analog to Digital Converter Design (3 wks)

5. Laboratory Module 5. NTSC Color Television Standard and Receiver Design (4 wks)

Class/Lab Schedule: 1 Class of 90 minutes and 1 3 hour lab per week.

Tests:	1 midterm exam, 1.5 hrs, 5 project reports.
Computer Usage:	Use of LabVIEW for system design and simulation.
Laboratory:	There are 5 distinct laboratory modules, which make up the entire course. See Topics above.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	0 credits or 0%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(b) Ability to: design & conduct experiments; analyze and interpret data;
(c) Ability to design a system, component, or process to meet desired needs;
(d) Ability to function on multi-disciplinary teams;
(e) Ability to identify, formulate, and solve engineering problems;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: Robert E. Morley **Prepared On:** 7/13/2005

JEE 4920 – Advanced Analog Electronics
Spring Semester 2005

Required/Elective Course: Elective for BSEE and BSSSE

Credit: 3 units

2004-2005 Catalog Data: Design and analysis of analog electronic circuits used in operational amplifiers, telecommunications, and control systems, with emphasis on integrated circuit utilization. Analysis of multi-transistor circuits, including large-signal transfer characteristics, distortion, power efficiency, impedances and high-frequency behavior. Frequency response, stability and frequency compensation of multi-stage feedback amplifiers. Review of general-purpose, precision, wideband video, and high-performance op amps and physical chip layout. Noise and noise-figure design of amplifiers. Linear and nonlinear analog circuits, including linear amplifiers, precision rectifiers, differentiators, AC integrators, phase-locked loops, high-frequency analog multipliers and mixers.

Prerequisite: JEE3370 – Electronic Devices and Circuits
Textbooks: P. R. Gray & R. G. Meyer, Analysis and Design of Analog Integrated Circuits, Fourth ed., Wiley, 2001.

Reference: S. Soclof, Design and Applications of Analog Integrated Circuits, Prentice Hall, 1991; D. L. Rode, Output Resistance of the Common-Emitter Amplifiers, IEEE Trans. On Electron Devices, September 2005; commercial literature and journal articles.

Misc. commercial literature and journal articles.

Coordinator: Daniel L. Rode, Professor of Electrical and Systems Engineering

Course Objectives: Study of the principles of design and operation of advanced analog circuits, computer simulations of their operation and applications to specific large-signal electronic transfer characteristics. Problems involving the design of analog electronic circuits using discrete and integrated-circuit devices for specified characteristics provide the design content of this course. Successful execution of homework assignments, projects, and examination problems involving the design and analysis of electronic circuits.

Prerequisites by topic:
1. Electrical network theory
2. Analog circuit operation
3. Electronic devices
4. Differential equations, Fourier and Laplace transforms

Topics Covered:
1. Integrated-circuit op amps, and bipolar, JFET and MOSFET field-effect transistor operating characteristics. Circuit models for large-signal analog operation. Large-signal analysis of linear and non-

linear negative feedback analog amplifiers. Limiting behavior of large-signal transfer characteristics and applications to small-signal behavior. Frequency-dependent input and output impedances, and distortion of current and voltage gain. Differential and common-mode characteristics, common-mode rejection, and distortion. Advanced computer simulation techniques using SPICE and Mentor Graphics tools. (7 classes)
2. Physical integrated-circuit chip layout, monolithic fabrication technology, crystal growth, etching, oxidation, diffusion, ion implantation, mask generation, lithography, and electronic device packaging. Electronic parasitic effects of substrates and packages. Thermal characteristics of electronic packaging. Packaging options, cost and properties. (4 classes)
3. Power amplifiers and output stages. Voltage, current and power gain. Power efficiency, heat management. Overall amplifier power efficiency, error voltage, distortion, input over-load protection, output overload protection, output short-circuit protection. Computer-aided design and analysis of power amplifier stages. (6 classes)
4. Frequency response and stability of analog circuits. Internal frequency compensation of analog integrated circuits, integrator response and phase behavior. Gain margin, phase margin, overshoot and settling time of of multi-pole amplifiers. Nyquist analysis of stability, pole-zero and root-loci plots in the complex frequency domain, gain compression. (6 classes)
5. Generalized concepts of negative feedback for use in electronic amplifiers. Loop gain and stability relationships. Effects on gain, precision, input impedance and output impedance. Voltage feedback and current feedback. Feedback configurations, series-shunt, shunt-shunt, shunt-series and series-series. Loading effects, bandwidth, and slew rate. (6 classes)
6. Concepts of statistics of electron flow and electrical noise properties of electronic components and circuits. Fundamental noise sources, thermal noise and shot noise. Extrinsic noise sources, 1/f noise, flicker noise, and popcorn noise. Noise figure characterization of transistors and amplifiers. Frquency-dependent noise-figure models of transistors. Input-referred noise sources for amplifiers and transistors. Minimum noise figure design and noise matching for best performance. (7 classes)
7. Aplications of discrete, hybrid and integrated analog circuits. Linear and power amplifiers. Non-linear amplifiers, precision rectifiers, limiters, and function generators. Phase-locked loops, frequency synthesizers, digital and radio receivers. D/A and A/D convertors. Analog multipliers, Gilbert cells, wideband electronic-gain programable amplifiers, multiplexers and demultiplexers. (8 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 3 equal-weight examinations

Computer Usage: Numerical analysis, graphing, electronic circuit simulation (PSPICE, Mentor Graphics)

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(c) Ability to design a system, component, or process to meet desired needs;

(e) Ability to identify, formulate, and solve engineering problems;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice.

Prepared By: Daniel L. Rode **Prepared On:** January 2005

JEE4980 - Electrical Engineering Design Projects
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Working in teams, students address design tasks assigned by faculty. Projects are chosen to emphasize the design process, with the designers choosing one of several paths to a possible result. The solution of a real technological or societal problem is carried through completely, including initial specification, consideration of alternatives, preparation of written proposal, and implementation and documentation of the design. Required documents are a written proposal and final report on the project. Oral presentations of progress reports and of the final project is also required. Collaboration with industry and all divisions of the University is encouraged.

Prerequisite: Senior standing

Textbooks: None

Reference: None

Coordinator: R. Martin Arthur, Professor of Electrical and Systems Engineering

Course Objectives: This is a senior-level, required course explicitly designed to fulfill the spirit of the ABET design mandate that some portion of this requirement must be satisfied by at least one course which is primarily design, preferably at the senior level, and draws upon previous course work in the relevant discipline.

Prerequisites by topic:
1. Elementary linear, time-invariant electric circuits in both the time and frequency domains.
2. Elementary analog and digital experimental- and analytical-skills.
3. Fundamental engineering electromagnetics.
4. Introductory signal analysis.

Topics Covered:
1. The Department has a policy of distributing the teaching of this course widely over the faculty.

2. The choice of project is left totally to the individual professor, and therefore the nature of the projects encountered by the student varies widely. Some are paper designs, a few have been computer exercises, but the greatest number have been hardware realizations (analog and/or digital).

3. Tools and structures to support the design process are common to each course offering

Class/Lab Schedule: 1 90-minute lecture per week, 1 3-hour laboratory session per week

Tests: None

Computer Usage:	As required by the individual project.
Laboratory:	Laboratory projects (including major items of equipment and instrumentation used): As required by the individual project. The total instructional laboratory resources of the Department are placed at the disposal of this course.

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	0 credits or 0%
Engineering Design:	3 credits or 100%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(b) Ability to: design & conduct experiments; analyze and interpret data;
(c) Ability to design a system, component, or process to meet desired needs;
(d) Ability to function on multi-disciplinary teams;
(e) Ability to identify, formulate, and solve engineering problems;
(f) Understanding of professional and ethical responsibility;
(g) Ability to communicate effectively;
(h) Understanding of the global and societal role of engineering;
(i) Recognition of need for and ability to engage in lifelong learning;
(k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
(l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: R. Martin Arthur **Prepared On:** 15 August 2005

JEM 3260 – Engineering Probability
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Study of probability and statistics together with engineering applications. Probability and statistics: random variables, distribution functions, density functions, expectations, means, variances, combinatorial probability, geometric probability, normal random variables, joint distribution, independence, correlation, conditional probability, Bayes theorem, the law of large numbers, the central limit theorem. Applications: reliability, quality control, acceptance sampling, linear regression, estimation, hypothesis testing. Examples are taken from engineering applications.

Prerequisite: Math 2000 (UMSL)-Analytic Geometry and Calculus III or equivalent

Textbooks: J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, McGraw Hill, Fourth edition, 2003.

Reference: None

Coordinator: I.N. Katz, Professor of Electrical and Systems Engineering

Course Objectives: To provide an introduction to probability theory and statistics and its applications for students in engineering.

Prerequisites by topic:
1. Elementary set theory
2. Differentiation, and integration
3. Infinite series/Taylor series
4. Two-dimensional calculus

Topics Covered:
1. Probability and combinatorics (2 classes)

2. Probability spaces (2 classes)

3. Discrete random variables and distributions (3 classes)

4. Continuous random variables and distributions (3 classes)

5. Reliability (2 classes)

6. Joint distributions (3 classes)

7. Sums of independent random variables (1 class)

8. Estimation (3 classes)
9. Testing (3 classes)

10. Linear regression (4 classes)

11. Quality control (2 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: None

Computer Usage: None

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	1 credits or 33%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	2 credits or 67%
Engineering Science:	2 credits or 67%
Engineering Design:	0 credits or 0%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering;
(e) Ability to identify, formulate, and solve engineering problems.
(l) Preparation for participation in regional industry

Prepared By: I. N. Katz **Prepared On:** August 5, 2005

JEM 3170 - Engineering Mathematics
Spring Semester 2005

Required/Elective Course: Required

Credit: 4 units

2004-2005 Catalog Data: The Laplace transform and applications; series solutions of differential equations, Bessel's equation, Legendre's equation, special functions; matrices, eigenvalues, and eigenfunctions; vector analysis and applications; boundary value problems and spectral representations; Fourier series and Fourier integrals; solution of partial differential equations of mathematical physics.

Prerequisite: Math 2020 (UMSL)-Introduction to Differential Equations or equivalent.

Textbooks: E. Kreyszig, Advanced Engineering Mathematics, (8th edition), Wiley & Sons, 1999.

Reference: F.B. Hildebrand, Advanced Calculus for Applications, Prentice-Hall, 1962.

Coordinator: I.N. Katz, Professor of Electrical and Systems Engineering

Course Objectives: This course provides engineering students with fundamental and advanced mathematical techniques for the solution of engineering and scientific problems.

Prerequisites by topic:
1. Differential and Integral Calculus; Ordinary Differential Equations.

Topics Covered:
1. Laplace transforms (4 classes)
2. Power series & special functions (4 classes)
3. Vectors and matrices (10 classes)
4. Vector differential calculus (5 classes)
5. Vector integral calculus (10 classes)
6. Boundary-value problems for ODE's and Fourier series (7 classes)
7. Partial differential equations (16 classes)

Class/Lab Schedule: 2 sessions; 120 minutes per session

Tests: 3 one hour exams, two hour final exam, all open book

Computer Usage: None

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	4 credits or 100%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	0 credits or 0%
Engineering Science:	0 credits or 0%
Engineering Design:	0 credits or 0%

Relationship of Course to Program Outcomes:

(a) Ability to apply math, science, and engineering
(e) Ability to identify, formulate, and solve engineering problems
(l) Preparation for participation in regional industry

Prepared By: I. Norman Katz **Prepared On:** 4/20/05

COURSE DESCRIPTION
JME 3200 Thermodynamics
Fall Semester 2005 & Spring Semester 2006

2005 Catalog Data : JME 3200 Thermodynamics. Prerequisites: Math 1900, Chemistry 1111 and Physics 2111. Classical thermodynamics, thermodynamic properties, work and heat, first and second laws. Entropy, irreversibility, availability. Application to engineering systems. Credit 3 units.

Textbook: General Thermodynamics: Foundation and Applications by Gyftopoulos and Beretta,

References: None

Coordinator: Eliot Fried, Associate Professor of Mechanical & Aerospace Engineering & Amy Shen, Assistant Professor of Mechanical & Aerospace Engineering

Goals: This course is designed to teach the fundamentals and basic applications of thermodynamics to mechanical and chemical engineering juniors.

Prerequisites by topic:

1. Calculus-differentiation and integration
2. General chemistry, including principles of chemical and ionic equilibria

Topics:

1. Basic concepts and definitions (thermodynamic systems, state, process; energy, work, equilibria)
2. General thermodynamic concepts (availability, entropy, temperature, chemical potentials)
3. Properties of pure simple compressible systems; ideal and real gases
4. Energy and energy analysis-The First Law of Thermodynamics
5. Entropy and entropy analysis-The Second Law of Thermodynamics
6. Availability and irreversibility

Computer usage:

None

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 3.0 credits **Engineering design:** 0 credit

Prepared by: Eliot Fried/Amy Shen **Date:** June 1, 2006

C. Faculty Curriculum Vitae

Summary curriculum vitae for all full-time and part-time faculty members are included on the following pages. Note that a Faculty Analysis, which summarizes the information about each faculty member, is given in Table I-4 of section I.A.

CURRICULUM VITAE

1. **NAME**: R. Martin Arthur

2. **ACADEMIC RANK**:
   Professor (Full-Time)

3. **DEGREES**:
   B.A. Rice University (1962)
   B.S. (E. E.) Rice University (1962)
   M.S. (E. E.) Rice University (1964)
   Ph.D. (Biomedical Engr.) University of Pennsylvania (1968)

4. **SERVICE ON THIS FACULTY**: 36 Years
   2003- present Interim Chairman, Department of Electrical and Systems Engineering
   2003- present Professor, Department of Electrical and Systems Engineering
   2002-2003 Interim Chairman, Department of Electrical and Systems Engineering
   1983-2003 Professor, Department of Electrical Engineering
   1975-1983 Associate Professor, Department of Electrical Engineering
   1970-1975 Assistant Professor, Department of Electrical Engineering
   1969-1970 Postdoctoral Fellow and Lecturer, Department of Electrical Engineering

5. **OTHER RELATED EXPERIENCE**:
   1998-present Professor, Biomedical Engineering
   1985-1998 Professor, Institute for Biomedical Computing
   1979-1980 Project Manager, American Heart Association ECG Arrhythmia Database
   1975-1980 Director, Clinical Engineering Program
   1973-1987 Research Associate, Biomedical Computer Laboratory

6. **CONSULTING, PATENTS, ETC**:
   1975-1981 President, Aspen Signal, Inc.
   1993-1994 President, Ultrasonics in Health Care, Inc.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   State of Missouri, E-014487

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   "A Discrete-Scatterer Model for Ultrasonic Images of Rough Surfaces," I*EEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control*, vol. 47, pp. 1520-1529 (2000). J. W. Trobaugh and R.M. Arthur.

   "Parallel Implementations of 3D Synthetic-Focus Ultrasonic Image Generation using MPI," **Proceedings of the Thirteenth ISCA International Conference on Parallel and Distributed Computing Systems**, vol. 2, pp. 205-212 (2000). M. A. Franklin, A. Mahajan and R. M. Arthur.

"A Physically-Based, Probabilistic Model for Ultrasonic Images Incorporating Shape, Microstructure and System Characteristics," *IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control*, vol. 48, pp. 1594-1605 (2001). J. W. Trobaugh and R. M. Arthur.

"Registration of the Spine Using a Physically-Based Image Model for Ultrasound," **Proceedings of MICCAI 2001**, Utrecht, Netherlands, pp. 1176-1177 (2001). J. W. Trobaugh and R. M. Arthur.

"Representation of Shape in Ultrasonic Images with a Physically-Based Image Model," **Proceedings of the IEEE Workshop on Mathematical Methods in Biomedical Image Analysis** (MMBIA 2001), pp. 79-86 (2001). J. W. Trobaugh and R. M. Arthur.

"Noninvasive Temperature Estimation Based on the Energy of Backscattered Ultrasound," *Medical Physics*, vol. 30, pp. 1021-1029 (2003). R. M. Arthur, W. L. Straube, J. D. Starman and E. G. Moros.

"Methods for Using Ultrasound to Generate a Heart Surface for Electrocardiographic Inverse Problems" *International Journal of Bioelectromagnetism*, vol. 5, pp. 314-315 (2003). J. W. Trobaugh and R. M. Arthur.

"Effects of Reducing the Full-Body Surface to a Torso Model in Forward and Inverse Electrocardiography," *International Journal of Bioelectromagnetism*, vol. 5, pp. 312-313 (2003). R. M. Arthur, K. J. Timbadia, A. Rauf and J. W. Trobaugh.

"Detection of the Fingerprint of the Electrophysiological Abnormalities the Increase Vulnerability to Life-Threatening Ventricular Arrhythmias," *J. of Interventional Cardiac Electrophysiology*, vol. 9, pp. 103-118 (2003). M. E. Cain, R. M. Arthur and J.W. Trobaugh.

"Temperature Dependence of Ultrasonic Backscattered Energy in Images Compensated for Tissue Motion," **Proceedings of the 2003 International IEEE Ultrasonics Symposium**", IEEE No. 03CH37476C, pp. 990-993 (2003). R. M. Arthur J. W. Trobaugh, W. L. Straube, E. G. Moros and S. Sangkatumvong.

"Estimation of Heart-Surface Potentials Using Regularized Multipole Sources," *IEEE Transactions on Biomedical Engineering*, vol. 51, pp. 1366-1373 (2004). D. G. Beetner and R. M. Arthur.

"Estimation of Surface Pose with a Physically-Based Ultrasonic Image Model," *IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control*, vol. 51, pp. 1128-1136 (2004). J. W. Trobaugh and R. M. Arthur.

"Representation of Tissue for Pulse-Echo Estimation of Speed of Ultrasound," Donald L. Snyder Workshop, Washington University in St. Louis, Springer-Verlag (in press). R. M. Arthur.

"Temperature Dependence of Ultrasonic Backscattered Energy in Motion-Compensated Images," *IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control* (in press). R. M. Arthur J. W. Trobaugh, W. L. Straube and E .G. Moros.

"Noninvasive Estimation of Hyperthermia Temperatures with Ultrasound" *International Journal of Hyperthermia* (in press). R. M. Arthur, J. W. Trobaugh, W. L. Straube and E. G. Moros.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

American Heart Association
American Institute of Medical and Biological Engineering (Fellow)
American Institute for Ultrasound in Medicine
Institute of Electrical and Electronic Engineers
Committee on the Safe Use of Electricity in Health Care Facilities,
National Fire Protection Association
Editorial Committee, Annual Reviews of Biophysics and Bioengineering
Editorial Board, Journal of Clinical Engineering

10. HONORS AND AWARDS:

BA awarded cum Laude
Sigma Tau
Tau Beta Pi
Fellow of the American Institute for Medical and Biological Engineering

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Digital Signal Processing (EE 445), Fall semester, 2001, 3 hours per week of lecture, Day, undergraduate
Principles of Ultrasonic Imaging (EE597), Spring semester 2002, 3 hours per week of lecture, Day, graduate
Introduction to Electrical Networks (ESE230), Fall semester 2004, 3 hours per week of lecture, Day, undergraduate
Signals and Systems (ESE351), Spring semester 2005, 3 hours per week of lecture, Day, undergraduate
Course coordinator for ESE 230, 471, 482, 498 and JEE 2300, 4710, 4820, 4980.

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

ABET Preparation Committee (1 hour per week)
Acting Chairman of the Department, Fall 1999
Undergraduate Committee (1 hour per week)
Graduate and Undergraduate Advising (2 hours per week)
Resources Committee (2 hours per month)
Research Activities (20 hours per week)

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attended 2 conferences per year.
Attended more than 1 seminar per week.

Collaborate with faculty on research projects approximately 4 hours per week.

14. PERSONAL WEBSITE:

http://ee.wustl.edu/~rma/bio.html

CURRICULUM VITAE

1. **NAME**: Donald Aucamp

2. **ACADEMIC RANK**:
   Adjunct Professor (Part Time)

3. **DEGREES**:
   D.Sc Washington Univeristy (1971)

4. **SERVICE ON THIS FACULTY**:
   2000-2005 Adjunct Professor

5. **OTHER RELATED EXPERIENCE**:
   Market Research Associates, Inc., President

6. **CONSULTING, PATENTS, ETC**:
   Investment Consulting

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   None

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   None

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   None

10. **HONORS AND AWARDS**:
    None

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    ESE 406 (old SSM 495A) Investment: A Mathematical Approach, Fall 2001,Fall 2002, Fall 2003, Fall 2004

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**:
    None

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
    None

14. **PERSONAL WEBSITE:**
    None

CURRICULUM VITAE

1. **NAME**: Kurt Baudendistel

2. **ACADEMIC RANK**:
   Adjunct Professor

3. **DEGREES**:
   B.S. (E.E.) Washington University, St. Louis (1983)
   B.S. (C.S.) Washington University, St. Louis (1983)
   M.S. (E.E.) University of Illinois, Urbana (1984)
   Ph.D. (E.E.) Georgia Institute of Technology, Atlanta (1992)

4. **SERVICE ON THIS FACULTY**: None

5. **OTHER RELATED EXPERIENCE**:

1988–1992	Teaching Assistant, Dept. of Electrical Engineering, Georgia Institute of Technology, Atlanta, GA
1987–1992	Research Assistant, Dept. of Electrical Engineering, Georgia Institute of Technology, Atlanta, GA
1983–1984	Teaching Assistant, Dept. of Electrical Engineering, University of Illinois, Urbana, IL

6. **EMPLOYMENT, CONSULTING, PATENTS, ETC**:

1996–Present	Director, Momentum Data Systems, Inc., Fountain Valley, CA
1993–1996	Member Technical Staff, Bell Laboratories, Murray Hill, NJ
1984–1987	Engineer, Motorola, Inc., Schaumburg, IL

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: None

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: None

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Member, IEEE
   Member, IEEE Signal Processing Society

10. **HONORS AND AWARDS**:
    Meritorious Contribution to Teaching Award, 1991.
    President’s Fellowship, Engineering Scholarship, 1987.
    Tau Beta Pi, Engineering Honorary, 1983.
    Langsdorf Scholar, Engineering Scholarship, 1979.

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:** None

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: None

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**: None

14. **PERSONAL WEBSITE:** None

CURRICULUM VITAE

1. **NAME**: Philip J. Beck

2. **ACADEMIC RANK**:
   Electrical Engineering Adjunct Associate Professor (Part Time)

3. **DEGREES**:
   B.S. (E.E.) University of Missouri - Rolla (1977)
   M.S. (E.E.) Washington University (1991)

4. **SERVICE ON THIS FACULTY**: 8 years
   1997-Present Adjunct Associate Professor

5. **OTHER RELATED EXPERIENCE**:
   1979-Present The Boeing Company, Manager – Flight Simulation Visualization and Computational Systems, St. Louis, MO.

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   none

10. **HONORS AND AWARDS**:
    BS awarded cum Laude

11. **COURSES TAUGHT IN THE LAST FIVE YEARS**:
    Introduction to Digital Logic & Computer Design, JEE2609, (3 times)
    Introduction to Electrical Networks, JEE230 (1 time)

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
    High school math tutor volunteer. This provided an opportunity to encourage students to pursue math/science professions.

14. **PERSONAL WEBSITE:** none

CURRICULUM VITAE

1. **NAME**: Christopher I. Byrnes

2. **ACADEMIC RANK**:
   Professor and Dean of the School of Engineering and Applied Science

3. **DEGREES**:
   Ph.D. – 1975 – University of Massachusetts
   M.S. – 1973 – University of Massachusetts
   B.S. – 1971 – Manhattan College

4. **SERVICE ON THIS FACULTY**: 17 years
   1991-present, Dean of the School of Engineering and Applied Science, Director of the Sever Institute, Prof. of Dept. of Electrical and Systems Engineering
   1989-1991, Chairman and Professor of the Dept. of Systems Science and Mathematics

5. **OTHER RELATED EXPERIENCE**:
   1975 -1978, Instructor, Department of Mathematics, University of Utah
   1978 -1982, Assistant Professor, Department of Mathe-Harvard University matics and Division of Engineering and Applied Sciences
   1982 – 1985, Associate Professor of Applied Mathematics on the Gordon McKay Endowment, Division of Applied Sciences, Harvard University
   1984 – 1989, Research Professor of Engineering and Mathematics, Department of Mathematics and Dept of Electrical and Computer Engineering, Arizona State Univ.
   1986-1990, Adjunct Professor, Department of Optimization and System Theory, Royal Institute of Technology, Stockholm
   1988 -1989, The Graduate College Distinguished Research Arizona State Univ., Prof.

6. **CONSULTING, PATENTS, ETC**:
   PCT-Method and Apparatus for Speech Analysis and Synthesis (US Ser. No. 08/854,150)
   Inventors: Byrnes/Lindquist

   US-Pat. App. For Method and Apparatus for a Tunable High-resolution Spectral Estimator (Investors: Byrnes/Lindquist/Georgiou)

   EP-Method and Apparatus for Speech Analysis and Synthesis Using Lattice-Ladder Filters; Inventors: Byrnes/Lindquist (Regional Phase of PCT/US98/09576 filed 5/11/98, Ref. No. 3047-5327)

   Consultant, Systems Engineering Inc., Greenbelt, MD, 1986
   Consultant, Scientific Systems, Inc. Cambridge, MA, 1980 -1984

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:

Directions in Mathematical Systems Theory and Optimization (Editor, with A. Rantzer). Lecture Notes in Control and Information Sciences, Vol. 286, Springer-Verlag, Heidelberg,, 2002.

Bifurcation analysis of the zero dynamics and the practical stabilization of nonlinear minimum phase systems (with A. Isidori), Asian Journal of Control, 4 (2002) No.2, 171-185.

Identifiability and well-posedness of shaping-filter parameterizations: A global analysis approach (with P. Enqvist and A. Lindquist) SIAM J. Control and Optimization 41 (2002) 23-59.

Regular Linear Systems Governed by a Boundary Controlled Heat Equations (with D. S. Gilliam, V. I. Shubov and G. Weiss), Journal of Dynamical and Control Systems, 8(3):341–370, 2002.

Limit Sets, Zero Dynamics and Internal Models in the Problem of Nonlinear Output Regulation (with A. Isidori), IEEE Trans. Aut. Control, 48(10):1712–1723, 2003.

A convex optimization approach to generalized moment problems (with A. Linquist) In Control and modeling of complex systems (Tokyo, 2001), Trends Math., pages 3–21. Birkh¨auser Boston, Boston, MA, 2003.

The uncertain generalized moment problem with complexity constraint. (with A. Lindquist) In New trends in nonlinear dynamics and control, and their applications, volume 295 of Lecture Notes in Control and Inform. Sci., pages 267–278. Springer, Berlin, 2003.

Generalized interpolation in $H\infty$ with a complexity constraint, (with T.T. Georgiou, A. Lindquist and A. Megretski) to appear in Transactions of the American Mathematical Society.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

Society for Industrial and Applied Mathematics (SIAM)
Institute for Electronic and Electrical Engineers (IEEE)
American Mathematical Society (AMS)
American Society for Engineering Education (ASEE)
The American Institute for Aeronautics and Astronautics (AIAA)
American Association for the Advancement of Science (AAAS)

10. HONORS AND AWARDS:

Foreign Member, The Royal Swedish Academy of Engineering Sciences, 2001 Fellows Award, The Academy of Sciences of St. Louis, 2001 Honorary Doctor of Technology, The Royal Insitute of Technology, Stockholm, 1998 Fellow, The Academy of Sciences of St. Louis, 1998 IFAC Automatica Best Paper Award, 1993 George Axelby Prize for Best Paper in IEEE Trans. Aut. Control, 1991 Fellow, IEEE, 1989 The Graduate College Distinguished Research Award, Arizona State University, 1988 Fellow , Japan Society for the Promotion of Science (JSPS), 1986 Case Centennial Scholar, Case Western Reserve University, 1980 Pi Mu Epsilon, Sigma Xi and Tau Beta Pi

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

Co-organizer, NSF-Washington University Workshop on Nonlinear Control Systems, St. Louis, 1992

Organizer, AFOSR-Washington University Workshop on Nonlinear Control and Its Applications, 1991

Member, Board of Directors, WUTA, Inc. (Washington University Technology Associates, Inc.), 1991 -present, President since 1993

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attends conferences and seminars
Collaborate with faculty on research projects

14. PERSONAL WEBSITE:

http://ese.wustl.edu/faculty/Byrnes/byrnes.html

CURRICULUM VITAE

1. **NAME**: Eftychios Christoforou

2. **ACADEMIC RANK**:
   Adjunct Professor (Part Time)

3. **DEGREES**:
   Diploma (Mech. Eng.) National Technical University of Athens, Greece (1994)
   Postgrad. Diploma (Manag.) Mediterranean Inst. of Management, Cyprus (1995)
   Ph.D. (Mech. Eng.) University of Canterbury, New Zealand (2000)

4. **SERVICE ON THIS FACULTY**: 1 year
   2004-Present Adjunct Professor

5. **OTHER RELATED EXPERIENCE**:
   1994-1996 Mechanical Eng., El&D Christou Electromech. Services, Nicosia, Cyprus
   2000-2004 Process Engineer, Hyperion Systems Engineering, Nicosia, Cyprus
   2003-2004 Lecturer of Mech. Eng., Frederic Inst. of Technology, Nicosia, Cyprus
   2004-Present Research Engineer, Washington Univ. School of Med., St. Louis, MO

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   Republic of Cyprus

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   "A remotely controlled device for real-time, MR-guided interventions inside cylindrical MR scanners," Proc. of ISMRM Scientific Meeting, Miami (2005). E. Christoforou, N. Tsekos and A. Ozcan.

   "A passivity-based control case study of flexible-link manipulators," Proc. of IEEE Int. Conf. on Robotics and Automation, Barcelona, pp. 1005-1010 (2005). E. Christoforou and C. J. Damaren.

   "A robotic manipulator for image-guided interventions," Siemens Interventional Cardiovascular MR Meeting, Warrenton, (2004). E. Christoforou, A. Ozcan and N. Tsekos.

   "The control of flexible-link robots carrying large payloads: theory and experiments," Journal of Robotic Systems, vol. 17, pp. 255-271 (2000). E. Christoforou and C. J. Damaren.

   "Experiments on the control of flexible-link robots carrying large payloads," Proc. of Int. Symp. Experimental Robotics, Sydney, pp. 445-454 (1999). E. Christoforou and C. J. Damaren.

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:

International Society for Magnetic Resonance Imaging
Scientific and Technical Chamber of Cyprus
Cyprus Mechanical Engineers Association

10. HONORS AND AWARDS:
Undergraduate studies scholarship award by the Government of Cyprus (1989)
Commonwealth scholarship award for postgraduate studies (1996-2000)

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Numerical Methods for Engineers, Fall 2003 (Frederic Inst. of Tech., Cyprus)
Control Systems, Spring 2003 (Frederic Inst. of Tech., Cyprus)
Linear Algebra, ESE 309, Fall 2004
Systems Engineering Lab., ESE 448, Spring 2005

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Currently collaborates with other faculty at the Medical School and the Mechanical Engineering Dept. of Washington University on research projects.

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: Thomas P. Collins

2. **ACADEMIC RANK**:
   Adjunct Asst. Prof. (part-time)

3. **DEGREES**:
   B.S. (E.E.) Washington University (1972)
   M.S. (E.E.) Washington University (1974)

4. **SERVICE ON THIS FACULTY**: 12 years
   1993-Present Adjunct Asst. Prof. in the Department of Electrical Engineering and the UMSL-WU Joint Engineering Program.
   1993-1981 Adjunct Lecturer in Electrical Technology Program
   1996-1993 Adjunct Professor in Dept of Physical Therapy-Washington Univiversity Medical School

5. **OTHER RELATED EXPERIENCE**:
   1988-Present Ameren Corporation- Telecommunications Dept.-Process Systems and Data Network Support; Network Engineering & Operations
   1988-1975 Union Electric Company-Engineering Computer Services Dept.
   1975-1972 Union Electric Company-T&D Operating Department-Substation Operating Division

6. **CONSULTING, PATENTS, ETC**:
   1975-Present On-Line Consultants-Various consulting jobs with power, power quality, computer systems analysis for process computers.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   State of Missouri, E-16661; State of Illinois, 062-040345; State of Iowa, PE-10234

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Institute of Electrical and Electronics Engineers (Member)
   IEEE Computer Society (Member)
   IEEE Communications Society (Member)
   Association for Computing Machinery (Member)
   ACM Special Interest Group on Computer Performance, Measurement , and Evaluation (Member)
   ACM Special Interest Group on Data Communications (Member)
   International Association of Electrical Inspectors (Member)
   National Fire Protection Association(Member)

10. HONORS AND AWARDS:
Eta Kappa Nu
Outstanding Senior In Electrical Engineering-St.Louis Electrical Board of Trade Award (1972)
Outstanding Contributor to Education-Awarded by the Ferguson Florissant R-2 School District (1986)

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
ESE332-Power, Energy, and Polyphase Circuits, Spring 2005, 3 hours per week of Lecture
ESE351-Signals and Systems, Summer 2004, 6 hours per week of Lecture for 7 weeks
ESE434-Solid State Power Circuits and Applications, Fall 2004, 3 hours per week of Lecture

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Duties as needed and requested by the Acting Chairman-Electrical Engineering and the coordinator of the UMSL-WU joint engineering program.
Fall 2004-Course Coordinator for ESE434
Spring 2005-Course Coordinator for ESE332

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attended 8 application seminars and job related classes per year
At least 1 Continuing Education course per year in engineering applications

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME:** John D. Corrigan

2. **ACADEMIC RANK**:
Affiliate Professor (Part-Time)

3. **DEGREES:**
B.S.E.E. University of Missouri - Rolla (1965)
M.S.E.E. University of Missouri - Rolla (1966)
Ph. D.E.E. University of Missouri - Rolla (1973)

4. **SERVICE ON THIS FACULTY:** 25 Years
2000-Present Affiliate Professor (Three-Quarter-Time)
1998-2000 Affiliate Assoc. Professor (Half-Time)
1980-1997 Adjunct Assistant Professor (Quarter-Time)

5. **OTHER RELATED EXPERIENCE:**
1997-1998 Technical Fellow, Avionics Technology, The Boeing Company
1995-1997 Fellow, Avionics Technology, McDonnell Douglas Corporation
1985-1995 Branch Chief, Avionics Technology, McDonnell Douglas Corporation
1978-1985 Section Chief, Avionics Analysis, McDonnell Douglas Corporation
1974-1978 Unit Chief, Avionics Analysis, McDonnell Douglas Corporation
1968-1974 Lead Engineer, Avionics Analysis, McDonnell Douglas Corporation
1965-1968 Senior Engineer, Electronics, McDonnell Aircraft Corporation

6. **CONSULTING, PATENTS, ETC:**
J.D. Corrigan, D. E. Simmons, and R. L. Berg, "Automatic Sensor Alignment," Patent No. 5,245,909; September 21, 1993

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER:**
None.

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:**
"Promise of Decision Aiding", Aerospace America, Pages 30, 31, & 51, (July 1989). John D. Corrigan, Kirby J. Keller, and Steven A. Meyer

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:**
Institute of Electrical and Electronic Engineers (Member)
American Institute of Aeronautics and Astronautics (Member)

10. **HONORS AND AWARDS:**
Fellow - McDonnell Douglas Corporation
Technical Fellow –The Boeing Company
Eta Kappa Nu
Tau Beta Pi

Phi Kappa Phi

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Control Systems (EE431), Spring 2001, 3 hours of lecture per week, day, undergraduate
Electrical and Electronics Laboratory I (EE250), Spring 2001, Fall 2001, Spring 2002, Fall 2002 and Spring 2003, 1.5 hours of lecture and 3 hours of laboratory per week, day, undergraduate
Electrical Energy Laboratory (EE416), Spring 2002 and Spring 2003, 1.5 hours of lecture and 3 hours of laboratory per week, day, undergraduate
Introduction to Electronic Circuits (EE290/ESE232), Fall 2003, Spring 2004, Fall 2004 and Spring 2005, 3 hours per week of lecture, day, undergraduate;
Introduction to Electronic Circuits (JEE2900/JEE2320), Fall 2003, Spring 2004, Fall 2004 and Spring 2005, 3 hours per week of lecture, evening, undergraduate;
Electronics Laboratory (ESE331), Fall 2006, 1 hour lecture and 3 hours lab per week, day, undergraduate
Electronics Laboratory (JEE3310), Fall 2006, 1 hour lecture and 3 hours lab per week, evening, undergraduate

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

Advisor and Coordinator for the UMSL/WU Joint Electrical Engineering Program
Member of the ABET Committee
Member of the Undergraduate Curriculum Committee

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Numerous management training classes at McDonnell Douglas Corporation which help greatly with class room organization, presentation, and management.
Other technical courses and seminars at McDonnell Douglas Corporation.

14. PERSONAL WEBSITE: http://faculty.ee.wustl.edu/corrigan/bio.html

CURRICULUM VITAE

1. **NAME**: William K. Dick

2. **ACADEMIC RANK**:
   Lecturer (Part-time)

3. **DEGREES:**
   B.S. (E.E.) Washington University (1949)
   M.S. (E.E.) University of Missouri, Columbia (1952)

4. **SERVICE ON THIS FACULTY:** 37 Years
   1966-Present Lecturer, Electrical Engineering
   1954-1956 Instructor, Electrical Engineering
   1951-1952 Instructor, Electrical Engineering

5. **OTHER RELATED EXPERIENCE:**
   1974-1991 Project Engineer, American Electric
   1956-1974 Development Engineer, Moloney Electric
   1952-1954 Radar Instructor, U.S. Army Signal Corps (Military Service)

6. **CONSULTING, PATENTS, ETC:**
   Consultant, Mallinckrodt Inc. 1991-2001
   D.F. Winter, W.K. Dick, "Electronic Grounding System for Electrical Distribution Systems", U.S. Patent No. 4551633, 1985

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER:**
   State of Missouri, EN015790

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:**
   "Measurement of Stray Voltage on Dairy Farms: Peak versus True RMS"

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:**
   Institute of Electrical and Electronic Engineers (Life Senior)

10. **HONORS AND AWARDS:**
    Tau Beta Pi, Eta Kappa Nu

11. **COURSES TAUGHT IN THE LAST FIVE YEARS**:
    Introduction to Electrical Networks, Electrical Laboratory I, Electrical Energy Laboratory

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:** N/A

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
    N/A

14. **PERSONAL WEBSITE:** N/A

CURRICULUM VITAE

1. **NAME**: James W. Dille

2. **ACADEMIC RANK**:
   Affiliate Professor (part-time)

3. **DEGREES**:
   Ph.D. 1987 Applied Sciences, Harvard University, Cambridge, MA
   M.S. 1985 Applied Sciences, Harvard University, Cambridge, MA
   M.S. 1980 Mechanical Engineering, University of Virginia, Charlottesville, VA
   B.S.1979 Mechanical Engineering, University of Virginia, Charlottesville, VA

4. **SERVICE ON THIS FACULTY**: 19 Years
   1988 – present Affiliate Professor

5. **OTHER RELATED EXPERIENCE**:
   January 1994 – Present Senior VP – Research & Development, Eclipse Capital Management
   St. Louis, MO
   September 1987 – January 1994 Senior Technical Specialist McDonnell Douglas Training Systems,
   St. Louis, MO
   August 1980 - August 1982 Engineer, Brown Shoe Company, St. Louis, MO

6. **CONSULTING, PATENTS, ETC**:
   January 1986 - September 1987 Consultant, Network Dynamics, Inc., Cambridge, MA
   November 1985 - September 1987 Consultant, Dynamics Research, Inc., Wilmington, MA

7. **STATES IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER**:
   Tau Beta Pi
   Pi Tau Sigma

10. **HONORS AND AWARDS**:
    National Science Foundation Fellow (recipient of 3 year fellowship)
    National Merit Scholar
    B.S. in Mechanical Engineering with Highest Distinction

11. **COURSES TAUGHT IN THE LAST FIVE YEARS**:
    Spring 2002 - 2006 ESE 407 Analysis and Simulation of Discrete Event Systems
    (3 hrs/wk, lecture, undergraduate, day)

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
none

14. **PERSONAL WEBSITE:**

CURRICULUM VITAE

1. NAME: Daniel R. Fuhrmann

2. ACADEMIC RANK:
Professor (Full-Time)

3. DEGREES:
B.S.E.E. (EE) Washington University (1979)
M.S.E. (EECS) Princeton University (1982)
M.A. (EECS) Princeton University (1982)
Ph.D. (EECS) Princeton University (1984)

4. SERVICE ON THIS FACULTY: 21 Years
2005-present Professor, Department of Electrical and Systems Engineering
2003-2005 Associate Professor, Department of Electrical and Systems Engineering
1990-2003 Associate Professor, Department of Electrical Engineering
1984-1990 Assistant Professor, Department of Electrical Engineering
1994-1996 Research Associate, Biomedical Computer Laboratory
1984-1987 Research Associate, Biomedical Computer Laboratory

5. OTHER RELATED EXPERIENCE:
Summer 1987. ASEE/Navy Summer Faculty Research Fellow, Naval Underwater Systems Center, New London, CT. Evaluation of underwater signal processing algorithms.
Summer 1981. Summer intern, Tektronix, Inc., Beaverton, OR. Evaluation of spectrum estimation algorithms.
1979-1980. Engineer I, Telex Computer Products, Tulsa, OK. Digital circuit design.

6. CONSULTING, PATENTS, ETC:
MIT Lincoln Laboratory, Lexington, MA
NewStar Collaborative Technologies, St. Louis, MO

7. STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER: none

8. PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:

D. Fuhrmann *et al.* "Clutter Scattering Function Estimation and Ground Moving Target Detection from Multiple STAP Datacubes", *Proc.ICASSP 2005,* Philadelphia, PA, March 2005.

D. Fuhrmann and G. San Antonio, "Transmit Beamforming for MIMO Radar Systems using Partial Signal Correlation", *Proc. 38th Asilomar Conf. Signals, Systems, and Computers*, Pacific Grove, CA, November 2004.

D.. Rieken and **D. Fuhrmann**, "Generalizing MUSIC and MVDR for Multiple Noncoherent Arrays", ***IEEE** Trans. Signal Processing,* vol. 52, no. 9, pp. 2396-2406, September 2004.

D. Fuhrmann *et al*., "Spectrum Estimation from Quantum-Limited Interferograms", *IEEE Trans. Signal Processing,* vol. 52, no. 4, pp. 950-961, April 2004.

D. Fuhrmann and L. Boggio, "Radar Imaging from Multiple Viewpoints and Multiple Noncoherent Data Sets", *Proc. 2004 Conf. Information Science and Systems*, Princeton University, March 2004.

D. Fuhrmann and L. Boggio, "Active-Testing Surveillance for Multiple Target Detection with Composite Hypotheses", *Proc. 2003 IEEE Workshop on Statistical Signal Processing*, St. Louis, MO, September 2003..

D. Fuhrmann and W. Smith, "Empirical Modeling and Calibration of Fourier Transform Spectrometers", *Optical Engineering,* vol. 42, no. 8, pp. 2268-2276, August 2003.

D. Fuhrmann et al., "Software for Automated Analysis of DNA Fingerprinting Gels", *Genome Research*, vol. 13, no. 5, pp. 940-953, May 2003.

D. Fuhrmann, "Active-Testing Surveillance Systems, or, Playing Twenty Questions with a Radar", *Proc. 11th Workshop on Adaptive Sensor Array Processing (ASAP),* MIT Lincoln Laboratory, Lexington, MA, March 2003.

D. Fuhrmann, "Detection of Multiple Overlapping Bands of Known Amplitude, with Application to DNA Fingerprinting", *Proc. 36th Asilomar Conf. on Signals, Systems and Computers*, Pacific Grove, CA, November 2002.

D. Rieken and **D. Fuhrmann**, "Generalizing MUSIC and MVDR for Distributed Arrays", *Proc. 36th Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, November 2002.

D. Fuhrmann, "Automated Image Analysis for DNA Fingerprinting", *Proc. 1st Workshop on Genomics, Signal Processing and Statistics (GENSIPS)*, Raleigh, NC, October 2002.

D. Rieken and **D. Fuhrmann**, "Statistical Signal Processing for Time-Varying Sensor Arrays", *Proc. 10th Workshop on Adaptive Sensor Array Processing (ASAP)*, MIT Lincoln Laboratory, Lexington, MA, March 2002.

J. Schein et al., "Physical Map of the Mouse Genome", presented at the *2001 Meeting on Genome Sequencing and Biology*, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, May 2001.

S. Ness et al., "Developing Computational Strategies for Constructing and Analyzing Physical Maps of Large Genomes", presented at the *2001 Meeting on Genome Sequencing and Biology*, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, May 2001.

D. Rieken and **D. Fuhrmann**, "Constrained Maximum-Likelihood Covariance Estimation for Time-Varying Arrays", *Proc. 9th Workshop on Adaptive Sensor Array Processing (ASAP)*, MIT Lincoln Laboratory, Lexington, MA, March 2001.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

Institute of Electrical and Electronic Engineers (Senior Member): Signal Processing Society, Signal Processing Theory and Methods Technical Committee

10. HONORS AND AWARDS:

Fulbright Scholar, Argentina, 2000-01
HKN Outstanding Professor, 1987-88
Tau Beta Pi
Eta Kappa Nu

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

FL00 Statistical Signal Processing for Sensor Arrays (UNLP, Argentina)

FL01 EE 437, Signals and Systems Laboratory
SP02 EE 180, Introduction to Electrical and Computer Engineering
FL02 EE 551, Probability and Stochastic Processes
SP03 EE 180, Introduction to Electrical and Computer Engineering
FL03 EE 180, Introduction to Electrical and Computer Engineering
SP04 EE 180, Introduction to Electrical and Computer Engineering
FL04 ESE 581,Radar Systems
SP05 ESE 102, Introduction to Electrical and Computer Engineering

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

On sabbatical AY 2000-01. No official duties, but regular communication with Department Chairman and other faculty members regarding departmental activity.
Reviewer, various IEEE publications
Tehnical Program Committee, 2001 Workshop on Adaptive Sensor Array Processing Workshop (MIT Lincoln Laboratory)
Review Committee, and South American liaison, 2001 IEEE Workshop on Statistical Signal Processing (Singapore)
Chairman, ESE Graduate Committee, 2003-present
Chairman, EE(ESE) Graduate Admissions, 1986-present
Member, ESE Undergraduate Committee, 2003-2005
Academic advising, various
Doctoral committees, various
Publications Chair, 1st Workshop on Genomics, Signal Processing, and Statistics, 2002
Guest Editor, Journal of the Franklin Institute, 2003
General Chairman, 2003 IEEE Workshop on Statistical Signal Processing (St. Louis, MO) , 2003
2004-present, Associate Editor, IEEE Transactions on Signal Processing

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Sabbatical leave in Buenos Aires, Argentina, AY 2000-01
9th Workshop on Adaptive Sensor Array Processing (ASAP), MIT Lincoln Laboratory, March 2001
2001 Meeting on Genome Sequencing and Biology, Cold Spring Harbor, NY, May 2001
10th Workshop on Adaptive Sensor Array Processing (ASAP), MIT Lincoln Laboratory, March 2002
1st Workshop on Genomics, Signal Processing, and Statistics (GENSIPS), Raleigh, NC, October 2002
36th Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, November 2002.
11th Workshop on Adaptive Sensor Array Processing (ASAP), MIT Lincoln Laboratory, March 2003
2003 IEEE Workshop on Statistical Signal Processing, St. Louis, MO, September 2003.
2004 Conference on Information Science and Systems (CISS), Princeton University, March 2004.

38th Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, November 2004
2005 International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Philadelphia, PA, March 2005.

14. PERSONAL WEBSITE: http://www.faculty.ee.wustl.edu/danf/bio.html

CURRICULUM VITAE

1. NAME: Narayan Ganesan

2. ACADEMIC RANK:
Ph. D Candidate/Research Assistant

3. DEGREES:
2002 – 2006 Washington University in St. Louis, St. Louis, MO
Doctor of Science(D.Sc) in Electrical and Systems Engineering

2000 – 2002 Washington University in St. Louis, St. Louis, MO
Master of Science(M.S) in Systems Science and Mathematics

1996 – 2000 Indian Institute of Technology, Kharagpur, India
Bachelor of Technology(B.Tech) Honors in Electrical Engineering

4. SERVICE ON THIS FACULTY:
2003-Present : Part time Instructor

5. OTHER RELATED EXPERIENCE: None

6. CONSULTING, PATENTS, ETC: None

7. STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER: None

8. PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:
N Ganesan, T J Tarn, "Control of Decoherence in Open Quantum Systems Using Feedback." IEEE Conf. Decision and Control-European Control Conf. 2005.
Available from Arxiv:quant-ph/0602217
N Ganesan, T J Tarn, "Feedback Control of Decoherence by continuous measurements", March 2006, (Submitted to Phys. Rev. Letters.,)
N Ganesan, T J Tarn, "Decoupling and Invariant Subspaces for Control of Decoherence", (Currently Under Preperation)

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
Institute of Electrical and Electronic Engineers (IEEE)
Student Member

10. HONORS AND AWARDS:
Chase-Norman fellowship, Washington University, 2001.
Graduate Research Assistantship, Dept. of Systems Science and Mathematics, 2000

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Spring 2003 : Robotics Dynamics and Control, SSM 463
Fall 2003 : Robotics Laboratory, SSM 447
Fall 2004 : Robotics Laboratory, ESE 447

Fall 2005 : Robotics Laboratory, ESE 447

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: None

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attend regular departmental seminars (once per week on avg)
IEEE CDC Intl' conference, Seville, Spain, Dec 2005.
Quantum Control Summer Workshop, Caltech, Pasadena, Aug 2005.

14. PERSONAL WEBSITE: None

CURRICULUM VITAE

1. **NAME**: Bijoy Kumar Ghosh

2. **ACADEMIC RANK**:
   Professor (full-time)

3. **DEGREES**:
   Ph.D. 1983 Engineering, Harvard University, Cambridge, MA
   M.Tech 1979 Electrical Engineering, IIT Kanpus, India
   B.Tech 1977 Electrical Engineering, BITS Pilani, India

4. **SERVICE ON THIS FACULTY**: 22 Years
   1995 – present Professor
   1986 – 1995 Associate Professor
   1984 – 1986 Assistant Professor
   1983 – 1984 Visiting Assistant Professor

5. **OTHER RELATED EXPERIENCE**:
   June 1980 - August 1983 Research and teaching assistant, Harvard University, Cambridge, MA

6. **CONSULTING, PATENTS, ETC**:
   none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   Biochemical Networks and Cell Regulation, Special Issue of the IEEE Control Systems Magazine, vol. 24, no. 4, Aug. 2004. (with Olaf Wolkenhauer and Kwang-Hyun Cho)

   Homogeneous Dynamical Systems Theory, IEEE Trans. on Aut. Cont., vol. 47, no. 3, pp. 462--472, March 2002. (with C. F. Martin).

   Motion and shape identification with vision and range, IEEE Trans. on Aut. Cont., vol. 47, no. 8, pp. 1392--1396, Aug. 2002. (with S. Takahashi).

   Canonical forms and parameter identification problems in perspective systems, Fourth special issue on linear systems and control, Linear Algebra and its Applications, vol. 351-352, pp. 701--717, 2002. (with S. Takahashi)

   Boundary location using control theoretic splines, Trans. of the Society of Instrument and Control Engineers, vol. 38, no. 3, pp. 293--298, March 2002. (with S. Takahashi and C. F. Martin)

On Minimal Degree Simultaneous Pole Assignment Problems, Fourth special issue on linear systems and control, Linear Algebra and its Applications, vol. 351-352, 2002, pp. 411--433. (with A. Wang)

Modelling and estimation problems in the turtle visual cortex, IEEE Trans. on Biomedical Engineering, vol. 49, no. 8, pp. 753--762, 2002. (with Z. Nenadic and P. S. Ulinski)

Parameter estimation under perspective and orthographic projections using laser range finder, Trans. of the Society of Instrument and Control Engineers, vol. 39, no. 2, pp. 1--7, 2003. (with S. Takahashi)

Pose estimation using line based dynamic vision and inertial sensors, IEEE Trans. on Aut. Cont., vol. 48, no. 2, pp. 186--199, Feb. 2003. (with H. Rehbinder)

Propagating waves in visual cortex: A large scale model of turtle visual cortex, Journal of Computational Neuroscience, 14, pp. 161--184, 2003. (with Z. Nenadic and P. Ulinski)

Nonlinear observers for perspective time-invariant linear systems, Automatica, vol. 40, no. 3, pp. 481--490, March 2004.
(with R. Abdursul, H. Inaba)
Real-time integration of sensing, planning and control in robotic work cells, Control Engineering Practice, vol. 12, no. 6, June 2004, pp. 653--663. (with D. Xiao, M. Song, N. Xi, T. J. Tarn, Z. Yu)

Encoding and decoding target locations with waves in the turtle visual cortex, IEEE Trans. on Biomedical Engineering, vol. 52, no. 4, pp. 566--577, April 2005. (with X.~Du and P.~S.~Ulinski)

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER:
Fellow of the Institute of Electrical and Electronics Engineering (IEEE)

10. HONORS AND AWARDS:
American Automatic Control Council's Donald Eckman, Award for 1988.
Washington University's SEAS Professional Development Award for 1992 for the purpose of visiting Osaka University, Japan.
TOKTEN Consultant in the year 1993 sponsored by United Nations Development Program for the purpose of visiting Indian Institute of Technology, Kharagpur, India in the area of Control Theory, Computer Vision and Electrical Engineering.
Japan Society for the promotion of science (JSPS) fellow for research in Japan in 1997.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
ESE 501 Mathematics of Modern Engineering I
ESE 502 Mathematics of Modern Engineering II
ESE 499 Systems Design Project

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**: none

14. **PERSONAL WEBSITE**: http://www.cbcis.wustl.edu

CURRICULUM VITAE

1. **NAME**: Xian-Zhong (Sam) Guo

2. **ACADEMIC RANK**:
   Adjunct Professor (Part Time)

3. **DEGREES**:
   B.S. (Math.) Nankai University, China (1982)
   M.S. (Math.) Nankai University (1985)
   Ph.D. (Math.) University of Maryland (1992)

4. **SERVICE ON THIS FACULTY**: 11 Years
   1994-Present Adjunct Professor

5. **OTHER RELATED EXPERIENCE**:
   1992-Present ERSD, Senior Research Scientist, St. Louis. Missouri

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Society for Industrial and Applied Math

10. **HONORS AND AWARDS**: none

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    ESE411/511: Numerical Methods
    ESE512: Advanced Numerical Methods
    ME265: Mechanical Engineering Computing

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
    Attended 2 conferences per year.

14. **PERSONAL WEBSITE:**
    http://ese.wustl.edu/~guo

CURRICULUM VITAE

1. **NAME**: Ronald S. Indeck

2. **ACADEMIC RANK**:
   Professor (Full-time)

3. **DEGREES**:
   PhD University of Minnesota (1987)
   MSEE University of Minnesota (1984)
   BSEE University of Minnesota (1981)

4. **SERVICE ON THIS FACULTY**: 18 Years
   2001-Present Director, Center for Security Technologies
   1987-Present The Das Family Distinguished Professor, Department of Electrical Engineering

5. **OTHER RELATED EXPERIENCE**:
   2002-Present Exegy, Founder and Chief Technology Advisor, St. Louis, MO

6. **CONSULTING, PATENTS, ETC**:
   "Method and apparatus for fingerprinting magnetic media", US Patent 5,365,586.
   "Method and apparatus for process control, tension control and testing of magnetic media", US Patent 5,408,505.
   "Method and apparatus for noise reduction in magnetic recording media".
   "Method and apparatus for fingerprinting and authenticating magnetic media", US Patent 5,428,683; Mexico Patent 189520.
   "Method and apparatus for noise reduction in magnetic media recordings", US Patent 5,587,654.
   "Method for precompensating signals for magnetic media noise", US Patent 5,959,794.
   "Method and apparatus for noise reduction in magnetic media", Australian Patent 680498.
   "Magnetic recording head with continuously monitored track following servo".
   "Method and apparatus for fingerprinting and authenticating various magnetic media", US Patent 5,546,462; 5,740,244, European Patent 95929523.9-2210, Australian Patents 680901 and 688956.
   "Method and apparatus for a Vernier magnetic recording head".
   "Method and apparatus for multiplicative noise precompensation for magnetic recordings".
   "Method and apparatus for secure data storage and manipulation using magnetic media", US Patent 5,625,689.
   "Method and apparatus for an associative memory database with approximate searching"

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   R. S. Indeck, M. A. Franklin, R. K. Cytron, and R. D. Chamberlain, "Beyond Petabytes: A Scalable Storage-Based System Solution for Fast Accessing and Processing of Massive Information", submitted to IEEE Trans. on Magn., (2005).

R. D. Chamberlain, R. K. Cytron, M. A. Franklin, and R. S. Indeck, "The Mercury System: Exploiting Truly Fast Hardware for Data Search", Proc. of Int'l Workshop on Storage Network Architecture and Parallel I/Os, 65 (2003).

R. S. Indeck and M. W. Muller, “Magnetic and Recording Measurements”, in Encyclopedia of Materials, Elsevier: Oxford, England, (2002).

Chi-Chun Hsu, Clayton T. Miller, R.S. Indeck, J.A. O’Sullivan, M.W. Muller, “Magnetization Estimation from MFM Images”, *IEEE Trans. on Magn*., vol. 38, 5, 2444 (2002).

A. Companieh, R. Eaton, R. S. Indeck, and M. Moser, “*In Situ* Ultra-high Resolution Magnetic Imaging”, *IEEE Trans. on Magn*., vol. 37, 4, 1257 (2001).

P. Dhagat, A. Jander, H. J. Richter, R, S, Indeck and M. W. Muller, “Sub-millisecond spin-stand measurements of thermal decay in magnetic recordings”, IEEE Trans. on Magn., vol. 36, 2, 528 (2000).

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

Fellow of the IEEE; President, Education Committee Chair, Administrative Committee Member of the IEEE Magnetics Society; General Chairman, Program Chairman, Local Chairman for the Intermag Conference; Editor IEEE Transactions on Magnetics; Chairman St. Louis Combined Group; Vice-chairman and Secretary of the IEEE Magnetics Group
Member of the American Physical Society
Member of Congressional Advisory Group on Science, Technology and Telecommunications
Member American Association for the Advancement of Science, Etta Kappa Nu

10. HONORS AND AWARDS:

American Bar Association Inventor of the Year
IEEE Distinguished Lecturer
National Science Foundation Presidential Young Investigator Award
Discover Award for Technological Innovation Finalist
Washington University Distinguished Faculty Award
IEEE Young Professional Award
IBM Faculty Development Award
National Science Foundation International Exchange Award
Eastman Kodak Fellowship
IEEE Centennial Young Engineer "Key to the Future" Award
American Electronics Association/HP Faculty Development Fellowship

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Magnetic Recording (EE512A), Spring 2002, 2004, 2006, 3 hours per week of lecture
Applied Optics (EE468A), Spring 2001, 2003, 3 hours per week of lecture
Engineering Electromagnetics (EE314M), Spring 2001, 3 hours per week of lecture
Electrical Engineering Laboratory (EE350), Spring 2000 - 2004, 4 hours per week of lecture
Course coordinator for JEE 368 and JEE 250.

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

Graduate Committee of the Department of Electrical Engineering (1 hour per week)

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
Attended 4 to 6 conference per year
Attended approximately 1 seminar per week
Collaborated with faculty on research projects approximately 8 hours per week

14. **PERSONAL WEBSITE:**

CURRICULUM VITAE

1. NAME: Alberto Isidori

2. ACADEMIC RANK:
Professor (half-time)

3. DEGREES:
Ph.D. 1969 (equivalent) Automatic Control, University of Rome, Rome, Italy
M.S. 1965 Electrical Engineering, University of Rome, Rome, Italy

4. SERVICE ON THIS FACULTY: 16 years
1989 – present Professor

5. OTHER RELATED EXPERIENCE:
1975 – present Professor, University of Rome
1979 – 1983 Chairman, Istituto di Automatica, University of Rome
July - August 1983 Research Mathematician, University of California, Davis, CA
April - May 1987 Visiting Professor, University of Illinois, Urbana, Illinois
January 1988 MacKay Visiting Professor,University of California, Berkeley
April - May 1988 Distinguished Visiting Professor, Arizona State University, Tempe, Arizona
April - June 1991 Visiting Professor, ETH, Zurich, Switzerland
November 1998 Visiting Lecturer, NASA, Langley

6. CONSULTING, PATENTS, ETC: none

7. STATES IN WHICH REGISTERED AS PROFESSIONAL ENGINEER: none

8. PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:
Books: A. Isidori, L. Marconi, A. Serrani, Robust Motion Control: an Internal-Model Approach, Springer Verlag, 2003.
Conference Proceedings: more than 15 articles
Journal papers: Since 1.1.2000 Dr. Isidori has published, with co-authors, 5 regular papers and 2 technical notes in the IEEE Transactions on Automatic, 3 papers in Automatica, 7 papers in Systems and Control Letters, 4 papers in the Journal of Robust and Nonlinear Control, 2 papers in the Asian Journal of Control, 1 paper in the European Journal of Control, 1 paper in Control Engineering Practice.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER:
Institute of Electrical and Electronic Engineers

10. HONORS AND AWARDS:
1987, elected fellow of the IEEE "for fundamental contributions to nonlinear control theory".
1996, received the "Georgio Quazza Medal" from the International Federation of Automatic Control (IFAC), for ``pioneering and fundamental contributions to the theory of nonlinear feedback control".

2000, received the first “Ktesibios” Award from the Mediterranean Control Association. In 2001, awarded the “H.Bode Lecture Prize” from the Control Systems Society of IEEE.
2004, installed as Edwin H. Murty Professor of Engineering at Washington University
2005, elected fellow of IFAC.
Outstanding Paper Awards in the IEEE Transactions on Automatic Control, in the year 1981 and in the year1990.
Outstanding Paper Awards Automatica, in the year 1991 and in the year 2004.
Listed in the Highly-Cited database (http://isihighlycited.com) among the top most-cited authors in Engineering.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Fall 2000-2004--SSM 557A and SSM 557B Advanced Nonlinear Dynamic Systems
(3 hrs/wk, lecture, undergraduate, day)

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS: none

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: Thomas P. Jolley

2. **ACADEMIC RANK**:
Lecturer (part-time)

3. **DEGREES**:
B.S. (E.E.) University of Missouri-Rolla(1983)

4. **SERVICE ON THIS FACULTY**: 5 Years
2000-Present Lecturer

5. **OTHER RELATED EXPERIENCE**:
1983-Present McDonnell Douglas/Boeing, Engineer, Center for Integrated Defense Simulation

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
Association of Computing Machinery

10. **HONORS AND AWARDS**:
Tau Beta Pi - 1983 MO Beta President
Eta Kappa Nu

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
Introduction to Digital Logic & Computer Design (JEE2600)
Summer, 2000 semester, 6 hours per week of lecture
Spring, 2001 semester, 3 hours per week of lecture
Summer, 2001 semester, 6 hours per week of lecture
Spring, 2002 semester, 3 hours per week of lecture
Summer, 2002 semester, 6 hours per week of lecture
Spring, 2003 semester, 3 hours per week of lecture
Summer, 2003 semester, 6 hours per week of lecture
Summer, 2004 semester, 6 hours per week of lecture
Summer, 2005 semester, 6 hours per week of lecture
Digital Computers II: Architecture (JEE3620)
Fall, 2002 semester, 3 hours per week of lecture
Fall, 2003 semester, 3 hours per week of lecture
Fall, 2004 semester, 3 hours per week of lecture

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS: none

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: Jenner J. Joseph

2. **ACADEMIC RANK**:
   Graduate Student

3. **DEGREES**:
   B.S. (Mathematics) Midwestern State University (1997)
   M.S. (SSM) Washington University (2002)
   D.Sc. (SSM) Washington University (2006)

4. **SERVICE ON THIS FACULTY**:
   2004-2005 (summer) Instructor

5. **OTHER RELATED EXPERIENCE**:
   2002-2005 “Washington University” “Teaching Assistant,” St. Louis, MO

6. **CONSULTING, PATENTS, ETC**:
   None

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   None

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   Jenner J. Joseph and Bijoy K. Ghosh "Turtle cortical activity captured by dynamic models", Conference on Decision and Control, 2004, p. 136-141

   Jenner J. Joseph and Bijoy K. Ghosh "Dynamic Modeling of Turtle Cortex Stimulated by Natural Input", American Control Conference, 2004, p. 299-304

   Jenner Joseph and B.K. Ghosh, "A Volterra Approach to Dynamic Modeling of the Visual Cortex", American Control Conference, 2003, p. 3579-3584

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:

10. **HONORS AND AWARDS**:
    BS awarded cum Laude
    Washington University Chancellor’s Fellowship Award

11. **COURSES TAUGHT IN THE LAST FIVE YEARS**:
    Engineering Mathematics I (ESE 501), summer, 2004-2005
    Engineering Mathematics II (ESE 502), summer, 2004-2005

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**:
    N/A

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**: Collaborate with faculty on research projects

14. **PERSONAL WEBSITE:** None

CURRICULUM VITAE

1. **NAME**: I. Norman Katz

2. **ACADEMIC RANK**:
   Professor (full-time), Chairman of Department (1991-2003)

3. **DEGREES**:
   Ph.D. (Mathematics) Massachusetts Institute of Technology, Cambridge, MA, 1959
   M.S. (Mathematics) Institute of Mathematics, Yeshiva University, New York City, NY, 1954
   B.A. (Mathematics) (Summa Cum Laude), Yeshiva College, NY, 1952

4. **SERVICE ON THIS FACULTY**: 38 Years
   1974 – present, Professor
   1991 – 2003, Chairman, Department of Systems Science and Mathematics
   1967 – 1974, Associate Professor

5. **OTHER RELATED EXPERIENCE**:
   September 1970 - August 1971, Visiting Associate Professor,
   Departments of Applied Mathematics and Computer Science
   Technion-Israel Institute of Technology, Haifa, Israel
   May 1966 - August 1967, Manager, Mathematics Department, Avco Corporation/Missile Systems Division, Wilmington, MA
   September 1966 - June 1967, Lecturer in Mathematics, Northeastern University, Boston, MA
   August 1963 - April 1966, Chief, Mathematical Analysis Section, Mathematics Department
   Avco Corporation/Missile Systems Division, Wilmington, MA
   August 1959 - April 1963, Senior Staff Mathematician, Mathematics Department
   Avco Corporation/Research and Advanced Development Division, Wilmington, MA
   September 1959 - June 1960, Lecturer in Mathematics, Northeastern University, Boston, MA

6. **CONSULTING, PATENTS, ETC**:
   1980 – 1990, McDonnell Douglas Aircraft Company, St. Louis, MO
   September 1967 - September 1974, Consultant, Avco/Systems, Wilmington, MA

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   "An Iterative Algorithm for Solving Hamilton-Jacobi Type Equations," (with J. Markman), SIAM Journal on Scientific Computing, Vol. 22, No. 1, pp. 312--329 (2000).

   "Sequential Linear Quadratic Method for Differential Games," H. Mukai, A. Tanikawa, I. Tunay, I. N. Katz, H. Schחttler, P. Rinaldi, I. A. Ozcan, G. J. Wang, L. Yang and Y. Sawada, Proceedings of the 2nd DARPA-JFACC Symposium on Advances in Enterprise Control, pp. 159-168, Minneapolis, April 2000.

“A Differential Game Formulation for Agile Control of Military Missions,” I. N. Katz, H. Mukai, Y. Sawada, and I. Tunay, SIAM Annual Meeting, Rio Grande, Puerto Rico, Paper No. CP01, July 10-14, 2000.

“Game-Theoretic Linear-Quadratic Method for Air Mission Control," (with H. Mukai, A. Tanikawa, I. Tunay, I. A. Ozcan, H. Schättler, P. Rinaldi, G. J. Wang, L. Yang and Y. Sawada), Proceedings of the IEEE Conference on Decision and Control, Sydney, Australia, December 2000

“Convergence of an Iterative Algorithm for Solving Hamilton-Jacobi Type Equation," (with J. Markman), Mathematics of Computation, Vol. 71, No. 237, pp. 77—103, 2001

“Solution of a Differential Game Formulation of Military Air Operations by the Method of Characteristics," I. N. Katz, H. Mukai, H. Schaettler, and M. Zhang. pp. 168-175, Proceedings of 2001 Automatic Control Conference, (longer version in JOTA, Journal of Optimization Theory and Applications).

“Controller, Estimator and Detector for Military Air Operations,” H. Mukai, A. Isidori, I. N. Katz, H. Schattler, A. Tanikawa, I. Tunay, C. De Persis, I. A. Ozcan, F. Caliskan, P. Rinaldi, G. J. Wang, R. Li and H. Gao, p. 250, Abstract of the Fifth SIAM Conference on Control and Its Applications, San Diego, July, 2001.

“Game Estimators for Air Combat Games with Unknown Enemy Inputs,” F. Caliskan, H. Mukai, I. N. Katz, A. Tanikawa, pp. 5381-5387, Proceedings of the American Control Conference, Denver, 2003.

“Solution of a Differential Game Formulation of Military Air Operations by the Method of Characteristics”, I. N. Katz, H. Mukai, H. Schattler, M. Zhang, and M. Xu, Journal of Optimization Theory and Applications, Vol.125, No. 1, pp.113-135, April 2005

Papers presented at professional meetings:

“Sequential Linear Quadratic Method for Differential Games,” H. Mukai, A. Tanikawa, I. Tunay, I. N. Katz, H. Schהttler, P. Rinaldi, I. A. Ozcan, G. J. Wang, L. Yang and Y. Sawada, 2nd DARPA-JFACC Symposium on Advances in Enterprise Control, Minneapolis, April 2000.

“A Differential Game Formulation for Agile Control of Military Missions,” I. N. Katz, H. Mukai, Y. Sawada, and I. Tunay, SIAM Annual Meeting, Rio Grande, Puerto Rico, Paper No. CP01, July 10-14, 2000.

“Game-Theoretic Linear-Quadratic Method for Air Mission Control," (with H. Mukai, A. Tanikawa, I. Tunay, I. A. Ozcan, H. Schättler, P. Rinaldi, G. J. Wang, L. Yang and Y. Sawada),IEEE Conference on Decision and Control, Sydney, December 2000

“Solution of a Differential Game Formulation of Military Air Operations by the Method of Characteristics,” I. N. Katz, H. Mukai, H. Schחttler, and M. Zhang, American Control Conference, Washington D.C., June 2001.

“Controller, Estimator and Detector for Military Air Operations,” H. Mukai, A. Isidori, I. N. Katz, H. Schattler, A. Tanikawa, I. Tunay, C. De Persis, I. A. Ozcan, F. Caliskan, P. Rinaldi, G. J. Wang, R. Li and H. Gao, Fifth SIAM Conference on Control and Its Applications, San Diego, July, 2001.

“Game Estimators for Air Combat Games with Unknown Enemy Inputs,” F. Caliskan, H. Mukai, I. N. Katz, A. Tanikawa, pp5381-5387, American Control Conference, Denver, 2003.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
American Mathematical Society, Society for Industrial and Applied Mathematics, American Mathematical Association

Reviewer for Proceedings of American Mathematical Society, SIAM Journal on Numerical Analysis, SIAM Journal on Control and Optimization, Mathematical Reviews, NSF, Operations Research, Management Science, European Journal on Operational Research, Transactions of AIIE, Zentralblatt Fur Mathematik

Member of Editorial Board of Computers and Mathematics with Applications

Lecturer for the Visiting Mathematics Lecturer Program (Sponsored by the Missouri Section of the American Mathematical Association)

10. HONORS AND AWARDS:
Washington University Founders’ Day Award (1984)
Burlington Northern Foundation Faculty Achievement Award (1991)

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
ESE 317 - Engineering Mathematics, (4 hrs/wk, lecture, undergraduate, day)
ESE 326- Probability and Statistics, (3 hrs/wk, lecture, undergraduate, day)

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Department Chair, 20 hrs/wk (2000-2003)
Committee for the Undergraduate Program
ABET Committee

13. IMPROVEMENT PROGRAMS IN THE LAST FIVE YEARS:
Attended meetings of professional societies

14. PERSONAL WEBSITE:
http://www.ssm.wustl.edu/faculty/Katz/katz.html

CURRICULUM VITAE

1. **NAME**: Kenneth E. Krause

2. **ACADEMIC RANK**:
Adjunct Assistant Professor (part-time)

3. **DEGREES**:
B.S. (E.E.) Univ. of Illinois (1973)
M.S. (E.E.) Bradley University (1983)
D.Sc.(E.E.) Washington University (1995)

4. **SERVICE ON THIS FACULTY**: 8 Years

5. **OTHER RELATED EXPERIENCE**:
2 years, Part Time Electronics Instructor - United Technologies/Otis Elevator
16 years, Electrical Engineer – Boeing

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
Institute of Electrical and Electronic Engineers (Member)
Antennas and Propagation Society, Signal Processing Society

10. **HONORS AND AWARDS**:
Honor Society of Phi Kappa Phi
Student Participant in United States Air Force Office of Scientific Research Summer Research Program - Summer 1992 - Rome Laboratory, Hanscom AFB, MA.

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
Engineering Electromagnetics I: Fundamentals (EE314/JEE214), Summer 2000, 2002 –2005, 6 hours per week of lecture, Night, undergraduate
Engineering Electromagnetics I: Fundamentals (JEE214), Spring 2002-2005, 3 hours per week of lecture, Night, undergraduate
Communication Theory and Systems (JEE321), Spring, 2001 semester, 3 hours per week of lecture, Night, undergraduate

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**: none

14. **PERSONAL WEBSITE:** none

CURRICULUM VITAE

1. **NAME**: David A. Kuefler

2. **ACADEMIC RANK**:
Lecturer (Part-Time)

3. **DEGREES**:
B.S. (E.E.) Washington University (1991)
M.S. (E.E.) Washington University (1994)

4. **SERVICE ON THIS FACULTY**:
1998-present. Lecturer in the Department of Electrical and Systems Engineering and in the Department of Electrical Engineering of the UMSL-WU Joint Engineering Program.

5. **OTHER RELATED EXPERIENCE**:
1996-present. Project engineer, Boeing Company, St. Louis, MO. Embedded software analysis and design.

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**: none

10. **HONORS AND AWARDS**:
Electrical Engineering Departmental Fellowship, Washington University, 1992-1994.
Dean's Award for Outstanding Academic Achievement, Washington University, 1992.
Electrical Engineering Dept David Levy Outstanding Senior Award, Washington University, 1991.
Tau Beta Pi
Eta Kappa Nu

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
Signals and Systems (EE 379/ESE351), Summer 2005, Spring 2005, Spring 2004, Fall 2003, Spring 2003, Spring 2002 & Spring 2001 semesters, 3 hours per week of lecture, 1 hour per week of recitation, Evening, undergraduate.

Introduction to Electronic Circuits (EE 290/ESE232), Fall 2002, Summer 2002, Fall 2001, Summer 2001 & Fall 2000 semesters, 3 hours per week of lecture, Evening, undergraduate.

Digital Systems Laboratory (EE455/ESE465), Fall 2004 semester, 1.5 hours per week of lecture, 2.5 hours per week of laboratory, Evening, undergraduate.

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attend an average of 4-5 Continuing Education courses per year.

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: Richard A. Livingston

2. **ACADEMIC RANK**:
   Affiliate Assistant Professor (Part-Time)

3. **DEGREES**:
   B.S. (Engineering Physics) Cornell University (1974)
   MSc (Physics) University of Illinois (1976)
   DSc (E.E.) Washington University (1998)

4. **SERVICE ON THIS FACULTY**: 7 Years

5. **OTHER RELATED EXPERIENCE**:
   2004-Present Senior Engineer, Singulex, Inc.
   1999-2004 Director of Research, BECS Technology, Inc.
   1996-1998 Owner, Livingston Consulting
   1977-1994 Asst. Project Manager, Hughes Aircraft Co.

6. **CONSULTING, PATENTS, ETC**:
   6 patents issues, 3 pending

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   State of Missouri, EN-027905, since 1996

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Institute of Electrical and Electronic Engineers
   Optical Society of America
   SPIE

10. **HONORS AND AWARDS**:
    Tau Beta Pi

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    Senior Design Laboratory (EE480/JEE380), Fall 1999, 2 hours per week of lecture, 3 hours per week laboratory, Evening, undergraduate

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**: none

14. **PERSONAL WEBSITE:** none

CURRICULUM VITAE

1. **NAME**: Edward P. Loucks

2. **ACADEMIC RANK**:
   Adjunct Associate Professor (Part Time)

3. **DEGREES**:
   B.S. (Math & Physics) Butler University (1983)
   M.S. (SSM) Washington University (1990)
   D.Sc. (SSM) Washington University (1994)

4. **SERVICE ON THIS FACULTY**: 8 years
   1997-Present: Adjunct Associate Professor

5. **OTHER RELATED EXPERIENCE**: none

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**: none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Society of Industrial & Applied Mathematics
   Mathematics Association of America

10. **HONORS AND AWARDS**:
    B.S. awarded cum Laude

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    JEMT 217, Engineering Mathematics
    ESE 556, Computational Methods in Systems
    ESE 415, Optimization

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**: none

14. **PERSONAL WEBSITE:** none

CURRICULUM VITAE

1. **NAME**: Gregory L. Mayhew

2. **ACADEMIC RANK**:
   Adjunct Professor (Part Time)

3. **DEGREES**:
   B.S. E.E. Massachusetts Institute of Technology (1978)
   M.S. E.E. University of Southern California (1981)
   Ph.D. E.E. University of Southern California (1988)

4. **SERVICE ON THIS FACULTY**:
   Spring 2006 – Present: Adjunct Professor

5. **OTHER RELATED EXPERIENCE**:
   2001 - Present Boeing Company, St. Louis, MO
   1978 – 2000 Hughes Space and Communications, El Segundo, CA

6. **CONSULTING, PATENTS, ETC**:
   Low Cost, High Speed Encryption System and Method (5,365,588)
   Train Location and Control Using Spread Spectrum Radio (5,420,883)
   Integrated Circuit Assembly Having Interposer with a Compliant Layer (6,455,936)
   Preparation of Passivation Chip-on-Board Electronic Devices (6,573,124)

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:

   "A Cyclic Subgraph Methodology for Estimating de Bruijn Weight Class Distributions", *Journal of Computational Analysis and Applications*, February 2006

   "Piecewise Projections of de Bruijn Weight Classes", *Journal of Concrete and Applicable Mathematics*, Volume 1, Number 2, pp. 183-190, March 2003.

   "Extreme Weight Classes of de Bruijn Sequences", *Discrete Mathematics*, Volume 256, Number 2, pp. 495-497, September 2002.

   "Further Results on de Bruijn Weight Classes", *Discrete Mathematics*, Volume 232, Number 1, pp. 171-173, April 2001.

   "Clues to the Hidden Nature of de Bruijn Sequences", *Computers and Mathematics with Applications*, Volume 39, Number 11, pp.57-65, June 2000.

   "Functional Design and Analysis", Boeing Technical Excellence Conference Six, February 2004.

"Maritime Airborne Early Warning Using Unmanned Aerial Vehicles", Boeing Technical Excellence Conference Five, July 2003.
"Autocorrelation Properties of Modified de Bruijn Sequences", Proceedings Position Location and Navigation Symposium (PLANS), pp. 349-354, March 2000.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
IEEE – Institute of Electrical and Electronic Engineers
SAE – Society of Automotive Engineers
AFCEA – Armed Forces Communications and Electronics Association
INCOSE – International Council on Systems Engineering
AOC – Association of Old Crows (Electronic Warfare)
AIAA – American Institute of Aeronautics and Astronautics

10. HONORS AND AWARDS:
Boeing Technical Fellow (2005)
Boeing Associate Technical Fellow (2003)
Beta Gamma Sigma (2003)
Hughes Doctoral Fellow
Eta Kappa Nu (1978)

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
FIN 301 Introduction to Finance, Fall 2003 to Present

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
None

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

MS Engineering Management	Washington University 2005
MS Finance	Washington University 2004
MBA	Washington University 2003

14. PERSONAL WEBSITE:
None

CURRICULUM VITAE

1. **NAME**: Timothy B. McBride

2. **ACADEMIC RANK**:
   Adjunct Associate Professor

3. **DEGREES**:
   B.S., Neurobiology and Animal Physiology, Purdue University (1996)
   B.A., Psychology, Purdue University (1997)
   J.D., Indian University School of Law (2001)

4. **SERVICE ON THIS FACULTY**:
   Adjunct Associate Professor (2003-present)

5. **OTHER RELATED EXPERIENCE**:
   Intellectual Property Attorney (2001-present)

6. **CONSULTING, PATENTS, ETC:**

7. **STATE(S) IN WHICH REGISTERED AS A PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   Collaborative Research and the CREATE Act. Harney, D., Hejlek, E., and McBride, T. Next Generation Pharmaceutical
   Deposit of Biological Materials in Support of a Patent. Harney, D. and McBride, T. Presented at Bio 2004, June 7-9, 2004; San Francisco, CA

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Missouri Bar Association
   Bar Association of Metropolitan St. Louis
   American Intellectual Property Law Association

10. **HONORS AND AWARDS**:

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    ESE 409 (previously EE 411) Patents and Other Ways to Protect Inventions (2003-present)

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**:

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
    Attend monthly conferences addressing changes in intellectual property practice and law
    Attend yearly BIO conference discussing current status of the biotechnology and pharmaceutical industries, including changes in the law and other relevant legal matters

that affect these industries with respect to both regulatory compliance and intellectual property protection

14. PERSONAL WEBSITE:

Personal Bio: www.senniger.com/attorneys/bios/Timothy_McBride.php

CURRICULUM VITAE

1. **NAME**: Michael S. McCoy

2. **ACADEMIC RANK**:
   Adjunct Professor

3. **DEGREES**:
   B.S., Mathematics, Southern Illinois University (1975)
   M.S., Systems Science and Mathematics, Washington University (1978)
   Ph.D., Multidisciplinary Studies, St. Louis University (1995)

4. **SERVICE ON THIS FACULTY**: 1Year
   2005 – present, Washington University, Adjunct Professor

5. **OTHER RELATED EXPERIENCE**:
   2004 – present, Southern Illinois University, Serve on the Industrial Participation Advisory Council
   2003 – present, Queens University of Belfast, Northern Ireland, serve on the International Advisory Council in Systems Engineering
   1984 – present, Technical Fellow, The Boeing Corporation
   1980 – present, University of Missouri, St. Louis, Adjunct Associate Professor of Mathematics

6. **CONSULTING, PATENTS, ETC**:

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   McCoy, Michael S. (2006), System of Systems Force Structure Optimization, The Royal Aeronautical Society Journal.

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   AIAA , INFORMS

10. **HONORS AND AWARDS**:
    Associate Technical Fellow, The Boeing Company, 2001
    Technical Fellow, The Boeing Company, 2003

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    ESE 404 Applied Operations Research, Fall 2005, 2006
    Math 2000 Analytical Geometry and Calculus III, Fall 2002
    Math 1800 Analytical Geometry and Calculus I, Fall 2000

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
The Boeing Corporation (1984-Present) – Technical Fellow. Currently is assigned to the Operations Analysis core area and consulting on the various programs in Naval Systems, Tactical Aircraft Systems, Space Systems and Phantom Works. Served for over three years as the Operations Analysis IPT Leader for the U.S. Coast Guard Deepwater program and has designed and implemented a multi-million dollar System of Systems study plan to derive the future force structure and optimal acquisition plan. Prior to this, a technical specialist, evaluating and modeling human-machine interaction for the F/A-18 E/F program, served as a staff specialist for process simulation technology and group manager for simulation development and application for manufacturing and logistics. Served as a lead engineer on the US Air Force/DARPA Pilot's Associate program responsible for the development of the Pilot/Vehicle Interface Expert System. In addition, provided modeling support and training to the Life Sciences Department. Also, consulted with various McDonnell Douglas Corporations components in Huntington Beach, Long Beach, Kennedy Space Center and St. Louis on Operations Research and Artificial Intelligence.

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

14. PERSONAL WEBSITE:

CURRICULUM VITAE

1. **NAME**: Nathan K. McGregor

2. **ACADEMIC RANK**:
Doctoral Candidate

3. **DEGREES**:
B.S. (Mathematics, Medieval Studies) University of Notre Dame (1999)
M.A.T. (Mathematics) Washington University (2000)
M.A. (Mathematics) Saint Louis University (2002)
M.S. (Systems Science and Mathematics) Washington University (2005)

4. **SERVICE ON THIS FACULTY**:
Instructor (2004-present)

5. **OTHER RELATED EXPERIENCE**:
NSF Teaching Fellow (2002-2004) at Gateway Middle School, St. Louis, MO
Instructor (2002) for Princeton Review, St. Louis, MO
Instructor (2000-2002) at Saint Louis University, St. Louis, MO
Student-Teacher (2000) at Kirkwood High School, Kirkwood, MO

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
Mukai, H., McGregor, N.K., "Robot Control Instruction for Eighth Graders", IEEE Control Systems Magazine, vol. 24, Number 5, pp. 20-23, October 2004.

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
none

10. **HONORS AND AWARDS**:
General Electric Award for Excellence in Mathematics (1998, 1999)
B.S. awarded Summa cum Laude (1999)
Phi Beta Kappa (1999)
Teaching Certificate, Secondary Education, Missouri (2000)
Passed M.A. Oral Exam "with distinction" (2002)

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**

Algebra	Spring 2000	Kirkwood High School
Geometry	Spring 2000	Kirkwood High School
Intermediate Algebra	Fall 2000	Saint Louis University
Trigonometry	Spring 2001	Saint Louis University
College Algebra	Summer 2001	Saint Louis University

Finite Mathematics	Fall 2001	Saint Louis University
Survey of Calculus	Spring 2002	Saint Louis University
SAT II C (Math)	Summer 2002	Princeton Review
Robotics Module	2002 – 2004	Gateway Middle School
Engineering Statistics	Summer ‘04, ’05	Washington University
Engineering Mathematics	Fall ’04, Spring ’05	Washington University
Quality Control	Fall ’04	Washington University

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attended MEGSL conference in St. Louis, MO (2000)
Reviewed text for Prentice Hall (2001)
Attended MTNS conference at Notre Dame, IN (2002)
Participated in the inaugural Robotics Seminar of the IEEE club (2003)
Refereed CDC paper (2004)
Attended GK-12 Annual Meeting in Washington, D.C. (2004)
Attended ACC in Boston, MA (2004)

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: James J. Meany

2. **ACADEMIC RANK**:
   Adjunct Associate Professor (Part Time)

3. **DEGREES**:
   B.S. (E.E.) University of Missouri (1978)
   M.S. (E.E.) University of Missouri (1980)
   Ph.D. (E.E.) University of Missouri (1989)

4. **SERVICE ON THIS FACULTY**: 2 Years
   1999-Present Adjunct Associate Professor

5. **OTHER RELATED EXPERIENCE**:
   2000-Present Boeing Technical Fellow, Boeing, St. Louis, MO
   1999 Associate Technical Fellow, Boeing, St. Louis, MO
   1997-1998 Senior Principal Technical Specialist, Boeing, St. Louis, MO
   1990-1997 Principal Technical Specialist, Boeing / McDonnell Douglas, St. Louis, MO
   1986-1989 Lecturer, University of Missouri, Columbia, MO
   1983-1986 Senior Engineer, McDonnell Douglas, St. Louis, MO
   1980-1983 Engineer, McDonnell Douglas, St. Louis, MO

6. **CONSULTING, PATENTS, ETC**:
   J.J. Meany and C.J. Martens, U.S. Patent No. 5,850,482, "Error resilient method and apparatus for entropy coding", Assignee: McDonnell Douglas Corporation, December, 1998
   Consultant, Questec Corporation, 1989-1990

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   Not Applicable

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   J. J. Meany. “Wavelets and Applications” (invited tutorial). 44th IEEE Midwest Symposium on Circuits and Systems. Applied Physics Lab - John Hopkins University. Dayton, Ohio, 14-17 August 2001. (Invited by Conference Chair - Dr. Robert Ewing, Information Directorate, Air Force Research Lab, Wright-Patterson Air Force Base.)
   R. Chellappa, Q. Zheng, C. Shekhar, P. Burlina, and J. Meany, "Model Supported Targeting", 1996 Automatic Target Recognizer Systems and Technology Symposium, APL - John Hopkins University, Laurel, Maryland, 23-25 July 1996
   J. J. Meany. “Error-Resilient Entropy Coding for Wavelet-Based Image Compression” (invited paper). Workshop on Error-Resilient Image and Video Compression. Naval Ocean Systems Center. San Diego, California, 13-14 February 1996.

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Institute of Electrical and Electronic Engineers:

Signal Processing Society

10. HONORS AND AWARDS:
Eta Kappa Nu

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Digital Representation of Signals (EE/CS592), Spring 00, Spring 01, Fall 02, Fall 03, Fall 04,
3 hours per week lecture, Evening, Graduate

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Not Applicable

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attend about 1 conference per year
Conducting image and signal processing R&D at Boeing full time

14. PERSONAL WEBSITE:

CURRICULUM VITAE

1. **NAME**: Paul S. Min

2. **ACADEMIC RANK**:
Associate Professor (Full-Time)

3. **DEGREES**:
Ph.D. (EE) The University of Michigan (1987)
M.S. (EE) The University of Michigan (1984)
B.S. (EE) The University of Michigan (1982)

4. **SERVICE ON THIS FACULTY**: 15 Years
1996 - Present Associate Professor, Department of Electrical Engineering
1990 - 1996 Assistant Professor, Department of Electrical Engineering

5. **OTHER RELATED EXPERIENCE**:
1999 - present Founder, Erlang Technology, Inc., St. Louis, Missouri
1997 - 1998 Founder, MinMax Technologies, Inc., St. Louis, Missouri
1987 - 1990 Member of Technical Staff, Bellcore, New Jersey

6. **CONSULTING, PATENTS, ETC**:
1993 - 1997 Consultant, Teleware Co. Ltd., Seoul, Korea.
1992 - 1994 Consultant, Access America Telemanagement, St. Louis, Missouri.
"Nonblocking Multi-Channel Switching with Multicasting Capability," U.S. Patent No. 5,440,549, 35 claims, August 8, 1995.
"Integrable Low Complexity Multi-Channel Switch," U.S. Patent No. 5,526,352, 24 claims, June 11, 1995.
"Network Designer for Communication Networks Networks," U.S. Patent No. 5,788,161, 35 claims, December 13, 1998.
"Packet Switching Apparatus with Multi-Channel and Multi-Cast Switching Functions and Packet Switching System Using the Same," U.S. Patent No. 6,128,292, 11 claims, October 3, 2000.
"Method of and Apparatus for Matching Strings of Different Lengths," U.S. Patent No. 6,614,789, 41 claims, September 2, 2003.
"Method of and Apparatus for Building and Using Multi-Dimensional Index Trees for Multi-Dimensional Data Objects," U.S. Patent No 6,859,455, 42 claims, February 22, 2005.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
Akl, B., Hegde, M.V., Naraghi-Pour, M., and Min, P.S., "Multi-Cell CDMA Network Design," *IEEE Transaction on Vehicular Technology*, June 2002..
Kim, Y. G. and Min, P. S., "On the Prediction of Average Queuing Delay with Self-Similar Traffic," *Proceedings of IEEE GLOBECOM 2003, San Francisco, December 2003.*

Hu, C., Saidi, H., and Min, P.S., "DB_WFQ: An Efficient Fair Queueing Using Binary Counter," *Proceeding of Coins 2002*.
Yoon, U., Park, S., Min, P.S., "Network Architecture and Wireless Data Service Protocol based on Mobile IP toward the Third Generation Wireless Communication", *Proceedings of 3G Wireless*, June 2000, San Francisco, pp. 211-215
R.G. Akl, M.V. Hegde, M. Naraghi-Pour, P.S. Min, "CDMA Network Design to Meet Non-uniform User Demand," *International Teletraffic Congress*, March 2000.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
Institute of Electrical and Electroni Engineers (Senior Member)
Eta Kappa Nu

10. HONORS AND AWARDS:
Outstanding Achievement Award, Bellcore, 1990.
18th ISATA Award of Technical Excellence, The best paper award at ISATA 1988.
Rockwell Fellow, Rockwell International, 1985, 1986.
Outstanding Graduate Student Award, The University of Michigan, 1985.
Outstanding Teaching Award, The University of Michigan, 1984, 1986.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Electrical Networks, (ESE230), 3hr/wk lecture, undergraduate
Transmission System and Multiplexing (ESE571), 3hr/wk lecture, graduate
Electrical Laboratory I (EE 250), 3hr/wk lecture, undergraduate
Signaling and Control of Comm. Networks (ESE572), 3hr/wk lecture, graduate
Queueing Systems and Discrete Stochastic Proc. (EE 536), 3hr/wk lecture, graduate
Digital Computer (EE 260M), 3hr/wk lecture, undergraduate
Computer/Communications System Analysis II (EE 558), 3hr/wk lecture, graduate
Computer/Communications System Analysis I (EE 557), 3hr/wk lecture, graduate
Digital Systems Laboratory (EE 455), 3hr/wk lecture, undergraduate

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
University Judicial Board (0.5 hour per week)
Telecommunications Committee, Chair (0.5 hour per week)
Graduate Committee (1 hour per week)
Computer Engineering Committee (0.5 hour per week)

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Networking Certificate Program
Computer Engineering Program

14. PERSONAL WEBSITE:
http://ee.wustl.edu/~psm/bio.html

CURRICULUM VITAE

1. **NAME**: Robert E. Morley Jr.

2. **ACADEMIC RANK**:
   Associate Professor, Full-time

3. **DEGREES**:
   D. Sc. in Electrical Engineering - Washington University (1977)
   MS in Electrical Engineering - Washington University (1975)
   BS in Electrical Engineering - Washington University (1973)

4. **SERVICE ON THIS FACULTY**: 26 Years
   Associate Professor of Electrical Engineering since 4/87
   Assistant Professor of Electrical Engineering 9/81 through 3/87

5. **OTHER RELATED EXPERIENCE**:
   Courses taught include: EE455 - Digital Systems Laboratory and Assembly Language Programming (redesigned course); EE421 - Communication Theory, EE463 - Introduction to VLSI Design, EE 563 - Advanced VLSI Design Projects, EE360 - Logic and Digital Systems Design, EE147 - Introduction to Computer Systems (created course), EE445 - Digital Signal Processing, and various EE400 - Independent Study projects, EE350 Intermediate Electronics Lab, EE 250 - Introductory Electronics Lab, EE 100 - Introduction to Electrical Engineering (created course).
   INDUSTRIAL CAREER
   Cofounder and vice-president of Micro-Term, Inc. manufacturer of microprocessor based video display terminals (1976-1981). Responsibilities included hardware and software design of numerous products and testing devices, development of documentation standards, technical marketing and training of in-house and field-service technicians. Products included the first terminals emulating multiple low-end units, and C-Phone deaf communication terminals.
   MIT Lincoln Laboratories (Summer 1975). Member of Technical Staff in satellite communications group. Designed a receiver to combat the effects of intersymbol interference. Simulated the receiver to verify a power savings of 3 dB for constant bit error rate.
   ABB Hafo, Stockholm Sweden, Summer 1993. Feasibility study for low power VLSI design of a digital hearing aid.
   National Acoustics Laboratory, Sydney Australia, Summer 1994. Signal processing for enhanced hearing aids.

6. **CONSULTING, PATENTS, ETC**:
   Expert testimony in a patent litigations for Finnegan, Henderson, Farrabow and Dunner; Robins, Kaplan, Miller and Ciresi; Haverstock, Garrett and Roberts; Senniger, Powers, Leavitt and Roedel; and Leydig, Voit & Mayer, Ltd.

"Hearing aids, signal supplying apparatus, systems for compensating hearing deficiencies, and methods." With A. M. Engebretson and G. R. Popelka. US Patent #4,458,085, October 22, 1985.
"Electronic filters, signal conversion apparatus, hearing aids and methods." With A.M. Engebretson, G.L. Engel and T.J. Sullivan. US Patent #5,111,419, May 5, 1992.
"Electronic filters, signal conversion apparatus, hearing aids and methods". With A.M. Engebretson, G.L. Engel and T.J. Sullivan. US Patent #5,357,251, October 18, 1994.
"Electronic filters, repeated signal charge conversion apparatus, hearing aids and methods." With A.M. Engebretson, G.L. Engel and T.J. Sullivan. US Patent #5,225,836, July 6, 1993.
"Method and Apparatus for Fingerprinting and Authenticating Various Magnetic Media," with R. S. Indeck and M. W. Muller. US Patent #5,920,628, July 6, 1999.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:

K. S. Maluf, E. J. Richter, R. E. Morley, J. W. Klaesner, and M. J. Mueller, "Validity of measurements obtained from an electronic monitoring system in diabetic footwear" (Abstract). J Orthopedic Sports Physical Therapy 2000; 30: A12.

Seh Wah Kwa, Engel, G. L., Morley, R. E., "Quantization noise analysis of sign/logarithm data encoders when excited by speech or sinusoidal inputs." IEEE Transactions on Signal Processing, Vol. 48 No. 12, December 2000.

R. E. Morley, E. J. Richter, J. W. Klaesner, K. S. Maluf, and M. J. Mueller, "In-Shoe multisensory data acquisition system." IEEE Transactions on Biomedical Engineering, Vol. 48, NO. 7, July 2001.

K. S. Maluf, R. E. Morley, E. J. Richter, J. W. Klaesner, M. J. Mueller, "Reliability and Validity of Measures Obtained from a Portable Device for Long-term Monitoring of In-Shoe Plantar Pressures, Temperature, and Humidity," In review.

X. F. Yang, D. W. Duffy, R. E. Morley, S. M. Rothman. "Neocortical seizure termination by focal cooling: temperature dependence and automated seizure detection." Epilepsia. 2002 March; 43(3): pp. 240-245.

Roger Chamberlain, Yen Hsiang Chew, Varuna DeAlwis, Eric Hemmeter, John Lockwood, Robert Morley, Ed Richter, Jason White, and Huakai Zhang, "Novel Numerical Representations for Low-Power Audio Signal Processing," in Proc. of International Hearing Aid Research Conference, August 2002.

Roger Chamberlain, Yen Hsiang Chew, Varuna DeAlwis, Eric Hemmeter, John Lockwood, Robert Morley, Ed Richter, Jason White, and Huakai Zhang, "Power Consumption of Customized Numerical Representations for Audio Signal Processing," in Proc. of 6th High Performance Embedded Computing Workshop, September 2002.

Roger Chamberlain, Eric Hemmeter, Robert Morley, and Jason White, "Modeling the Power Consumption of Audio Signal Processing Computations Using Customized Numerical Representations." Proc. of 36th Annual Simulation Symposium, April 2003.

Deepak Srinivasagupta, Babu Joseph, and Robert Morley. "New in Situ Sensor Modeling Approach to Measurement Validation."Industrial & Engineering Chemistry Research 2003, 42(11), pp. 2324-2333.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
Senior Member IEEE, Member Eta Kappa Nu

10. HONORS AND AWARDS:
IEEE Young Professional Award for contributions to the St. Louis Electronics Industry, 1981.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Digital Systems Lab (EE455). Signals and Sytems Lab (EE 437), Senior Design Projects (ESE 498).

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Undergraduate Committee in the Department of Electrical Engineering (1 hour per week).
Laboratory planning.

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attended approximately 2 seminars per month
Collaborated with faculty on research projects approximately 3 hours per week
Consulted on various projects on campus and in industry.

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: Zhi-Zhong Mou

2. **ACADEMIC RANK**:
   Adjunct Professor (Part Time)

3. **DEGREES**:
   B.S. (M.E.) Northeastern University, Shenyang City, China (1967)
   Advanced study in reliability and quality engineering, Aerospace and Mechanical Engineering Department, University of Arizona (1981-1983)

4. **SERVICE ON THIS FACULTY**: 13 years
   1991-2004 Adjunct Associate Professor

5. **OTHER RELATED EXPERIENCE**:
   1998-present Quality Engineer, Daimler Chrysler Corp. St. Louis North Assembly Plant
   1992-1998 Quality Engineer, Auto Parts Company, St. Louis, Mo
   1986-1991 Chairman, Mechanical Engineering Department, Director of Reliability and Quality Engineering Lab, Shanghai University, China
   1983-1991 Professor, Mechanical Engineering Department, Director of Reliability and Quality Engineering Lab, Shanghai University, China
   1972-1980 Lecturer, Mechanical Engineering Department, Director of Machine Design and Manufacturing Group, Shanghai University, China
   1967-1972 Engineer, Shanghai Automotive Company, China

6. **CONSULTING, PATENTS, ETC**:

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:

10. **HONORS AND AWARDS**:

11. **COURSES TAUGHT IN THE LAST FIVE YEARS**:
    Reliability and Quality Control (ESE 405/505), Fall 2004, Fall 2003, Fall 2002, Fall 2001

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**:

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:

14. **PERSONAL WEBSITE:**

CURRICULUM VITAE

1. **NAME**: Hiroaki Mukai

2. **ACADEMIC RANK**:
   Professor (full-time)

3. **DEGREES**:
   Ph.D. 1974 Electrical Engineering & Computer Sciences, U of California, Berkeley, CA
   M.S. 1971 Electrical Engineering & Computer Sciences, U of California, Berkeley, CA
   B.E. 1969 Electrical Engineering, Wasada University, Tokyo, Japan

4. **SERVICE ON THIS FACULTY**: 31 years
   2006 – present Associate Chair, Dept of Elect. & Systems Eng.
   1993 – present Director, Undergraduate Programs
   1989 – present Director, Master of Control Engineering
   1983 – present Professor
   1979 – 1983 Associate Professor
   1975 – 1979 Assistant Professor

5. **OTHER RELATED EXPERIENCE**:
   Feb - June 1989 Visiting Researcher, Dept of Electrical Power Engineering,University of Ghent, Ghent, Belgium
   Sept 1987- June 1988 Visiting Professor, Dept of Mathematics,University of Namur, Namur, Belgium
   April - June 1982 Visiting Associate Professor Dept of Electrical Engineering and Computer Sciences University of California, Berkeley, CA
   February - August 1975 Assistant Research Engineer University of California, Berkeley, CA

6. **CONSULTING, PATENTS, ETC**:
   1994-1999 Consultant, Abbott Ambulance, St. Louis, MO
   January - Dec. 1982 Consultant, Dept of Engineering Computer Applications Pacific Gas and Electric Co., San Francisco, CA

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: Missouri

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   In Referred Journals:

   “Sequential Linear-Quadratic Method for Differential Games with Air Combat Applications," *Computational Optimization and Applications*, Vol. 25, pp. 193-222, 2003 (with many people).

   I. N. Katz, H. Mukai, H. Schattler M. Zhang, and M. Xu, “Solution of a Differential Game Formulation of Military Air Operations by the Method of Characteristics,” Vol. 125, No. 1, pp. 113-135, Apr. 2005, *J. of Optimization Theory and Applications*.

   In Conference Proceedings:

"Solution of a Differential Game Formulation of Military Air Operations by the Method of Characteristics," I. N. Katz, H. Mukai, H. Schättler, and M. Zhang, pp. 168-175, *Proc. of the American Control Conference*, Washington D.C., June 2001.

"Galerkin-Based Method for a Differential Game of a Two-Dimensional Distributions," Y. Sawada, H. Mukai, and R. de la Guardia, *Proc. of the 27th Conf. of the IEEE Industrial Electronics Society,* Denver, November 2001.

"Sequential Quadratic Methods for Differential Games," H. Mukai, A. Tanikawa, P. Rinaldi, and I. Tunay, pp. 182-189, *Proceedings of the American Control Conf.*, Washington D.C., June 2001.

"Controller, Estimator and Detector for Military Air Operations," H. Mukai, A. Isidori, I. N. Katz, H. Schattler, A. Tanikawa, I. Tunay, C. De Persis, I. A. Ozcan, F. Caliskan, P. Rinaldi, G. J. Wang, R. Li and H. Gao, p. 250, *Abstract of the Fifth SIAM Conf. on Control and Its Applications*, San Diego, July, 2001.

"Solution of a Differential Game with Geographically Distributed Resources," R. de la Guardia, Y. Sawada and H. Mukai, paper 315A-2 (6 pages), *Proc. of the SICE 2001 Conf.*, Nagoya, July 2001.

"Game Estimators for Air Combat Games with Unknown Enemy Inputs," F. Caliskan, H. Mukai, I. N. Katz, and A. Tanikawa, pp5381-5387, *Proc. of the American Control Conf.*, Denver, 2003.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER:
Membership: IEEE (Control Systems Society)

10. HONORS AND AWARDS:
Most Favorite Professor, School of Engineering, Washington University (Fall 2002)
Professor of the Year (voted by engineering students), Washington Univ. (1990 & 1991)
University of California Graduate Fellowships (1971-72 & 1972-73)
Waseda University Graduate Fellowship (1969-1970)
Sansui Valedictory Award, Wasada University

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
SSM 202/ESE 251 Intro. to Systems Science and Engineering (2 hrs/wk of lecture, 4 hours/wk of lab, undergraduate, day)
SSM 351/ESE 351 Linear Dynamic Systems (3 hrs/wk of lecture, undergraduate, day)
SSM 521/ESE 516 Optimization in Function Space (3 hrs/wk of lecture, graduate day)

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Departmental Undergraduate Curriculum Committee (Chair, 1 hr/week, no extra compensation)
Departmental ABET Committee (Chair, 1 hr/week, no extra compensation)

Coordination of Departmental Instructional Laboratories (1/2 hr/week, no extra compensation)
Faculty advisor for the Mathematical Contest in Modeling (1/8 hr/week, no extra compensation)
Engineering Promotion Review Committee (1/2 hr/week, no extra compensation)
Faculty Advisor, SIAM Student Chapter at Washington Univ.(1/8 hr/week, no extra compensation)

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE (LAST FIVE YEARS):
Regularly attends 1 to 2 professional conferences per year.

14. PERSONAL WEBSITE: http://ese.wustl.edu/~mukai/

CURRICULUM VITAE

1. **NAME**: Marcel Muller

2. **ACADEMIC RANK**:
Senior Professor

3. **DEGREES**:
B.S. (E.E.) Columbia University (1949)
M.S. (E.E.) Columbia University (1952)
Ph.D. (E.E.) Stanford University (1957)

4. **SERVICE ON THIS FACULTY**: 39 year
1991-Present Senior Professor, Department of Electrical and Systems Engineering
1966-1991 Professor, Department of Electrical Engineering

5. **OTHER RELATED EXPERIENCE**:
1976-1977 Visiting Scientist, Max Planck Institute for Metals Research, Stuttgart, Germany
1952-1966 Engineer to Senior Scientist, Varian Associates, Palo Alto, CA
1962-1963 Visiting Lecturer, University of Zurich, Switzerland

6. **CONSULTING, PATENTS, ETC**:
Consultant Emerson Electric Company, St. Louis MO, 1963
Consultant McDonnell-Douglas Corporation, St. Louis MO, 1981,1993
Consultant Hewlett-Packard Laboratories, Palo Alto CA, 1986-1987
Consultant SRI International, Menlo Park CA, 1988-Present

"Pulsed Ferromagnetic Microwave Generator", M. Muller, U.S. Patent 3,252,111 (1966)

"Solid State Plasma Maser", M. Muller, J. Feinstein, U.S. Patent 3,533,011 (1970)

"Optical Maser", M. Muller, A Sher, U.S. Patent 3,564,449 (1971)

"Method and Apparatus for Fingerprinting Magnetic Media", R.S. Indeck, M. Muller, U.S. Patent 5,365,586 (1994)

"Method and Apparatus for Process Control, Tension control, and Testing of Magnetic Media", R.S. Indeck, M. Muller, U.S. Patent 5,408,505 (1995)

"Method and Apparatus for Fingerprinting and Authenticating Magnetic Media", R.S. Indeck, M. Muller, G.L. Engel, A.L. Hege, U.S. Patent 5,428,683 (1995); Australian Patent 680901

"Method and Apparatus for Fingerprinting and Authenticating Various Magnetic media", R.S. Indeck, M. Muller, G.L. Engel, A.L. Hege, U.S. Patent 5,546,462 (1996); Australian Patent 688956

“Method and Apparatus for Noise Reduction in Magnetic Media Recordings”, R.S. Indeck, M. Muller, U.S. Patent 5,587,654 (1996); Australian Patent 680498

“Method and Apparatus for Secure Data Storage and Manipulation Using Magnetic Media”, R.S. Indeck, M. Muller, U.S. Patent 6,625,689 (1997)

“Method and Apparatus for Fingerprinting and Authenticating Various Magnetic Media”, R.S. Indeck, M. Muller, G.L. Engel, A.L. Hege, U.S. Patent 5,740,244 (1998)

“Method and Apparatus for Fingerprinting and Authenticating Various Magnetic Media”, R.S. Indeck, M. Muller, R.E. Morley, U.S. Patent 5,920,628 (1999)

“Method for Precompensating Signals for Magnetic Media Noise”, R.S. Indeck, M. Muller, J.A. O’Sullivan, U.S. Patent 5,959,345 (1999)

7. STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER:

8. PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
American Physical Society (Fellow)
Division of Condensed Matter Physics, Forum on Physics and Society
Institute of Electrical and Electronic Engineers (Fellow)
Magnetics Society, Lasers and Electrooptics Society
Union of Concerned Scientists

10. HONORS AND AWARDS:
Tau Beta Pi
Eta Kappa Nu
Alexander von Humboldt Prize
Honorary Fulbright Fellowship

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attended 2 conferences per year.
Attended department seminars.
Collaborate with faculty on research projects

14. PERSONAL WEBSITE:

CURRICULUM VITAE

1. **NAME**: William J. Murphy

2. **ACADEMIC RANK**:
   Affiliate Professor (part-time)

3. **DEGREES**:
   D.Sc. 1967 Control Systems, Washington University
   M.S. 1963 Engineering - Servomechanisms, St. Louis University
   B.S. 1960 Electrical Engineering, St. Louis University

4. **SERVICE ON THIS FACULTY**: 38 Years
   1972 – present Affiliate Professor (part-time)
   1966 – 1971 Assistant Professor (full-time)

5. **OTHER RELATED EXPERIENCE**:
   1959 – 1962 Engineer - Industrial and Theater Controls,Vickers Inc., St. Louis, MO
   1962 – 1966 Guidance and Control Engineer - Gemini Project, McDonnell Aircraft Co., St. Louis, MO
   1971 - 1984 McDonnell Aircraft Co., St. Louis, MO, Advanced Design, Electronics Technology
   1983 Lecturer: NATO Advisory Group on Aerospace Guidance and Controls Lecture Series 122: Application of Digital Mapping Technology to Guidance and Control Systems
   1984 - 1989 Chief Engineer - Avionics Integration and Mission Systems, Chief Engineer - Electronics Systems Technology, McDonnell Aircraft Co., St. Louis, MO
   1988 - 1989 Lecturer - Aerospace Vehicle Systems Engineering Center for Professional Development, The University of Maryland, College Park, MD
   1988 - 1993 McDonnell Douglas Corporate Representative Electronic Systems Committee Aerospace Industries Association of America
   1989 - 1993 Director - Avionics Technology Director - F/A-18 Program Analysis and Investigation, McDonnell Douglas Corp., St. Louis, MO
   August 1993 Retired from McDonnell Aircraft Corporation

6. **CONSULTING, PATENTS, ETC**:
   Patent No. 4,050,068: Augmented Tracking System
   Patent No. 4,092,716: Control Means and Method for Controlling an Object

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   Since promotion to Chief Engineer in 1984 managerial responsibilities precluded publication of scientific research. Prior to promotion, during the period 1968-1984, seventeen (17) publications were authored.

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER**:
   none

10. HONORS AND AWARDS:

Eta Kappa Nu
Sigma Xi
Who's Who in Technology
Who's Who in the Midwest
Who's Who in Aviation and Aerospace

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Fall 2000 - 2003 EE/ME 431 Control Systems I (3 hrs/wk, lecture, undergraduate, day)
Spring 2000 - 2004 EE/ME 432 Control Systems II (3 hrs/wk, lecture, undergraduate, day)
Fall 2004 ESE/ME 441 Control Systems I (3 hrs/wk, lecture, undergraduate, day)
Spring 2005 ESE 442 Control Systems II (3 hrs/wk, lecture, undergraduate, day)

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS: none

14. PERSONAL WEBSITE:

CURRICULUM VITAE

1. **NAME**: Arye Nehorai

2. **ACADEMIC RANK**:
Professor and Chairman

3. **DEGREES**:
Ph.D., EE, Stanford University (1983)
M.Sc., EE, Technion, Israel (1979)
B.Sc., EE, Technion, Israel (1976)

4. **SERVICE ON THIS FACULTY**:
2006 – present - Professor and Chairman

5. **OTHER RELATED EXPERIENCE**:
1995–2005 Professor. The University of Illinois at Chicago, Department of Electrical and Computer Engineering, and Department of Bioengineering, Chicago, IL
2000–2001 Professor and Division Chair. The University of Illinois at Chicago, Elect and Comp Eng Division, Dept of Elect Eng and Computer Science
1989–1995 Associate Professor. Yale University, Department of Electrical Engineering

6. **CONSULTING, PATENTS, ETC**:
A. Nehorai and E. Paldi, U.S. Patent No. 5,315,308, "Method for electromagnetic source localization," May 24, 1994.
F-L. Luo, C. Pavlovic, and A. Nehorai, U.S. Patent No. 6,754,356, "Two-stage adaptive feedback cancellation scheme for hearing instruments," June 22, 2004.
Visiting Consultant, DSO National Laboratories, Singapore, 7/97
Visiting Consultant, DSO National Laboratories, Singapore, 7/96 – 8/96
Visiting Consultant, DSO National Laboratories, Singapore, 12/90 – 1/91

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: N/A

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:

"Space-time fading channel estimation and symbol detection in unknown spatially correlated noise," *IEEE Trans. on Signal Processing*, Vol. SP-50, pp. 457-474 (Mar. 2002), Dogandzic and A. Nehorai.

"Adaptive null-forming scheme in digital hearing aids," *IEEE Trans. on Signal Processing*, Vol. SP-50, pp. 1583-1590 (July 2002), F-L. Luo, J. Yang, C. Pavlovic and A. Nehorai.

"Separation and tracking of multiple broadband sources with one electromagnetic vector sensor," *IEEE Trans. on Aerospace and Electronic Systems*, Vol. 38, pp. 1109-1116 (July 2002), C-C. Ko, J. Zhang, and A. Nehorai.

"Spectral contrast enhancement: algorithms and comparisons," *Speech Communication*, Vol. 39, No. 1-2, pp. 33-46 (Jan. 2003), F-L. Luo, J. Yang, and A. Nehorai.

"Mutual coupling of two collocated orthogonally oriented circular thin-wire loops," *IEEE Trans. Antennas and Propagat*, Vol. AP-51, pp. 1307-1314 (June, 2003), Y. Huang, A. Nehorai, and G. Friedman.

"Wideband source localization using a distributed acoustic vector-sensor array," *IEEE Trans. Signal Processing*, Vol. 51, pp. 1479-1491 (June 2003), M. Hawkes and A. Nehorai.

"Generalized multivariate analysis of variance: a unified framework for signal Processing in correlated noise," *IEEE Signal Processing Magazine,* Vol. 20, pp. 39-54 (Sep. 2003), A. Dogandzic and A. Nehorai.

"Interference mitigation in STAP using the two-dimensional Wold decomposition model," *IEEE Trans. Signal Processing,* Vol. SP-51, pp. 2461-2470 (Oct. 2003), J. Francos and A. Nehorai.

"Estimating mechanical properties of the heart using dynamic modeling and tagged magnetic resonance imaging," *Physics in Medicine and Biology,* Vol. 49, pp. 371-386, No. 3 (Feb. 2004), A. Jeremic and A. Nehorai.

"OFDM channel estimation in the presence of interference," *IEEE Trans. Signal Processing,* Vol. 52, pp. 3429-3439 (Dec. 2004), A. Jeremic, T. A. Thomas, and A. Nehorai.

"Estimating brain conductivities and dipole source signals with EEG arrays," *IEEE Trans. Biomedical Engineering,* Vol. 51, pp. 2113-2122 (Dec. 2004), D. Gutierrez, A. Nehorai, and C. H. Muravchik.

"Model selection in spatio-temporal electromagnetic source analysis," *IEEE Trans. Biomedical Engineering,* Vol. 52, pp. 414-420 (Mar. 2005), L. Waldorp, H. Huizenga, A. Nehorai, R. Grasman, and P. Molenaar.

"Line-source modeling and estimation with magnetoencephalography," *IEEE Trans. Biomedical Engineering,* Vol. 52, pp. 839-851 (May 2005), I. S. Yetik, A. Nehorai, C. H. Muravchik, and J. Haueisen.

"Ellipsoidal head model for fetal magnetoencephalography: forward and inverse solutions," *Physics in Medicine and Biology*, Vol. 50, No. 9, pp. 2141-2157 (May 2005), D. Gutierrez, A. Nehorai, and H. Preissl.

"MEG forward problem formulation using equivalent surface current densities," *IEEE Trans. Biomedical Engineering,* Vol. 52, pp. 1210-1217 (July 2005), N. von Ellenrieder, C. H. Muravchik, and A. Nehorai.

"Simultaneous estimation and testing of sources in multiple MEG data sets," *IEEE Trans. on Signal Processing,* Vol. 53, pp. 3449-3460 (Sep. 2005), F. Bijma, J. C. de Munck, H. M. Huizenga, R. M. Heethaar, and A. Nehorai.

"Maximum likelihood estimation of point scatterers for computational time-reversal imaging," *Communications in Information and Systems*, Vol. 5, No. 2, pp. 227-256, (2005), G. Shi and A. Nehorai.

"Microstrip antennas with suppressed radiation in horizontal directions and reduced coupling," *IEEE Trans. Antennas Propagat.*, Vol. 53, pp. 3468-3476 (Nov. 2005), M. Nikolic, A. Djordjevic, and A. Nehorai.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
IEEE Signal Processing Society - various Boards, committees and societies
Silicon Valley Technical Institute Advisory Board
Steering Committee for the *IEEE Transactions on Multimedia*
NSF Review Panels, 1997, 2002, 2003, 2004
Sigma Xi since 1983

10. HONORS AND AWARDS:
University Scholar Award, University of Illinois, 2001-04
Vice President (Publications) and Chair of the Publications Board,
IEEE Signal Processing Society, since 2003
Distinguished Lecturer, IEEE Signal Processing Society, 2004-05

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Communication Theory and Systems
Detection and Estimation Theory

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Attended conferences and collaborate with others on research projects

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attended conferences, seminars and collaborate with faculty on research projects

14. PERSONAL WEBSITE: http://ese.wustl.edu/~nehorai/

CURRICULUM VITAE

1. **NAME**: Emir Osmanagic

2. **ACADEMIC RANK**:
   Adjunct Associate Professor (Part Time)

3. **DEGREES**:
   B.S. (E.E.) Washington University of St. Louis (1997)
   M.S. (E.E.) Washington University of St. Louis (2000)

4. **SERVICE ON THIS FACULTY**: 2 years
   2003-Present Adjunct Associate Professor

5. **OTHER RELATED EXPERIENCE**:
   2003-Present "Pfizer Inc." "Associate Director" St. Louis, MO

6. **CONSULTING, PATENTS, ETC**:
   "Emir Osmanagic" and "Karey Van Sant, Brian Kilpatrick"
   "6-Channel Parallel Purification System", Assignee: Pharmacia Inc, July 2003

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   State of Missouri, "2002003398"

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Association for Lab Automation

10. **HONORS AND AWARDS**:
    BS Dean's List
    MS GPA 4.0

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    Introduction to Electrical Circuits JEE2800, SP04, FL04, SP05

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**: none

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:
    Collaborate with other faculty

14. **PERSONAL WEBSITE:** none

CURRICULUM VITAE

1. **NAME**: Joseph Andrew O'Sullivan

2. **ACADEMIC RANK**:
   Professor (Full-Time)

3. **DEGREES**:
   Ph.D. (E.E.) Univ. of Notre Dame (1986)
   M.S. (E.E.) Univ. of Notre Dame (1984)
   B.S. (E.E.) Univ. of Notre Dame (1982)

4. **SERVICE ON THIS FACULTY**: 19 Years
   2004-Present Samuel C. Sachs Professor of Electrical Engineering
   1998-Present Director, Electronic Systems and Signals Research Laboratory, Wash Univ.
   2000-Present Professor, Dept. of Electrical Engineering, Washington Univ.
   2000-Present Professor, Dept. of Biomedical Engineering, Washington Univ.
   2000-Present Professor, Dept. of Radiology, Washington Univ.
   1994-2000 Associate Professor, Dept. of Electrical Engineering, Washington Univ.
   1998-2000 Associate Professor, Radiology, Washington Univ.
   1987-1994 Assistant Professor, Dept. of Electrical Engineering, Washington Univ.
   1995-Present Investigator, Center for Imaging Science, Washington Univ.
   1987-Present Research Assoc, Electronic Systems & Signals Research Lab, Wash Univ.
   1986-1987 Visiting Assistant Professor, Dept. of Electrical Engineering, Wash Univ.

5. **OTHER RELATED EXPERIENCE**:
   1985-1986 Senior Teaching Fellow, Dept. of Electrical Eng., Univ. of Notre Dame
   1982-1985 Research Assistant, Dept. of Electrical Eng., Univ. of Notre Dame

6. **CONSULTING, PATENTS, ETC**:
   Consultant: Hunter Engineering Company; Technologies; DSCI; COINCO
   P.-C. Cheng, J.A. O'Sullivan, D.L. Snyder, M.W. Vannier, and G. Wang, "Iterative Process for Reconstructing Cone-Beam Tomographic Images," U.S. Patent No. 5,909,476, June 1, 1999.
   G.A. O'Sullivan and J.A. O'Sullivan, "Multimode Power Processor," U.S. Patent No. 5,929,538, July 27, 1999.
   R.S. Indeck, M.W. Muller, and J.A. O'sullivan, "Method for Precompensating Signals for Magnetic Media Noise," U.S. Patent No. 5,959,794, September 28, 1999.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: MO

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   N. A. Schmid and J. A. O'Sullivan, "Performance Prediction Methodology for Biometric Systems Using a Large Deviations Approach," to appear, *IEEE Transactions on Signal Processing*, October 2004.

D. R. Fuhrmann, C. Preza, J. A. O'Sullivan, D. L. Snyder, and W. H. Smith, ``Spectrum Estimation from Quantum-Limited Interferograms," *IEEE Transactions on Signal Processing*, Vol. 52, No. 4, pp. 950-961, April 2004.

J. A. O'Sullivan and M. D. DeVore, ``Quantitative Statistical Assessment of Conditional Models for Synthetic Aperture Radar," *IEEE Transactions on Image Processing*, Vol. 13, No. 2, pp. 113-125, February 2004.

Y. Wu, J. A. O'Sullivan, N. Singla, and R. S. Indeck, ``Iterative Detection and Decoding for Separable Two-Dimensional Intersymbol Interference," *IEEE Transactions on Magnetics*, Vol. 39, No.4, pp. 2115-2120, July 2003.

V. A. Markel, J. A. O'Sullivan, and J. C. Schotland, ``Inverse Problem in Optical Diffusion Tomography. IV. Nonlinear Inversion Formulas," *J. Opt. Soc. Am. A*, Vol. 20, No. 5, May 2003.

M.D. DeVore and J.A. O’Sullivan, “Target-Centered Models and Information-Theoretic Segmentation for Automatic Target Recognition,” *Multidimensional Systems and Signal Processing Special Issue on Radar Signal Processing and its Applications*, Kluwer Acad. Publ., Vol. 14, Issue 1/3, pp. 139-159, April 2003.

P. Moulin and J. A. O'Sullivan, ``Information-Theoretic Analysis of Information Hiding," *IEEE Transactions on Information Theory,* Vol. 49, No. 3, pp. 563-593, March 2003.

J. F. Williamson, B. R. Whiting, J. Benac, R. J. Murphy, G. J. Blaine, J. A. O'Sullivan, D. G. Politte, and D. L. Snyder, ``Prospects for Quantitative Computed Tomography Imaging in the Presence of Foreign Metal Bodies Using Statistical Image Reconstruction," *Med. Phys.* Vol. 29, No. 10, pp. 2404-2418, October 2002.

N. Singla, J. A. O'Sullivan, R. S. Indeck, Y. Wu, ``Iterative decoding and equalization for 2-D recording channels," *IEEE Transactions on Magnetics*, Vol. 38 No. 5, pp. 2328-2330, September 2002.

Chi-Chun Hsu; C. T. Miller, R. S. Indeck, J. A. O'Sullivan, and M. W. Muller, ``Magnetization estimation from MFM images," *IEEE Transactions on Magnetics*, Vol. 38 No. 5, pp. 2444-2446, September 2002.

J. A. O'Sullivan, M. Jiang, X.-m. Ma, and G. Wang, ``Axiomatic Quantification of Multi-Dimensional Image Resolution," *IEEE Signal Processing Letters,* Vol. 9, No. 4, pp. 120-122, April 2002.

M.D. DeVore and J.A. O’Sullivan, “A Performance Complexity Study of Several Approaches to Automatic Target Recognition from Synthetic Aperture Radar Images,” *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 38, No. 2, pp. 632-648, April 2002.

M.B. Westover and J.A. O’Sullivan, ``Pattern Recognition on a Bit Budget,’’ book chapter, to appear in *Neural Information Processing Systems*, N. Tishby, editor, 2005.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
Fellow, Institute of Electrical and Electronic Engineers

Member, IEEE Information Theory, Control Systems, Circuits and Systems, Magnetics, and Signal Processing Societies
Member, The Society for Photo-Optical Instrumentation Engineers
Member, SIAM; Member, AAAS
Chairman, History Committee of IEEE Control Systems Society, 11/87 - 12/90
Faculty Advisor, Washington University IEEE Student Chapter, 1/87 - present
Student Activities Chairman, IEEE St. Louis Section, 5/90 - 12/92

10. HONORS AND AWARDS:
Samuel C. Sachs Professor of Electrical Engineering
Eta Kappa Nu member
Burns Fellowship, University of Notre Dame, 1984 - 1985 academic year
IEEE Third Millenium Medal

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
ESE 230, short course
ESE 351, Signal Analysis for Electronic Systems and Circuits
ESE 441, Control Systems
ESE 523 (used to be EE 553), Introduction to Information Theory
ESE 524 (used to be EE 552a), Detection & Estimation Theory
ESE 570 (used to be EE 550), Coding Theory and Applications
ESE 596 (used to be EE 5671), Seminar in Imaging Science and Engineering

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Chair, Faculty Senate, 7/02 – 6/04
Chair, Faculty Senate Council, 7/02 – 6/04
Member, Faculty Senate Council, 6/00 - Present.
Advisory Committee, SEAS Faculty Assembly, 6/01 - Present.
Member and Chair, Gender Pay Equity Committee, 1997 - Present.
Undergraduate Council and its Steering Committee, 1994 - Present.
ESE Dept Undergrad Committee, Fall 1987 - Spring 1989, and Fall 1998 - present.
ESE Faculty Advisor, IEEE Student Chapter January 1987 - present.

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Co-Chair of 2006 IEEE International Symposium on Information Theory.
Local Arrangements Chair for 2003 IEEE Workshop on Statistical Signal Processing.
Attended approximately 6 conferences and workshops per year.
Attended approximately 2 seminars per month.
Performed research at least 25 hours per week.
Associate Editor for IEEE Transactions on Information Theory.
Guest Associate Editor for Special Issue on Information Theoretic Imaging of IEEE Transactions on Information Theory.
Member of Washington University Undergraduate Council.

14. PERSONAL WEBSITE: http://www.essrl.wustl.edu/~jao

CURRICULUM VITAE

1. **NAME**: William F. Pickard

2. **ACADEMIC RANK**:
   Senior Professor

3. **DEGREES**:
   A.B. (Physics, *summa cum laude*) Boston University (1954)
   M.A. (Physics) Harvard University (1955)
   Ph.D. (Applied Physics) Harvard University (1962)

4. **SERVICE ON THIS FACULTY**:
   2001-present: Senior Professor
   1973-2001: Professor
   1966-1973: Associate Professor

5. **OTHER RELATED EXPERIENCE**:
   1963-1966: Massachusetts Institute of Technology, Research Fellow in Biology
   1962-1963: Harvard University, Research Fellow in Electronics

6. **CONSULTING, PATENTS, ETC**:
   Not applicable

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   Missouri, No. 015741

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   "How Might Spatial Nonuniformity of Dose in a Homogeneous Biological System Affect its Total Response?"
   Bioelectromagnetics 22, 66-70 (2001).
   W. F. Pickard.
   "Energy Deposition Processes in Biological Tissue: Nonthermal Biohazards Seem Unlikely in the Ultra-High Frequency Range".
   Bioelectromagnetics 22, 97-105 (2001).
   W. F. Pickard and E. G. Moros.
   "Cytogenetic Studies in Human Blood Lymphocytes Exposed In Vitro to Radiofrequency Radiation at a Cellular Telephone Frequency (835.62 MHz, FDMA)".
   Radiation Res. 155, 113-121 (2001).
   Vijayalaxmi, W. F. Pickard, K. S. Bisht, B. Z. Leal, M. L. Meltz, J. L. Roti Roti, W. L. Straube, and E. G. Moros.
   "Neoplastic Transformation in C3H 10T½ Cells after Exposure to 835.62 MHz FDMA and 847.74 MHz CDMA Radiations.
   Radiation Res. 155, 239-247 (2001).
   J. L. Roti Roti, R. S. Malyapa, K. S. Bisht, E. W. Ahern, E. G. Moros, W. F. Pickard, and W. L. Straube.

"A Novel Class of Fast Electrical Events Recorded by Electrodes Implanted in Tomato Shoots".
Aust. J. Plant Physiol. 28, 121-129 (2001).
W. F. Pickard.

"Chromosome Damage and Micronucleus Formation in Human Blood Lymphocytes Exposed In Vitro to Radiofrequency Radiation at a Cellular Telephone Frequency (847.74 MHz, CDMA)".
Radiation Res. 156, 430-432 (2001).
Vijayalaxmi, K. S. Bisht, W. F. Pickard, M. L. Meltz, J. L. Roti Roti, and E. G. Moros.

"Micronuclei in the Peripheral Blood and Bone Marrow of Cells of Rats Exposed to 2450 MHz Radiofrequency Radiation".
Int. J. Radiat. Biol. 77, 1109-1115 (2001).
Vijayalaxmi, W. F. Pickard, K. S. Bisht, T. J. Prihoda, M. L. Meltz, M. C. LaRegina, J. L. Roti Roti, W. L. Straube, and E. G. Moros.

"The Role of Cytoplasmic Streaming in Symplastic Transport".
Plant Cell Environ. 26, 1-15 (2003).
W. F. Pickard.

"The Riddle of Root Pressure. I. Putting Maxwell's Demon to Rest" .
Functional Plant Biol. 30, 121-134 (2003).
W. F. Pickard.

"The Riddle of Root Pressure. II. Root Exudation at Extreme Osmolalities" .
Functional Plant Biol. 30, 135-141 (2003).
W. F. Pickard.

"The Effect of Chronic Exposure to 835.62 MHz FDMA or 847.74 MHz CDMA Radiofrequency Radiation on the Incidence of Spontaneous Tumors in Rats".
Radiation Res. 160, 143-151 (2003).
M. C. LaRegina, E. G. Moros, W. F. Pickard, W. L. Straube, J. Baty, and J. L. Roti Roti.

"Measurement of DNA Damage and Apoptosis in Molt-4 Cells after In Vitro Exposure to Radiofrequency Radiation".
Radiation Res. 161, 193-200 (2004).
G. J. Hook, P. Zhang, I. Lagroye, L. Li, R. Higashikubo, E. G. Moros, W. L. Straube, W. F. Pickard, J. D. Baty, and J. L. Roti Roti.

"Base to Apex Thermal Conductance of a Cone Embedded in a Non-Ideal Insulator".
Internat. J. Heat Mass Trans. 47, 5271-5283 (2004).
W. F. Pickard.

"Inverse Statistical Estimation Via Order Statistics: A Resolution of the Ill-Posed Inverse Problem of PERT Scheduling".
Inverse Problems 20, 1565-1581 (2004).
W. F. Pickard.

"Perspectives on the Biophysics of Xylem Transport".
In Vascular Transport in Plants (N. M. Holbrook and M. A. Zwieniecki, eds.), Amsterdam, Elsevier (2005). pp. 3-18.
W. F. Pickard and P. J. Melcher.

"Prospective Energy Densities in the Forisome, a new Smart Material".
Materials Science & Engineering C 26, 104-112 (2006).
Pickard, W. F., Knoblauch, M., Peters, W. S., and Shen, A. Q.

"Absorption by a Moving Spherical Organelle in a Heterogeneous Cytoplasm: Implications for the Role of Trafficking in a Symplast ".
Journal of Theoretical Biology XX: In press (2006).

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
American Physical Society
American Society of Plant Biologists
Bioelectromagnetics Society
Institute of Electrical and Electronics Engineers (*Life Fellow*)

10. HONORS AND AWARDS:
Eta Kappa Nu
Phi Beta Kappa
Sigma Nu
Fellow of the Institute of Electrical and Electronics Engineers (1989)*"For contributions to the engineering aspects of biology and in particular to our understanding of the health effects of nonionizing radiation."*

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Electrical Energy Laboratory (EE 416), Spring 2001
Biological Control Systems (EE 431B), Spring 2002

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Advised undergraduates

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attended approximately 2 conferences per year
Attended approximately 1 seminar per week
Did a great deal of research, both independent and collaborative

14. PERSONAL WEBSITE:
http://www.faculty.ee.wustl.edu/pickard/bio.html

CURRICULUM VITAE

1. **NAME**: Chrysanthe Preza

2. **ACADEMIC RANK**:
   Instructor and Research Associate

3. **DEGREES**:
   B.S. (E.E.) Washington University, St. Louis (1987)
   B.S. (C.S.) Washington University, St. Louis (1987)
   M.S. (E.E.) Washington University, St. Louis (1990)
   M.S. (C.S.) Washington University, St. Louis (1991)
   D.Sc. (E.E.) Washington University, St. Louis (1998)

4. **SERVICE ON THIS FACULTY**: 5 Years
   2000 – Present Instructor, Dept. of Electrical and Systems Engineering
   2000 – Present Research Associate, Electronic Systems and Signals Research Laboratory

5. **OTHER RELATED EXPERIENCE**:
   2003 –2004 Visiting Assistant Professor, Dept. of Electrical and Computer Engineering, University of Cyprus, Nicosia, Cyprus
   1998 – 2000 Research Associate, Institute for Biomedical Computing Washington University, St. Louis, MO

6. **CONSULTING, PATENTS, ETC**:
   Consultant, Ikonisys, Inc., New Haven, CT, Fall 2004

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   Preza, C. and Conchello, J.-A. "Depth-Variant Maximum-Likelihood Restoration for Three-Dimensional Fluorescence Microscopy," *Journal of the Optical Society of America A*, Vol. 21, No. 9, pp. 1593-1601, September, 2004.

   Fuhrmann, D. R., Preza, C., O'Sullivan, J. A., Snyder, D. L., Smith, W.H., "Spectrum Estimation from Quantum-Limited Interferograms," *IEEE Transactions on Signal Processing,* Vol. 52, No. 4, pp. 950-961, April, 2004.

   Homem, M. R. P., Mascarenhas, N. D. A., Costa, L. F., and Preza C., "Biological Image Restoration in Optical-Sectioning Microscopy Using Prototype Image Constraints," *Real Time Imaging*, special issue on *Imaging in Bioinformatics*, 8(6), 475-490, 2002.

   Preza, C., "Rotational-diversity phase estimation from differential interference contrast microscopy images," *Journal of the Optical Society of America A,* 17(3), 415-424, 2000.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

Member, Institute of Electrical and Electronics Engineers

Member, Optical Society of America

Member, International Society for Optical Engineering (SPIE)

10. HONORS AND AWARDS:

Journal of the Optical Society of America Publications Award, July 1999.

Fullbright / CASP scholarship: Full tuition and stipend, 1983-1987.

B.S. degrees awarded cum Laude, 1987.

Tau Beta Pi and Eta Kappa Nu, Engineering Honoraries, 1986.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Introduction to Electrical and Computer Engineering (ESE 102), Spring 2003.

Introduction to Electrical Networks (ESE 230, JEE 2330), Fall 2004, Spring 2005, Fall 2005.

Electrical and Electronic Circuits Lab (ESE 233, JEE 2330), Spring 2002, Fall 2002, Spring 2005.

Signal Analysis for Electronic Systems and Circuits (ESE 351), Fall 2001.

Communication Theory and Systems (ESE 471), Spring 2001, 2002, and 2003.

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

ABET Committee (1 hour per week)

ABET Facilitator (10 hours per week)

Research Activities (10 hours per week)

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attend 1-2 conference(s) per year.

Conference Session Chair, Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing X, BiOS 2003.

Attend more than 1 seminar per week.

Collaborate with faculty on interdisciplinary research projects

14. PERSONAL WEBSITE: http://www.essrl.wustl.edu/~preza

CURRICULUM VITAE

1. **NAME**: Edward Richter

2. **ACADEMIC RANK**:
   Instructor and Research Associate

3. **DEGREES**:
   Example: B.S. (E.E.) Virginia Tech (1985)
   M.S. (E.E.) Washington University (2001)

4. **SERVICE ON THIS FACULTY**:
   2005-Present System Administrator
   2005-Present Laboratory Support
   1998-Present Staff Research Associate

5. **OTHER RELATED EXPERIENCE**:

6. **CONSULTING, PATENTS, ETC:**
   Robert E. Morley, Jr, Robert S. Deland, Jr., Emmanuel C. Limtao, Edward J. Richter, Stephen R. Wood, U.S. Patent Application Number 11/014,930, "Method and Apparatus for Authenticating a Magnetic Fingerprint Signal Using a Filter Capable of Isolating a Remanent Noise Related Signal Component."

   Robert E. Morley, Jr, Edward J. Richter, George L. Engel, U.S. Patent Application Number 11/014,931, "Method and Apparatus for Authenticating a Magnetic Fingerprint Signal Using an Adaptive Analog to Digital Converter."

   Robert E. Morley, Jr, Edward J. Richter, George L. Engel, U.S. Patent Application Number 11/015,271, "Method and Apparatus for Authenticating a Magnetic Fingerprint Signal Using Compressive Amplification."

   Edward J. Richter, U.S. Patent No. 6,115,629, "Two electrode heart rate monitor measuring power spectrum for use with exercise equipment.", Assignee: Digital Concepts of Missouri, September 5,2000.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   None

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   "Foot pressures during level walking are strongly associated with pressures during other ambulatory activities in subjects with diabetic neuropathy", Archives of Physical Medicine and Rehabilitation, (February 2004). Katrina S. Maluf PT, PhD, Robert E. Morley, Jr DSc, Edward J. Richter MSEE, Joseph W. Klaesner, PhD, and Michael J. Mueller PT, PhD.

“Power Consumption of Customized Numerical Representations for Audio Signal Processing." Proc. Of 6th High Performance Embedded Computing Workshop, (September 2002), R. Chamberlain, Y.H. Chew, V. DeAlwis, E. Hemmeter, J. Lockwood, R. Morley, E. Richter, J. White, and H. Zhang

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

None

10. HONORS AND AWARDS:

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Signals and Systems Laboratory, ESE488, SU04, FL04, FL05

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

Full time staff in the VLSI Design Laboratory. Involved in all aspects of VLSI design including digital architecture, VHDL, Verilog, simulation, synthesis, layout, production test, analog design, digital signal processing, and system modeling in Labview. C++ and assembly language programming of signal processing algorithms on commercial DSPs.

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attended more than 5 seminar per year.

Collaborate with faculty on research projects

14. PERSONAL WEBSITE:

CURRICULUM VITAE

1. **NAME**: Daniel L. Rode

2. **ACADEMIC RANK**:
   Professor (Full-Time)

3. **DEGREES**:
   Ph.D. (Applied Physics) Case-Western Reserve University (1968)
   M.S. (E.E.) Case Institute of Technology (1966)
   B.S. (E.E.) University of Dayton (1964)

4. **SERVICE ON THIS FACULTY**: 25 years
   1980-Present, Professor

5. **OTHER RELATED EXPERIENCE**:
   1968-1980 Bell Labs-Murray Hill

6. **CONSULTING, PATENTS, ETC**:
   Motorola, Siemens, Exxon, etc.
   D.L. Rode "Self-Resonant LSA Microwave Oscillator Devices" U.S. Patent 3,562,666 (February 09, 1971)
   R.W. Dixon, W.B. Joyce and D.L. Rode "Light-Emitting Semiconductor Apparatus for Optical Fibers" U.S. Patent 3,877,052 (April 08, 1975)
   J.V. DiLorenzo, W.C. Niehaus, D.L. Rode and B. Schwartz "Electrochemical Thinning of Semiconductor Devices" U.S. Patent 3,890,215 (June 17, 1975)
   J.V. DiLorenzo, W.C. Niehaus and D.L. Rode "Gallium Arsenide Schottkty Barrier Avalanche Diode Array" U.S. Patent 3,896,473 (July 22, 1975)
   D.L. Rode and N.E. Schumaker "LPE Technique for Reducing Edge Growth," U.S. Patent 3,950,195 (April 13, 1976)
   D.L. Rode "Growing Smooth Epitaxial Layers on Misoriented Substrates" U.S. Patent 4,050,964 (September 27, 1977)
   D.L. Rode "Continuous Ribbon Epitaxy" U.S. Patent 4,419,178 (December 06, 1983)
   D.L. Rode and J. C. Sciortino "Buried-Heterostructure Laser Modulator" U.S. Patent 5,091,799 (February 25, 1992)
   C.A. Gaw, P.M. Holm, K.H. Leung, G.W. Rhyne and D.L. Rode "Monolithic Optoelectronic Integrated Circuit" U.S. Patent 5,237,633 (August 17, 1993)
   D.P. Ames and D.L. Rode "Device and method for monitoring fluids" U.S. Patent 6,043,505 (March 28, 2000)

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   "Do We Need a Roadmap?," Herbert S. Bennett, Joseph G. Pellegrino, D. L. Rode, Thomas J. Shaffner, David G. Seiler and Emil Venere, Compound Semiconductor 5, 43-4 (April 1999).

"Device and Method for Monitoring Fluids with a Detection of Cross Sectional Shape of Transmitted Beam," D.P. Ames and D.L. Rode, U.S. Patent 6,043,505 (March 28, 2000).
"Analysis of Electron Transport in a High-Mobility Freestanding GaN Substrate Grown by Hydride Vapor-Phase Epitaxy," F. Yun, H. Morkoc, D.L. Rode, K.T. Tsen, L.A. Farina, C. Kurdak, S.S. Park, and K.Y. Lee, Mat. Res. Soc. Symp.Proc. 680E, E2.2.1-6 (March 2001).

"Hall mobility and carrier concentration in free-standing high-quality GaN templates grown by hydride vapor-phase epitaxy," D. Huang, F. Yun, M.A. Reshchikov, D. Wang, H. Morkoc, D.L. Rode, L.A. Farina, C. Kurdak, K.T. Tsen, S.S. Park and K.Y. Lee, Solid-State Electronics 45, 711-5 (June 2001).

"Silicon Epitaxy," Semiconductors and Semimetals, eds. Danilo Crippa, Daniel L. Rode and Maurizio Masi (Academic Press, New York, 2001) Vol. 72.

"Hydrogenated amorphous and microcrystalline GaAs films prepared by radio-frequency magnetron sputtering," L. H. Ouyang, D. L. Rode, T. Zulkifli, Barbara Abraham-Shrauner, N. Lewis, and M. R. Freeman, J. Appl. Phys. 91, 3459 (1 March 2002).

"Optical characterization of radio-frequency magnetron-sputtered gallium-arsenide films under non-uniform thickness conditions," T. Zulkifli, D. L. Rode, L. H. Ouyang, and Barbara Abraham-Shrauner, International Conference on Compound Semiconductor Manufacturing Technology, p.147-150, May 03-05, 2004 (Miami Beach, Florida).

"Coupling LEDs to Fiber," D. L. Rode, Photonics Spectra Magazine, Vol. 38, Issue 8, p. 43, August 2004.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

Tau Beta Pi (Engineering Honor)
Sigma Xi (Science Honor)
Pi Mu Epsilon (Mathematics Honor)
IEEE (Senior Member)
APS
AAAS
AACG
LIA

10. HONORS AND AWARDS:

Ford Foundation Fellow
Max Planck Institute Visiting Scientist and Lecturer

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Fiber-Optic Communications & Devices (ESE575) Alternate Fall, 3 hours per week of lectures
Principles of Electronic Devices (ESE336) Spring Term, 3 hours per week of lectures
Electronic Devices & Circuits (ESE337) Fall Term, 3 hours per week of lectures

Advanced Analog Electronics (ESE432) Spring Term, 3 hours per week of lectures
Advanced Electronic Devices (ESE436) Alternate Fall, 3 hours per week of lectures

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Academic Standards Committee (1 hour per week)
Affirmative Action Committee for Faculty & Staff
WUTA Board of Directors (0.5 hour per week)
Solid-State Coordinator (0.5 hour per week)
Part-Time Graduate-Student Advisor (1 hour per week)
Doctoral Students (2) Research Advisor (6 hours per week)
Undergraduate Students (3) Research Advisor (6 hours per week)

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attend teaching workshop
Attend 3 conferences per year
Attend 1 seminar per week
Laboratory research (20 hours per week)

14. PERSONAL WEBSITE:
http://www.faculty.ee.wustl.edu/dlr/bio.html

CURRICULUM VITAE

1. NAME: Ervin Y. Rodin

2. ACADEMIC RANK:
Professor (full-time)
Director, Center for Optimization and Semantic Control

3. DEGREES:
Ph.D. 1964 Mathematics, The University of Texas, Austin, TX
B.A. 1960 Mathematics, The University of Texas, Austin, TX

4. SERVICE ON THIS FACULTY: 39 Years
1972 – present Professor
1966 – 1972 Associate Professor

5. OTHER RELATED EXPERIENCE:
1966 – 1974 Department of Applied Mathematics and Computer Science, Washington University, St. Louis, MO
1964 - 1966 Research Scientist and Senior Mathematician,Wyle Laboratories, Huntsville, Alabama
1960 - 1964 Texas Special Instructor in Mathematics, The University of Texas, Austin

6. CONSULTING, PATENTS, ETC:
1997-present Consultant, DATEX-OHMEDA Corp.

7. STATES IN WHICH REGISTERED AS PROFESSIONAL ENGINEER:
none

8. PRINCIPAL PUBLICATIONS (LAST FIVE YEARS):
"Modeling and Robust Control Design for Aircraft Brake Hydraulics", (with Tunay et. al.), IEEE Transactions on Control Systems Technology 9/2, pages 319-329, 2001 "Routing Airlift Aircraft By The Double Sweep Algorithm", (with Rink et. al.), Mathematical and Computer Modelling 30, pages 133-147, 1999
"Neural Network Augmented Anti-skid Controller for Transport Aircraft," (with Tunay and Amin) ,Proceedings of the 37th AIAA Aerospace Sciences Meeting and Exhibit, paper # AIAA 99-0260, 9 pp., 1999

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER:
Director, Center for Optimization and Semantic Control
Editor in Chief, International Journal of Computers and Mathematics With Applications
Editor in Chief, International Journal of Mathematical and Computer Modelling
Managing Editor, Applied Mathematics Letters
Editor in Chief, Monographs in Modern Applied Mathematics and Computer Science
Editorial Board Member, International Journal of Mathematics and Mathematical Sciences
Editorial Board Member, International Journal on Scientific Computing & Modeling

Advisory Editor, LEONARDO, an International Journal of the Arts, Sciences and Technology
Honorary Editor, International Journal of Holocaust and Genocide Studies
Member of Editorial Boards of Various Symposium Proceedings
Founding Member, Committee on Mathematical Competition in Modeling
Associate Fellow, A.I.A.A.
Advisor, Tau Beta Pi, 1978-present
American Mathematical Society
Operations Research Society of America
Society for Industrial and Applied Mathematics
American Institute for Aeronautics and Astronautics
Society of Engineering Science
International Association for Mathematical Modelling
Association for Computing Machinery
Institute of Electrical and Electronics Engineers

10. HONORS AND AWARDS:

Phi Beta Kappa, Magna Cum Laude, University Fellow.
Elected Senior Fellow in the Center for the Biology of Natural Systems, St. Louis, Missouri for the period 1967-70.
Elected Distinguished Engineer, Tau Beta Pi, 1976.
Several listings in various Who's Who volumes.
Recipient, Washington University Founders Day Faculty Award 1977,
Professor of the Year, Washington University School of Engineering, 1978-1979.
Elected Associate Fellow, American Institute of Aeronautics and Astronautics, 1991.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

SSM 481(ESE 403) Mathematics of Operations Research (3 hrs/wk, lecture, undergraduate-graduate; day)
SSM 503(ESE 503) Mathematics and Practicum of Operations Research (3 hrs/wk, lecture, undergraduate, day)
SSM 591C Seminar in Artificial Intelligence in Control
SSM 543 Calculus of Variations (3 hrs/wk, lecture, graduate, day)
SSM 591D Seminar in Artificial Intelligence in Control
SSM 517(ESE 517) Partial Differential Equations

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

Undergraduate and Graduate advising: SIAM and INFORMS student chapter advisor; joint research projects with faculty members from the School of Medicine; joint research projects with the technical staffs of US Transportation Command and HQ, Air Mobility Command; research on optimization, transportation problems, artificial intelligence and differential games. None of these carry extra compensation. Average hours: about 1/2 time.

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Editor in Chief of several international Journals, and through activities in various professional organizations.

14. PERSONAL WEBSITE: http://rodin.wustl.edu

CURRICULUM VITAE

1. **NAME**: Heinz Michael Schättler

2. **ACADEMIC RANK**:
   Associate Professor (full-time)

3. **DEGREES**:
   Ph.D. 1986 Mathematics, Rutgers University, New Brunswick, NJ
   Diplom 1982 Bayerische Julius-Maximilians Universität, Würzburg, West-Germany

4. **SERVICE ON THIS FACULTY**: 18 years
   1993 – present Associate Professor
   1987 – 1993 Assistant Professor

5. **OTHER RELATED EXPERIENCE**:
   July 1986 - June 1987 Visiting Lecturer and Postdoctoral Fellow, University of California at Davis, Davis, CA

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   In Refereed Journals:

A. Özcan and H. Schättler, "A computational method for the calculation of the feasibility boundary and clustering in differential-algebraic systems," *IEEE Transactions on Circuits and Systems*, accepted for publication, to appear

U. Ledzewicz and H. Schättler, "Optimal controls for a model with pharmacokinetics maximizing bone marrow in cancer chemotherapy," *Mathematical Biosciences*, accepted for publication, to appear

I. Genc, H. Schättler and J. Zaborszky, "Clustering the bulk power system with applications towards Hopf bifurcation related oscillatory instabilities," *Electric Power Components and Systems*, Vol. 33, pp. 181-198, 2005

U. Ledzewicz and H. Schättler, "Controlling a model for bone marrow dynamics in cancer chemotherapy," *Mathematical Biosciences and Engineering*, Vol. 1, pp. 95-110, 2004

U. Ledzewicz and H. Schättler, "Analysis of a cell-cycle specific model for cancer chemotherapy," *J. of Biological Systems*, Vol. 10, pp. 183-637, 2002

J. Noble and H. Schättler, "Sufficient conditions for relative minima of broken extremals," *J. of Mathematical Analysis and Applications*, vol. 269, pp. 98-128, 2002

Conference proceedings:

U. Ledzewicz and H. Schättler, "A local field of extremals for single-input systems near state constraints of relative degree 1," *Proc. Of the 43rd IEEE Conf. on Decision and Control*, pp. 923-928, December 2004,

P. Rinaldi and H. Schättler, "On optimal control problems with state-space constraints arising in the design of bipolar transistors," *Proc. Of the 41st IEEE Conf. on Decision and Control*, pp. 4722-4727, December 2002,

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER:
Society of Industrial and Applied Mathematics (SIAM)

10. HONORS AND AWARDS: none

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

ESE 309 (old SSM 309) Matrix Algebra (3 hrs/wk, lecture, graduate, day)
ESE 499 (old SSM 499) Systems Design Project (course coordinater, no lectures)
ESE 520 (old SSM 570) Probability and Stochastic Processes (3 hrs/wk, lecture, graduate, day)
ESE 521 (old SSM 571A) Random Variables and Stochastic Processes I (3 hrs/wk, lecture, graduate, day)
ESE 544 (old SSM 554) Optimization and Control (3 hrs/wk, lecture, graduate, day)
ESE 553 (old SSM 553) Nonlinear Dynamic Systems (3 hrs/wk, lecture, graduate, day)

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Chairman of Ph.D. Qualifying Exam Committee, Departmental representative on Discipline Committee

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE (LAST FIVE YEARS):
none

14. PERSONAL WEBSITE: www.ssm.wustl.edu/~heinz

CURRICULUM VITAE

1. NAME: Barbara Abraham-Shrauner

2. ACADEMIC RANK:
Senior Professor (part-time)

3. DEGREES:
B. A. (Physics, cum laude) University of Colorado (1956)
A. M. (Physics) Harvard University (1957)
Ph. D. (Physics) Harvard University (1962)

4. SERVICE ON THIS FACULTY:
2003-2006 Senior Professor (part-time)
1977-2003 Professor
1969-1977 Associate Professor
1966-1969 Assistant Professor

5. OTHER RELATED EXPERIENCE:
Summer 1954 Technical Aid, Bell Telephone Laboratories, Murray Hill, NJ
Summer 1957 Researcher, ESSO Research and Engineering, Linden, NJ
1957-60 Teaching Fellow, Harvard University, Cambridge, MA
1961-62 Research Assistant, Harvard University, Cambridge, MA
1962-64 Postdoctoral Fellow, Chimie Physique II, Universite Libre de Bruxelles, Brussels, Belgium
1964-65NAS-NASA Resident Research Associateship, NASA-Ames Research Center, Moffett Field, CA
1975-76 Visitor at Los Alamos Scientific Laboratory, Los Alamos, NM
Fall 1985 Visitor at Lawrence Berkeley Laboratory, CA.

6. CONSULTING, PATENTS,ETC.:
Sum.,1967 Consultant, NASA-Ames Research Center, Moffett Field, CA
1980-1982 Consultant at NASA, Washington, DC
Sum.,1979 Consultant at Los Alamos National Laboratory,
Sum.,1984 Los Alamos, NM
July, 1984 Consultant at Naval Surface Weapons Center, Silver Spring, MD
Fall, 1985 Consultant at SSC Design Group, URA, Berkeley, CA

7. STATES IN WHICH REGISTERED AS PROFESSIONAL ENGINEER:
None

8. PRINCIPAL PUBLICATIONS IN LAST FIVE YEARS:
B. Abraham-Shrauner, "Plasma etch profiles of passivated open area trenches," *J. Vac. Sci. & Tech.B.* **19**, 711-721 (2001).

B. Abraham-Shrauner, "Hidden Symmetries, First Integrals and Reduction of Order of Nonlinear Ordinary Differential Equations," *J. Nonlinear Math. Phys.* **9**, Supplement 2, 1-9, (2002).

C. Liu and B. Abraham-Shrauner, "Plasma Etching Model for SiO_2 Contact Holes, " *IEEE Trans. Plasma Sci..* **30**, 1579-1586 (2002).

L.-H. Ouyang, D. L Rode, T. Zulkifli, B. Abraham-Shrauner, N. Lewis and M.R. Freeman, "Hydrogenated amorphous and microcrystalline GaAs Films prepared by radio-frequency magnetron sputtering," *J. Appl. Phys*. **91**, 3459-67 (2002).

B. Abraham-Shrauner, "Simultaneous, multilayer plasma etching and deposition of fluorocarbon layers on silicon," *J. Appl. Phys*. **94**, 4776-4780 (2003).

B. Abraham-Shrauner, "Lie symmetry solutions for anomalous diffusion," *J. Phys*. A: Math. & Gen. **38** 2547-2553 (2005).

B. Abraham-Shrauner, Keshlan S. Govinder and Danny Arrigo, "Type II hidden symmetries of the linear 2-D and 3-D wave equations" *J. Phys*. A: Math. & Gen. (to be published 2006).

B. Abraham-Shrauner and Keshlan S. Govinder," Provenance of Type II hidden symmetries from nonlinear partial differential equations," *J. Nonl. Math*. (submitted)

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES-MEMBER:

American Physical Society-Division of Plasma Physics, DPP Fellowship Committee, 2004-2005
American Geophysical Union
American Association of University Professors-WU Executive Committee-2001-2003
Institute of Electrical and Electronic Engineers -Nuclear and Plasma Sciences Society
Phi Beta Kappa
American Vacuum Society and University Fusion Association: 2001-2003

10. HONORS AND AWARDS:

Sigma Epsilon Sigma, Sigma Pi Sigma, Mortar Board. Phi Beta Kappa, B. A. cum laude, Sigma Xi, Eta Kappa Nu, *Fellow*, American Physical Society, *Senior Member*, IEEE

11. COURSES TAUGHT IN LAST FIVE YEARS:

Fall 2001:Network Analysis, EE 380/JEE 280; Plasma Applications, EE 526
Spring 2002: Power, Energy and Polyphase Circuits, EE 327/JEE 227; Introduction to Digital and Linear Electronics, EE 290
Fall 2002:Introduction to Electrical Network, EE 280; Engineering Electromagnetics I: Fundamentals, EE 314M
Spring 2003: Nonlinear Methods in Engineering, EE 523A; Introduction to Digital and Linear Electronics, EE 290
Fall 2003: Introduction to Digital and Linear Electronics, EE 290-Subsitute for 3 weeks (ill faculty member)

12. OTHER ASSIGNED DUTIES IN LAST FIVE YEARS.

2001-2005- Departmental meetings (1-3 hours a month)

2001-2003- Undergraduate Committee (1 hour per week)

2001-2004- Undergraduate and graduate advisor (1/ 1/2 hour per week)

2001-2003- Compton and Ferguson Committee (<1/2 hour per week)

2001-2003 -Research meetings (1 hour per week)

2001-2003- Sports and Recreation Committee (<1/2 hours per week)

2003-2004-Association of Women Faculty Executive Board (1 hour per month)

13. IMPROVEMENT PROGRAMS IN LAST FIVE YEARS

Attended 1 or 2 seminars per week

Attended 1 or 2 conferences per year

Collaborate with faculty at Washington University and elsewhere on research projects

14. PERSONAL WEBSITE: http://ee.wustl.edu/~bas/bio.html

CURRICULUM VITAE

1. **NAME**: Donald L. Snyder

2. **ACADEMIC RANK**:
   Senior Professor

3. **DEGREES**:
   B.S.E.E. University of Southern California (1961)
   M.S.E.E. Massachusetts Institute of Technology (1963)
   Ph.D. E.E. Massachusetts Institute of Technology (1966)

4. **SERVICE ON THIS FACULTY**:
   2003-present Senior Professor
   1993-2003 Professor of Radiology, Washington University, St. Louis MO.
   1986-1996 Dir., Electronic Systems and Signals Research Lab., Wash. Univ., St. Louis MO.
   1976-1986 Chairman, Department of Electrical Engineering, Wash. Univ., St. Louis MO.
   1975-1976 Assoc. Director, Biomedical Computer Laboratory, Wash. Univ., St. Louis MO.
   1975-2003 Professor, Department of Electrical Engineering, Wash. Univ., St. Louis MO.
   1970-1975 Associate Prof., Dept of Electrical Engineering, Wash. Univ., St. Louis MO.
   1969-1975 Research Assoc., Biomedical Computer Laboratory, Wash. Univ., St. Louis MO.
   1969 Visiting Assoc. Prof., Dept. of Electrical Engineering, Wash. Univ., St. Louis MO.

5. **OTHER RELATED EXPERIENCE**:
   1966-1969 Assistant Prof., Dept. of Electrical Engineering, Mass. Institute of Technology, Cambridge MA.

6. **CONSULTING, PATENTS, ETC**:
   Carl J. Brunett, Jerome R. Cox, Jr., Donald L. Snyder, and Rodney A. Mattson, "Tomography System Having Nonconcurrent, Compound Axial Scanning," U.S. Patent No. 3,986,885; August 24, 1976.
   Carl J. Brunett, Jerome R. Cox, Jr., Donald L. Snyder, and Rodney A. Mattson, "Transverse Tomography System Having Multibeam Orbital Scanning With All Beams Offset From The Center of Orbit," U.S. Patent No. 4,008,400; February 15, 1977.
   Jerome R. Cox, Jr. and Donald L. Snyder, "Tomography System Having Axial Scanning," U.S. Patent No. 3,983,399; September 28, 1976.
   Harper J. Whitehouse and Donald L. Snyder, "Imaging System," U.S. Patent No. 4,768,156; August 30, 1988.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   State of Missouri, 14547 (lapsed)

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   D. L. Snyder and J. A. O'Sullivan, B. R. Whiting, R. J. Murphy, J. Benac, J. A. Cataldo, D. G. Politte, and J. F. Williamson, "Deblurring subject to nonnegativity constraints when

known functions are present, with application to object-constrained computerized tomography," *IEEE Trans. on Medical Imaging*, Vol. 20, No. 10, pp. 1009-1017, 2001.
J. F. Williamson, B. R. Whiting, J. Benac, R. J. Murphy, G. J. Blaine, J. A. O'Sullivan, D. G. Politte, and D. L. Snyder, ``Prospects for Quantitative Computed Tomography Imaging in the Presence of Foreign Metal Bodies Using Statistical Image Reconstruction," *Med. Phys.* Vol. 29, No. 10, pp. 2404-2418, October 2002.

J. A. O'Sullivan, B. R. Whiting, D. L. Snyder, and O. Earl, "Image Reconstruction from Data Acquired With an X-Ray Computerized Tomographic System Having Energy-Integrating Detectors," *IEEE Trans. on Medical Imaging*, in review, 2003.

D. R. Fuhrmann, C. Preza, J. A. O'Sullivan, D. L. Snyder, and W. H. Smith, ``Spectrum Estimation from Quantum-Limited Interferograms," *IEEE Transactions on Signal Processing*, Vol. 52, No. 4, pp. 950-961, April 2004

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

Institute for Electrical and Electronic Engineers (Life Member)
IEEE Information Theory Society
IEEE Signal Processing Society
IEEE Communications Society
Topical Editor for Signal and Image Processing, J. Optical Society of Amer. A, 2000-2003
President, IEEE Information Theory Group, 1980
Associate Editor for Random Processes, IEEE Transactions on Information Theory, 1974-1977

10. HONORS AND AWARDS:

Samuel C. Sachs Professorship in Electrical Engineering
Fellow IEEE
Fellow St. Louis Academy of Science

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Senior Design Project, EE480, SP2001
Seminar in Imaging Science and Engineering, FA2001
Detection and Estimation, EE552A, SP2002
Seminar in Imaging Science and Engineering, FA2002
Tomographic Systems, EE554A, SP2003
Seminar in Imaging Science and Engineering, FA2003

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

Undergraduate Committee (1 hour per week)
Graduate and Undergraduate Advising (2 hours per week)

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attended 1 conferences per year.

Attended more than 1 seminar per week.
Collaborate with faculty on research projects.

14. PERSONAL WEBSITE:

http://www.faculty.ee.wustl.edu/dls/bio.html

CURRICULUM VITAE

1. **NAME**: Barry E. Spielman

2. **ACADEMIC RANK**:
   Professor (full-time)

3. **DEGREES**:
   B.S. (E.E.) Illinois Institute of Technology (1964)
   M.S. (E.E.) Pennsylvania State University (1967)
   Ph.D. (E.E.) Syracuse University (1971)

4. **SERVICE ON THIS FACULTY**: 20 Years
   1987-Present Professor

5. **OTHER RELATED EXPERIENCE**:
   1984-1987 Head, Microwave Technology Branch, Naval Research Lab., Wash., D.C.
   1978-1984 Head, Solid State Circuits Section, Naval Research Lab., Wash., D.C.
   1971-1978 Research Electronics Engineer, Naval Research Lab., Wash., D.C.
   1967-1971 Research and Teaching Assistant, Syracuse University, Syracuse, N.Y.
   1964-1967 Research Assistant, Penn State University, University Park, P.A.

6. **CONSULTING, PATENTS, ETC**:
   1988 McDonnell Douglas Corp
   1983, 1985 Member of DoD Technology Assessment Team on Japanese Electronics

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   "Frequency-Differential Representation of Losses to Express Quality Factor in Terms of Reactance-Slope Parameters for Three-Dimensional, Arbitrarily-Shaped Resonators," *2005 IEEE MTT-S Int'l. Micr. Symp. Dig.*, Long Beach, CA., June 12-17, 2005, 4 pages.
   "A Field-Theoretic Foundation for the Representation of Quality Factor in Terms of Reactance-Slope Parameters for Electrically-Large Three-Dimensional Arbitrarily-Shaped Resonators," *IEEE Trans. Micr. Th. Techs*., Vol 52, No. 7, July, 04, pp. 1683-92.
   "Investigative Synthesis of Slot-Notch Antennas Using Genetic Algorithms and Information Theory," *Conferfence Digest IEEE AP2000 Millennium Conference on Antennas and Propoagation,* Davos Switzerland, 9-14 April 2001. (with Bornholdt, J. M. and L. N. Medgyesi-Mitschang)

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Institute of Electrical and Electronics Engineers (Fellow): Microwave Theory and Techniques Society.
   Eta Kappa Nu
   Sigma Xi

Editorial Review Board for Microwave and Optical Technology Letters
Editorial Review Board for IEEE-MTTS Transactions
Technical Program Committee for Annual IEEE International Microwave Symposium

10. HONORS AND AWARDS:

Recipient of IEEE Third Millenium Medal (2000)
Fellow of the IEEE.
Elected and listed in Marquis's Who's Who
Naval Research Laboratory, Outstanding Performance award
President of the National Electrical Engineering Department Heads Association for 1998-1999.
Recipient of the IEEE-MTTS N. Walter Cox Award in 1992
Awarded 1995 Education Award by the St. Louis Section of the IEEE
Listed in American Men and Women of Science
President(1988), Vice-President, Secretary-Treasurer of IEEE-MTTS.
Chairman, Vice-chairman, Secretary of the Washington Chapter of IEEE-MTTS.
Member of the Washington DC IEEE-MTTS Escecutive Committee.
Chairman, Vice-Chairman, Secretary of the Washington Chapter of the IEEE-MTTS
Member of Washington, DC Chapter IEEE MTT-S Executive Committee
Member of IEEE/MTT-S National Administrative Committee (ADCOM)
Member of Technical Program Committee 1976 IEEE-MTTS International Microwave Symposium (Philadelphia--New Jersey)
Member of IEEE-MTTS ADCOM Technical Committee (MTT-6) on Microwave and Millimeter Wave Integrated Circuits
Secretary of Steering Committee for 1980 International Microwave Symposium
Editor of Special Issue of IEEE-MTTS Transactions for 1980 International Microwave Symposium
Chairman of 1977 International Microwave Symposium Session on Multifunction Microwave Assemblies
Session Chairman at 1979 IEEE-MTTS International Microwave Symposium in Orlando for Computer-Aided Design Session
Appointed Chairman of Ad Hoc Committee of IEEE Microwave and Millimeter- wave Monolithic Circuits Symposium
Voted Syracuse University Outstanding Electrical Engineering Instructor as a Graduate Student
Chairman of Technical Committees Activity for IEEE-MTTS ADCOM
General Chairman of 1982 IEEE Microwave and Millimeter-wave Monolithic Circuits Symposium
Member of Steering for 1982, 1983, 1984, 1985, and 1986 IEEE Microwave and Millimeter-wave Monolithic Circuits Symposia
Selected to serve as U.S. Navy Dept. Representative on First Technology Assessment Task Force to Japan
Member of ONT Strategy Committee on Solid State Microwave and Millimeter-wave Technology
Member of Technical Planning Committee with SPAWAR for NRL Electronics Technology Division

Member of Technical Planning Committee with NAVAIR for NRL Electronics Technology Division
Digest Editor for 1986 IEEE Microwave and Millimeter-wave Monolithic Circuits Symposium
Invited Special Guest Editor IEEE Proceedings Special Issue on RF Integrated Electronics, March 1991
1998-2001 Member NEEDHA Board of Directors
1998-99 Member IEEE Educational Activities Board
1998-99 Member IEEE Committee on Engineering Accreditation Activities (CEAA)
1999 Member IEEE Continuing Education Committee

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Engineering Electromagnetics II: Applications (ESE 430, JEE 4300, previously EE 410, JEE 310), Spring 02, 04, 06 semester, 3 hours per week of lecture.
Engineering Electromagnetics I: Fundamentals (ESE 330, JEE, 3300 previously EE 314M, JEE 214), Fall and Spring semesters, 3 hours per week of lecture.
RF and MW Technology for Wireless Systesm (ESE 433, JEE 4330, previously EE 412, JEE 312), Spring 01, 03, 05, Summer 04.
Course coordinator for each of these courses

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Until June 30, 2002:
Chairman, Department of Electrical Engineering (30 hours per week).
Undergraduate Committee Member -Ex Officio (1.5 hours per week)
School of Engineering and Applied Science Executive Committee (1 hour per week).
Research (10 hours per week).
Chairman of Washington University Committee on Research Integrity (Hilltop Campus)
June 30, 2002 through August 31, 2004: Responsibility for organizing EE written doctoral qualifying exams (approx. 10 hours)
September 1, 2004 to date: BSEE Program ABET coordinator (1 hour per week)

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Attended one technical seminar every two weeks on the average.
Attended at least one technical conference per year.
Attended National Electrical Engineering Department Heads Association meeting each year until 2003

14. PERSONAL WEBSITE: <http://www.faculty.ee.wustl.edu/bes/bio.html>

CURRICULUM VITAE

1. **NAME:** Karl A. Spuhl

2. **ACADEMIC RANK**:
   Adjunct Professor, part time

3. **DEGREES:**
   B.S., Electrical Engineering, Washington University, 1959
   M.S., Electrical Engineering, St. Louis University1970

4. **SERVICE ON THIS FACULTY:** 21 years
   1984-Present Adjunct Associate Professor

5. **OTHER RELATED EXPERIENCE:**
   March 1962 to present, The Boeing Company, Engineer Scientist involved in research and development of sensor simulation technology, St. Louis, MO. Previous experience includes the design and development of control systems, electronic systems, optical, and pneumatic systems supporting fighter aircraft and NASA space programs.

   June 1959 – March 1962, Emerson Electric Company, Engineering representative on Materials Review Board, St. Louis, MO.

6. **CONSULTING, PATENTS, ETC:** none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   Missouri, E-12099

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   Spuhl, Karl A. Daniel A. Schmidt, "Experiments and Problem Issues in Simulating Real-time Person-in-loop air-to-ground Radar Imagery," *American Institute of Aeronautics and Astronautics,*

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   IMAGE Society, Chairman Special Interest Group on Sensors
   American Institute of Aeronautics and Astronautics
   The Institute of Electrical and Electronics Engineers

10. **HONORS AND AWARDS:**
    Associate Technical Fellow – The Boeing Company
    Awarded Washington University's 1994 Excellence in Teaching Award.
    Awarded honorary membership in Washington University's Chapter of Alpha Sigma Lambda

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    JME 4310 "Control Systems I" summer, 6 hrs/wk lecture, evening, undergraduate

JME 4310 "Control Systems I" fall, 3 hrs/wk lecture, evening, undergraduate

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Delivered tutorials for the past 5 years at the IMAGE Society Conferences dealing with correlation issues in simulating radar, EO, IR sensor imagery.

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: Eric Sutton

2. **ACADEMIC RANK**:
   Adjunct Assistant Professor (Part Time)

3. **DEGREES**:
   B.S. (E.E.) Southern Illinois University (1985)
   M.S. (E.E.) Southern Illinois University (1988)
   Ph.D. (E.E.) University of Iowa (1996)

4. **SERVICE ON THIS FACULTY**:
   2006-Present Adjunct Assistant Professor

5. **OTHER RELATED EXPERIENCE**:
   2004-present The Boeing Company, Research Engineer, St. Louis, MO
   2000-2004 University of Florida Graduate Education & Research Center, Assistant Professor, Shalimar, FL
   2000 University of Iowa, Adjunct Lecturer (part time), Iowa City, IA
   1997-2000 Rockwell Collins, Systems Engineer, Cedar Rapids, IA
   1992-1996 University of Iowa, Graduate Research Assistant, Iowa City, IA
   1988-1992 Johns Hopkins Applied Physics Laboratory, Associate Professional Staff, Laurel, MD

6. **CONSULTING, PATENTS, ETC**:
   E. Sutton, U.S. Patent No. 6,256,583, "GPS attitude determination system and method using optimal search space identification for integer cycle ambiguity resolution," Assignee: Rockwell Collins, July 3, 2001

   E. Sutton, U.S. Patent No. 6,023,240, "Method for determining a phase measurement error map using rotating antenna information," Assignee: Rockwell Collins, February 8, 2000

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   S. C. Rosengren and E. Sutton, "Attitude from combined GPS and imaging system data," in Proc. ION 61st Annual Meeting, pp. 961-969, June 2005.

   E. Sutton, "Integer cycle ambiguity resolution under conditions of low satellite visibility," in Proc. IEEE Position, Location, and Navigation Symposium 2002 (PLANS '02), pp. 91-98, April 2002.

   M. Markel, E. Sutton, and H. Zmuda, "Optimal anti-jam attitude determination using the global positioning system," in Proc. IEEE Position, Location, and Navigation Symposium 2002 (PLANS '02), pp. 12-19, April 2002.

M. Markel, E. Sutton and H. Zmuda "An antenna array-based approach to attitude determination in a jammed environment," in Proc. ION GPS 01, (Salt Lake City, Utah), pp. 2914-2926, September, 2001.

E. Sutton and H. Na, "Time varying reconstruction of the ionosphere: Part 1. The algorithm," Int. J. Imag. Systems Technol., vol. 9, no. 6, pp. 484-490, 1998.

E. Sutton and H. Na, "Time varying reconstruction of the ionosphere: Part 2. Data source analysis," J. Imag. Systems Technol., vol. 9, no. 6, pp. 491-499, 1998.

E. Sutton, "Calibration of differential phase map compensation using single axis rotation," in Proc. ION GPS 98, Part 2, (Nashville, Tennessee), pp. 1831-1840, September, 1998.

K. W. Ulmer and E. Sutton, "Performance improvements achieved using differential phase map compensation in a direction finding system," in Proc. ION GPS 98, Part 1, (Nashville, Tennessee), pp. 563-572, September, 1998.

E. Sutton, "Optimal search space identification for instantaneous integer cycle ambiguity resolution," in Proc. ION GPS 97, Part 1, (Kansas City, Kansas), pp. 313-322, September, 1997.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
Institute of Electrical and Electronic Engineers (IEEE)
Institute of Navigation (ION)
American Society for Engineering Education (ASEE)

10. HONORS AND AWARDS:
Tom & Ruth Dimond Graduate Fellowship, 1992-1995
Best paper award, attitude determination session, ION GPS 97

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
Computers in Engineering, 57:017 (University of Iowa)
Foundations of Digital Signal Processing, EEL5701 (University of Florida)
Electronic Navigation Systems, EEL6935 (University of Florida)
C/C++ for Engineers, EEL5934 (University of Florida)
Image Processing and Computer Vision, EEL6562 (University of Florida)
Noise in Linear System, EEL5544 (University of Florida)
Digital Control Theory, ESE442, Spring 2006

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
Graduate advisor for Master's Degree student Scott Rosengren at the University of Florida.
Graduate co-advisor (with Dr. Henry Zmuda) for Doctoral student Matthew Markel at the University of Florida.

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Institute of Navigation (ION) Annual Meeting, 2005
IEEE Position, Location, & Navigation Symposium (PLANS), 2002

14. PERSONAL WEBSITE:
http://www.ecsutton.ece.ufl.edu/

CURRICULUM VITAE

1. NAME: Tzyh-Jong Tarn

2. ACADEMIC RANK: Professor (full-time)

3. DEGREES:

D.Sc. 1968 Control Systems Science and Engineering, Wash Univ, St. Louis, MO
M.S. 1965 Chemical Engineering, Stevens Institute of Technology, Hoboken, NJ
B.S. 1959 Chemical Engineering, Cheng-Kung University Tainan, Taiwan, China

4. SERVICE ON THIS FACULTY: 36 Years

1977 - present Professor
1972 – 1977 Associate Professor
1969 – 1972 Assistant Professor
1968 – 1969 Postdoctoral Fellow

5. OTHER RELATED EXPERIENCE:

Fall 2005 Visiting Professor, Australia National University, Canberra, Australia
2004-present Visiting Chair Professor in Quantum, Communication, Computing and Control, Tsinghua University, Beijing, China
1987-present Director, Ctr for Robotics and Automation, Wash Univ, St. Louis, MO
1977- present Professor, Washington University, St. Louis, MO
March-July 1989 Visiting Research Director, Laboratoire d'Automatique de Nantes, C.N.R.S. Nantes, France
1985-present Visiting Professor, Beijing Institute of Aeronautics and Astronautics Beijing, China
1983-present Visiting Professor, Beijing Institute of Technology, Beijing, China
January-February 1979 Visiting Professor, Nagoya University, Nagoya, Japan
June-July 1978, Visiting Professor, May-July 1981, The University of Rome, Rome, Italy, March-April 1990, May 1991
January 1975-June 1975 Academic Visitor, Imperial College of Science and Technology London, England
1972-1977 Associate Professor, Washington University, St. Louis, MO
1969-1972 Assistant Professor, Washington University, St. Louis, MO
1968-1969 Postdoctoral Fellow, Washington University, St. Louis, MO

6. CONSULTING, PATENTS, ETC:

1984 – present Consulting, Editor, Control Theory and Applications

7. STATES IN WHICH REGISTERED AS PROFESSIONAL ENGINEER: none

8. PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS:

"Robotic Wedding, Intelligence and Automation," Lecture Notes in Control and Information Sciences, Vol. 299, Springer-Verlag, Berlin Heidelberg, 2004. Co-editors: Shan-Ben Chen and Changjiu Zhou.

"Hybrid Control of the Pendubot," IEEE/ASME Transactions on Mechatronics, Vol. 7, No. 1, pp. 79-86, March 2002. Co-author: Mingjun Zhang.

"Pseudo-Hamiltonian Realization and Its Application," Communications in Information and Systems, Vol. 2, No. 2, pp. 91-120, December 2002. Co-authors: Daizhan Cheng, and Tielong Shen.

"New Integrability Conditions for Differential Constraints," Systems & Control Letters, Vol. 49, pp. 335-345, 2003. Co-authors: Mingjun Zhang, and Andrea Serrani.

"Control Routh Array and Its Applications," ASIAN Journal of Control, Vol. 5, No.1, pp. 132-142, March 2003. Co-authors: Daizhan Cheng.

"Control of Quantum Systems," International Journal of Modern Physics B, Vol. 8, pp. 5397-5411, 2003. Co-authors: J. W. Chark and D. G. Lucarelli.

"Real-time Integration of Sensing, Planning and Control in Robotic Workcells," Control Engineering Practice, Vol. 12, pp. 653-663, 2004. Co-authors: Di Xiao, Muming Song, B. K. Ghosh, Ning Xi and Zhenyu Yu.

"Interactive DNA Sequence and Structure Design for DNA Nanoapplications," IEEE Transactions on Nanobioscience, Vol. 3, No. 4, pp. 286-292, 2004. Co-authors: Mingjun Zhang, C. L. Sabharwal, Weimin Tao, Ning Xi and G. Li.

"Analytic Controllability of Time-dependent Quantum Control Systems," Journal of Mathematical Physics, Vol. 46, pp. 052102-1 to -21, 2005. Co-authors: Chunhua Lan, Quo-Shin Cui and John W. Clark.

"A Function Model Based Approach to Develop a Flexible Micro-titer Tray Manufacturing Automation System for DNA microarray Fabrication," Journal of Advanced Manufacturing System, Vol. 4, No. 1, 2005. Co-authors: Mingjun Zhang, William Fischer and Hans Sitte.

"A Hybrid Switching Control Strategy for Nonlinear Under-actuated Mechanical Systems," IEEE Transactions on Automatic Control, Vol. 48, No. 10, pp. 1777-1782, Oct., 2003. Co-authors: Mingjun Zhang.

"An Experimental Study of Output Regulation for Nonlinear Systems," IEEE Transactions on Control Technology, July 2005. Co-authors: Peerayot Sanposh, Daizhan Cheng and Mingjun Zhang.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

The Institute of Electrical and Electronics Engineers (IEEE) – Various boards, committees and societies.
Society for Industrial and Applied Mathematics
Sigma Xi
Member of the Advisory Committee, Frontier Research Program, The Institute of Physical and Chemical Research (RIKEN), Japan, 2004-2007.
Advisory Council Honorary Chair, IEEE/RSJ International Conference on Intelligent Robots and Systems, IROS, 1997-present
Board Member, IEEE Neural Networks Council, 1994-1995 and 1997-2002
Associate Editor, Progress in Systems and Control Theory, 1990-present.
Associate Editor, Systems and Control: Foundations and Applications, 1990-present.

Consulting Editor, Control Theory and Applications, 1984-present.

10. HONORS AND AWARDS:

Pioneer Award, IEEE Robotics and Automation Society, 2004.
"IEEE ROBIO: T.J. Tarn Best Paper in Robotics" The IEEE International Conference on Robotics and Biomimetics (ROBIO) has established this best paper award starting from July 2005 with a prize of $3,000.

Awarded the prestigious Joseph F. Engelberger Award for contributing to the advancement of the science of robotics, Robotic Industries Association, 1999.

Awarded the Auto Soft Lifetime Achievement Award in recognition of his pioneering and outstanding contributions to the fields of Robotics and Automation at the World Congress in Automation, 2000.

Awarded the first Nakamura Prize (in recognition and appreciation of his contribution to the advancement of the technology on intelligent robots and systems over a decade) at the 10^{th}Anniversary of the IEEE/RSJ International Conference on Intelligent Robots and Systems, Grenoble, France, 1997.

Awarded Distinguished Member by the IEEE Control Systems Society, Dec. 1996.

Awarded the IEEE/RSJ IROS'94 Best Paper Prize on "Intelligent Planning and Control for Telerobotic Operations," Co-Authors: A.K. Bejczy, Chuanfan Guo and Ning Xi, Sep. 1995

NASA Certificate of Recognition for the creative development of a technical innovation on "Robot Arm Dynamic Control by Computer" June 1987.

Awarded IEEE Fellow, 1985.

Awarded fellowship by the National Research Council (CNR) of Italy twice in 1978 and 1981 for research and lecture at Rome University.

Awarded fellowship by the Japan Society for the promotion of Science (JSPS) in 1979 for research at Nagoya University and lecture at various Japanese Universites.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

ESE 551 Linear Dynamic Systems I (3 hrs/wk, lecture, graduate, day)
ESE 446 Robotics: Dynamics and Control (3 hrs/wk, lecture, graduate, day)
ESE 552 Linear Dynamic Systems II (3 hrs/wk, lecture, graduate, day)

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:

Advising 10 doctoral candidates.

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS: None

14. PERSONAL WEBSITE: http://wurobot.wustl.edu

CURRICULUM VITAE

1. **NAME**: Jason W. Trobaugh

2. **ACADEMIC RANK**:
Research Instructor, Department of Medicine
Research Instructor, Department of Electrical and Systems Engineering

3. **DEGREES**:
B.S. (E.E.) Washington University in St. Louis (1991)
M.S. (E.E.) Washington University in St. Louis (1993)
D.Sc. (E.E.) Washington University in St. Louis (2000)

4. **SERVICE ON THIS FACULTY**: 4 years
2001-Present Research Instructor, Affiliate Faculty

5. **OTHER RELATED EXPERIENCE**:
1996-2000 Medtronic Surgical Navigation Technologies, Software Engineer, Broomfield, Colorado

6. **CONSULTING, PATENTS, ETC**:
Kessman, P., Holsing, T., Trobaugh, J. "Navigation Information Overlay onto Ultrasound Imagery", U.S. Patent No. 6,379,302.
Assignee: Medtronic.
Trobaugh, J.W., Arthur, R.M. "Methods for Inference of Tissue and System Properties Using an Image Model Combining Shape, Microstructure and System Characteristics", Application pending.
Assignee: Washington University in St. Louis.

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
R. M. Arthur, J. W. Trobaugh, W. L. Straube, E. G. Moros, "Noninvasive estimation of hyperthermia temperatures using ultrasound", International Journal of Hyperthermia, *in press.*
R. M. Arthur, J. W. Trobaugh, W. L. Straube, E. G. Moros, "Temperature Dependence of Ultrasonic Backscattered Energy in Motion-Compensated Images", IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, *in press*.
Trobaugh, J.W., Arthur, R.M. "Estimation of Surface Pose with a Physically-Based Ultrasonic Image Model", IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, 2004, vol. 51, 1128-1136.
Cain M.E., Arthur, R.M., Trobaugh, J.W. "Detection of the fingerprint of the electrophysiological abnormalities that increase vulnerability to life-threatening ventricular arrhythmias", Journal of Interventional Cardiac Electrophysiology, 2003, vol. 9, 103-118.

Trobaugh, J.W., Arthur, R.M., "Representation of Shape in Ultrasonic Images with a Physically-Based Image Model", Proceedings of the IEEE Workshop on Mathematical Methods in Biomedical Image Analysis (MMBIA 2001), 79-86.

Trobaugh, J.W., Arthur, R.M. "A Physically-Based, Probabilistic Model for Ultrasonic Images Incorporating Shape, Microstructure and System Characteristics", IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, November 2001, vol. 48, no.6, 1594-605.

Trobaugh, J.W., Arthur, R.M. "A Discrete-Scatterer Model for Ultrasonic Images of Rough Surfaces", IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, November, 2000, vol. 47, no. 6, 1520-1529.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:

Institute of Electrical and Electronic Engineers (IEEE)
Ultrasonics, Ferroelectrics, and Frequency Control Society

10. HONORS AND AWARDS:

B.S. awarded cum Laude
Tau Beta Pi
Eta Kappa Nu

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

ESE 482 (formerly EE 445) Digital Signal Processing, FL 2002, 2003, 2004
EE 480 Senior Design Project, SP 2003
EE 592 Ultrasonic Imaging, SP 2004
ESE 483 Principles of Medical Imaging, SP 2005

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:

Attended 1-2 conferences per year.
Attended more than 1 seminar per week.
Collaborate with faculty on research projects

14. PERSONAL WEBSITE:

http://ese.wustl.edu/~jasont

CURRICULUM VITAE

1. **NAME**: Ilker Tunay

2. **ACADEMIC RANK**:
   Adjunct Professor

3. **DEGREES**:
   B.S. (EE) Bogazici University, Istanbul, Turkey (1990)
   M.S. (SSE) Bogazici University, Istanbul, Turkey (1993)
   M.S. (SSM) Washington University, St. Louis (1996)
   D.Sc. (SSM) Washington University, St. Louis (1999)

4. **SERVICE ON THIS FACULTY**: 6 Years
   2000 – Present Instructor, Dept. of Electrical and Systems Engineering

5. **OTHER RELATED EXPERIENCE**:
   2001 – Present Controls Scientist, Stereotaxis, Inc.
   1999 – 2001 Post-doctoral Research Associate, Dept. of Systems Sci. and Math.

6. **CONSULTING, PATENTS, ETC**:

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   Member, IEEE
   Member, SIAM

10. **HONORS AND AWARDS**:
    Tau Beta Pi Engineering Honorary, 1999.

11. **COURSES TAUGHT IN THE LAST FIVE YEARS:**
    Linear Dynamic Systems (SSM 351A)
    Optimization (SSM 480)
    Control Systems (ESE 441)

12. **OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS**:
    Supervising Senior design projects.

13. **SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS**:

14. **PERSONAL WEBSITE:**

CURRICULUM VITAE

1. **NAME**: Alan Clement Wheeler

2. **ACADEMIC RANK**:
   Affiliate Professor (part-time)

3. **DEGREES**:
   Ph.D. 1968 Statistics, Stanford University, Palo Alto, CA
   M.S. 1964 Statistics, Stanford University, Palo Alto, CA
   B.A. 1962 Mathematics, Harvard University, Cambridge, MA

4. **SERVICE ON THIS FACULTY**: 27 years
   1978 – present Affiliate Professor

5. **OTHER RELATED EXPERIENCE**:
   1995 – present Lecturer, Department of Mathematics and Statistics, Southern Illinois University Edwardsville, Edwardsville, IL
   1987 – present Adjunct and Visiting Associate Professor School of Business Administration University of Missouri-St. Louis, St. Louis, MO
   1974 – 1985 Assistant Vice President, Operational Analysis Assistant General Auditor Federal Reserve Bank of St. Louis, St. Louis, MO
   1974 – 1976 Affiliate Professor of Operations Research and Visiting Associate Professor of Quantitative Business Analysis Washington University, St. Louis, MO
   1970 – 1974 Associate Professor of Computer Science and Operations Research Southern Methodist University, Dallas, TX
   1966 – 1970 Assistant Professor of Applied Mathematics Washington University, St. Louis, MO

6. **CONSULTING, PATENTS, ETC**:
   1973 – 1974 Consultant, The Western Company, Fort Worth, TX
   1969 – 1970 Statistical Consultant, National Center for Drug Analysis, Food and Drug Administration, St. Louis, MO
   1969 – 1970 Consultant to Department of Market Research General Steel Industries, St. Louis, MO

7. **STATES IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**:
   none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   none

9. **SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER**:
   American Statistical Association
   INFORMS
   Sigma Xi

Former Reviewer for Navel Research Logistics Quarterly, J.A.S.A., Management Science, Operations Research, Opsearch, SIAM J. Appl. Math., Automatica, two publishers.

10. HONORS AND AWARDS: none

11. COURSES TAUGHT IN THE LAST FIVE YEARS:

Spring, Summer	ESE 317	Engineering Mathematics (4 hrs/wk, lecture, undergraduate, day and night)
Spring, Fall	ESE 326	Probability and Statistics for Engineers (3 hrs/wk, lecture, undergraduate, day and night)

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS:
none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE (LAST FIVE YEARS): none

14. PERSONAL WEBSITE: none

CURRICULUM VITAE

1. **NAME**: Kevin Andrew Wise

2. **ACADEMIC RANK**:
   Affiliate Professor (Part Time)

3. **DEGREES**:
   B.S. (M.E.) University of Illinois, Urbana-Champaign (1980)
   M.S. (M.E.) University of Illinois, Urbana-Champaign (1982)
   Ph.D. (M.E.) University of Illinois, Urbana-Champaign (1987)

4. **SERVICE ON THIS FACULTY**: 9 years
   1996-Present Affiliate Professor

5. **OTHER RELATED EXPERIENCE**:
   1990-Present University of Missouri-Rolla, Adjunct Professor in Electrical Engineering, STL, MO.
   1987-Present Southern Illinois University at Edwardsville, Adjunct Professor in Electrical Engineering, Edwardsville IL.
   1982-Present The Boeing Company, Senior Technical Fellow, STL MO.

6. **CONSULTING, PATENTS, ETC**: none

7. **STATE(S) IN WHICH REGISTERED AS PROFESSIONAL ENGINEER**: none

8. **PRINCIPAL PUBLICATIONS IN THE LAST FIVE YEARS**:
   Control in an Information Rich world, contributed chapter in SIAM Report on Future Directions in Control and Dynamical Systems, 2002.
   "Flight Testing of Reconfigurable Control Law on the X-36 Tailless Aircraft," Journal of Guidance, Control, and Dynamics, Vol. 24, No. 5, 2001, pp. 903-917. (With J. Brinker)
   "Adaptive Control of a Sensor Guided Munition," to be presented at the 2005 AIAA GNC Conference, San Francisco, CA, Aug 2005, Wise, Kevin A., Lavretsky, E., Zimmerman, J., Francis-Jr., J. H., Dixon, D., and B. T. Whitehead.
   "Adaptive Control of Flight: Theory, Applications, and Open Problems," presented at the Thirteenth Yale Workshop on Adaptive and Learning Systems on May 30 - June 1 at Becton Center, Yale University, New Haven, Connecticut, 2005, K. Wise, E. Lavretsky, N, Hovakimyan.
   "Unmanned Aircraft: The Future in Military Aviation," Proceedings of the 6th IFAC-Symposium on Nonlinear Control Systems (Paper for Plenary lecture), September 1-3, Suttgart Germnay, 2004.
   "X-45 Unamnned Combat Air Vehicle Program Overview and Flight Test Status," Proc. Of the 2nd AIAA "Unmanned Unlimmited" Systems, Technologies, and Operations-Aerospace, Land, and Sea Conference, San Diego, CA, September 2003., AIAA paper No. 2003-6645.

"First Flight of the X-45A Unmanned Combat Air Vehicle (UCAV)," Proc. Of the 2003 AIAA Guidance, Navigation, and Control Conference, Austin Tx, August 2003., AIAA paper No. 2003-5320.

9. SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH YOU ARE A MEMBER:
Senior Member Institute of Electrical and Electronic Engineers (IEEE)
Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA)

10. HONORS AND AWARDS:
AIAA Mechanics and Control of Flight Award, August 2004
Pride@Boeing Achievment Award, May 2003 (UCAV Flight Test)
Boeing Senior Technical Fellow Award, January 2003.
Pride@Boeing Achievment Award, January 2002 (UCAV VMS SW Development)
Certificate of Recognition Award, December 2000.

11. COURSES TAUGHT IN THE LAST FIVE YEARS:
WU: ESE 425/525 Stochastic Processes and Kalman Filtering, Spring 05, 04, 03, 02, 01.
WU: ESE 443/543 Control System design Using State Space Methods, Fall 04, 03, 02, 01.
UMR: EE 430 Nonlinear and Adaptive Control, Spring 05
UMR: EE 530 Modern Control Systems,, Fall 05
UMR: EE 333 Digital Control Systems Control, Spring 05
SIUE: EE 550 Modern Control Systems, Fall 04,03, 01

12. OTHER ASSIGNED DUTIES IN THE LAST FIVE YEARS: none

13. SPECIFIC PROGRAMS IN WHICH FACULTY MEMBER HAS PARTICIPATED TO IMPROVE TEACHING AND PROFESSIONAL COMPETENCE IN THE LAST FIVE YEARS:
Conferences attended annually: American Control Conference (June). AIAA Guidance, Navigation, and Control Conference (August).
Taught Robust and Adaptive Control Workshop at AIAA GNC Conference (Aug 03) at ACC (Jun 04), in STL at IEEE Missouri Control Conference (Mar 03)

14. PERSONAL WEBSITE: none

D. JEE Student Advisory Board Survey Results – Oct 27, 2004

Please consider the following questions to aid in our ongoing review of your experience in the UMSL/WU Joint Electrical Engineering Program at Washington University. In developing your answers to these questions, consider gathering comments from other students as well.

The following questions are not in any particular order of importance, so consider them in any order you wish. Some questions may not have any answers as far as you are concerned. Any additional items that you think are appropriate for consideration are welcome.

1. Is there overlap in topics between JEE courses? If so, which courses? Which topics? Should the overlap be eliminated or reduced or is it helpful in the learning process?

(a) There certainly IS overlap among some courses, but I have always found this to be helpful. Mostly, I would characterize the overlap more as a review of known concepts and springboard into new concepts, rather than a re-hash of old material or redundancy. It is good for me to refresh pertinent lessons from earlier classes as a first step to venturing into new territory.

(b) There is some overlap, but I think that is a wonderful thing so we can see how things tie together…I think the classes that have NO overlap would be more difficult to enjoy just because we may not see any correlation to why we take them.

(c) I think the overlap in courses, where it occurs, is helpful in the learning process. Usually if they overlap, it's for good reason.

2. Are there JEE (or other department's) courses that seem "behind the times?" If so, which ones and in what way?

(a) All of the lecture courses are up to date. A couple of the labs need some updating, see next question.

Actually, I'd like to propose an interesting elective course that reviews old technologies as a way of putting current topics into perspective. I imagine a course something like "the history of electrical engineering" that illuminates achievements of the past and their influence on current technologies, but also reveal the mathematics and engineering principles employed. I'd like to spend a few weeks on tubes, analog computers, early relay and tube computers, early rotating machines, telegraphy, power distribution, radio, television, telephone switching, etc.

(b) The Digital Lab class seems behind because NOBODY talks or hears anything about Assembly Language until that class.

(c) Definitely the Digital Lab. I think the lab should use a programming language that is used proficiently in the work force today.

3. In what ways, if any, can the learning experience in JEE undergraduate laboratories be improved?

(a) There are four lab courses in EE. Mostly, the lab subjects are up-to-date, though some of the lab manuals could benefit from a re-write. The power and energy lab manual, especially falls into this category. Several sections are no longer performed.

The Digital Design Lab is suffering this semester from equipment failures, leading to a high degree of frustration and much lower learning rates. This lab also suffers from inadequate student preparation for the concepts of using the FPGA design and synthesis tools. A lecture or two to refresh the concepts of combinational logic and how they are implemented would be very helpful. Instead, students only followed a couple of short step-by-step tutorials that were nearly worthless for learning… they merely lead students through an exercise, but offer little actual instruction.

(b) The one thing I can think of is that instructors find a better way to make sure one person doesn't do all the work in a group, that one person doesn't just sit around and do nothing in a group, and that each person is able to get some "hands on" experience to allow learning for EVERYONE4.

(c) In most cases, I think a TA should offer out-of-class sessions to help the students who are struggling. Maybe on a Saturday or Sunday.

4. Do the recitations in JEE 3149 and JEE 3790 and the oral presentation in JEE 4800 help improve oral communication skills? Do you have any other comments about these recitations or oral presentations? Do you have any suggestions for ways that the department can help its undergraduate JEE students gain improved communication skills and experience?

(a) I took JEE3149 over the summer with Mr. Collins and there was no recitation section. The benefits of recitation/presentation are to give students a chance to talk in front of a group, and insist that they gain a sufficient mastery of a problem solution so they CAN talk about it in front of a group. In Dr. Spielman's recitation section, student's met in small groups only once or twice during the semester and were invited to individually solve a problem that was proposed on the spot.

This style falls short of the goals that I thought were appropriate for recitation. Personally, I think recitation is a great idea. It's teaching/learning goals are important, but can only be achieved through more recitation, not less. I think at least half of the lecture courses should include a recitation/presentation component.

Of course, this requires time, so attention must be paid to the recitation design. I imagine several formats. One is that a student is given a problem, then a week or two to research the problem and develop the solution, followed by a 5 to 10 minute presentation.

Another format is more extemporaneous, but could be embarrassing, as students are invited to immediately solve problems posed by the instructor. Embarrassment could be reduced by inviting students to work in teams of three or four. Problems would be simpler, so they could be posed, solved, and presented in under 10 minutes. In order for this to work in practice, the entire class should be involved, with teams working on different problems. Teams who complete the problem present immediately, those who don't present during the next class.

(b) I don't remember having any "recitation" times in any of my classes.

(c) In my case, the recitations were used as more of a question and answer session regarding homework. This worked well for me, but I'm sure there are others who would benefit from it being a required session.

5. Are there particular courses (JEE and otherwise) that you feel need substantial improvement or revision? If so, which ones and in what way?

(a) My main criticism of the program is that too much is packed into too few classes. For instance, the requirements for EE are just 127 hours, while the ME requires 139 and CE requires 137 hours. I think the Intro to Electrical Networks and Power, Energy, and Polyphase Systems should each be split, and then at least one additional elective should be required. Even then, the EE program would still require the least number of hours to earn a degree. Personally, I desire a Joint Computer Engineering degree.

(b) The Digital Lab as described above and possibly go more in depth in the topics we will use in our classes when taking the Engineering Math course and eliminate topics we never see again. Also, I definitely would have been helped with a class that taught Matlab and PSpice as I knew NOTHING about them and still only know LIMITED things.

(c) The Digital Lab is horrendous. There is not ample time or instruction to do the projects given.

6. Are there actions that the JEE Program should take to improve the "quality of life" and/or educational experience of its undergraduate students?

(a) I have noticed a great deal of cynicism among students created by cheating. No doubt, this is a problem faced by students around the country and we are no different. Unfortunately, those students who have access to prior semester's homework and tests have an advantage over students who do not, and the enticement to cheat increases. Instructors have different techniques for combating the problem, but an effective combination includes reducing the contribution of homework in the final grade while encouraging students to collaborate on homework, offer more quizzes, and then offer tests where problems cannot be easily predicted by using those from recent earlier semesters. In fact, I recommend publishing homework guides with problems similar to current homework, and the guide could simply be a compilation of previous semester's problems and solutions. Frankly, I learn quite well by working through difficult, novel problems with the help of a solution. The point is to facilitate learning, but not by creating tension between honesty and grade seeking.

(b) I'm not sure what can be done about this since everyone in the program has a different background, goal, and situation.

(c) Nope.

7. Do you have any comments about any of the textbooks assigned to JEE courses or about the library as a source for additional reference material?

(a) The best textbooks are the ones that pose sample problems and work through the solutions. The more the better. Of course, texts like these are 30% to 50% thicker, probably more expensive, but also a lot more useful.

(b) I can't really think of any.

(c) The text for Jee3370 is not very helpful.

8. In what ways, if any, can the advising of JEE undergraduates be improved?

(a) Prompt, accurate response to student issues is important. This is usually what I have experienced when I approached anyone in the JEE Program Administration.

(b) I think there should be a way of notifying students ahead of time when registration will begin, what classes will be offered, and a schedule for people to sign up if they need to meet with an adviser before registration.

9. In what ways, if any, can the Center for Engineering Computing (CEC) improve its services in support of JEE undergraduate courses?

(a) Support is usually of high quality, but can be spotty. For instance, some software, like Hspice is only available in Urbauer 114. Another, FPGA Pro, is only available in Urbauer 115. The state-of-the-art is improving, but software access is still a bit archaic. Availability should be not be restricted to **place**, but to **user**. No doubt, there are technical reasons for the lack of universal availability.

(b) I'm not sure on this one.

10. Assess the overall use of computers and the web in the JEE undergraduate experience. What, if anything, should be done to improve this experience?

(a) There appears to be a move to increase the use of computer software, such as PSpice, in solving problems. This is a great development, as long as we are using tools that are commonly used in industry.

I've noticed that the computer labs in Sever get very crowded during the last month of each semester. This suggests several solutions. More PC stations is obvious, but also distributing software access to more machines in different locations would help, and perhaps installing software on student PCs would help, too.

(b) I think that it's fine the way it is. You can't rely too heavily on computers because not all students have the resources, or the time to do computer work outside of class.

11. Would entrance (i.e., testing of prerequisites) and exit examinations for a JEE course be of potential value in assessing the success of the course in educating students in it?

(a) If you are proposing an additional exit exam, then I would say "Unlikely." The final exam is essentially the same as the exit exam, right? If so, then there is your measure of course success. If not, what other kind of test would you devise to see if learning objectives had been achieved?

Of greater value, perhaps, is empowering students to gauge their own preparedness and likelihood of success by taking an online prerequisites quiz before registering for a class. Some instructors, like yourself, offer a quiz over prerequisite material, but the student is already in class and unlikely to withdraw based on poor results. It might be of greater value to take this quiz before registration. Would it help you to ask a student "how did you do on the prereq quiz?" while you are advising them for registration?

In any case, you still need the in-class prerequisites quiz in order to develop a correlation factor, if possible, between success on the prerequisites quiz and final grade.

Finally, passing a "course entrance exam" might be considered, especially for admission to certain electives or even required upper level courses.

(b) I think it might be, but some just don't do well in those situations.

(c) This is probably a good idea. Not necessarily to reject or accept certain students, but at least to get an idea of the knowledge level of the students entering the program.

12. In your view, is our undergraduate JEE program missing any important course (or courses)? If so, what is it, and which course would you suggest dropping in order to offer it?

(a) Use this guide: drop nothing, only add. It is only a guide… there will be exceptions as time goes passes.

(b) I would like to see more options in the Elective courses and also have a better way of letting students know what a class is about before they sign up.

(c) A prerequisite to the Digital Lab based on assembly language and hardware usage.

13. Do you have any comments regarding the experience in design in the following required JEE courses: JEE2500, JEE2609, JEE2800, JEE2900, JEE3149, JEE 3270, JEE3790, JEE4160, JEE4550, JEE4800? How might the design experience and training in these courses be modified to increase the self-confidence of students in design using the material in them?

(a) JEE2500 Electrical Lab. Hands on, but limited design experience. Mostly, circuits were constructed and tested, only one unit actually involved transistor amplifier design.

JEE2609 Digital Computers Logic. Not much actual design, but there is a missed opportunity to use VHDL to implement and simulate homework solutions.

JEE2800 Intro to Electrical Networks. Not much actual design, but there is an opportunity to use PSpice for homework solutions.

JEE2900 Intro to Digital and Linear Electronics. Not much actual design, but there is an opportunity to use PSpice for homework solutions.

JEE3149 Engineering Electromagnetics I. Several design opportunities, but these were mostly on the scale of homework problems.

JEE 3270 Power, Energy, and Polyphase Systems. One design problem, but very little discussion of it's various aspects, and no feedback. Few of the lectures offered guidance to me about how to proceed. The students with the best projects seemed to meet regularly with the instructor outside of class. The design project would be improved if it were broken down into milestone parts, which were turned in for grading and instructor remarks.

JEE3790 Signal Analysis. No design experience… just lecture and homework.

JEE4160 Electrical Energy Lab. Excellent theory lectures and practical experiments. However, there is not much actual design experience.

JEE4550 Digital Design Lab. Excellent design experience. However, this semester the course suffers from poorly functioning equipment and lack of supporting lectures. Unfortunately, Dr. Johnston has been absent several times because of business related matters.

JEE4800 Senior Design Project. This course offers excellent design experience! Dr. Livingston offers excellent design-oriented lectures and projects.

In all cases, student confidence is built by understanding the design trade-offs, and perhaps by defending his design, a-la recitation or presentation.

(b) Classes in Matlab and PSpice are what I wish I would have had before anything else.

14. How has being enrolled in joint class sections with students from the WU day school influenced your experience? Should this practice be increased, minimized, or eliminated?

(a) I have had a few courses populated with WU students. They seem to be pretty sharp to me, and I'm glad for their contribution. Certainly, don't make policies that eliminate or minimize mixing the groups.

(b) I think it has been O.K., but in general it doesn't really seem fair to the joint students to have to be graded on curves when in classes with students who are ONLY students and probably have more access to study time as well as help from other FULL TIME STUDENTS.

(c) I don't think it necessarily a bad or good thing. I have noticed that they are usually the ones who score well on the exams, etc. Sometimes this is a little discerning.

15. Assess the quality of instruction that you have encountered in the Washington University portion of your program. How does it compare with the quality of instruction you have encountered in the UMSL/Community College portion of the joint program? Have the adjunct instructors been on a par with the full time WU faculty that you have encountered?

(a) Mostly, the instruction has been satisfactory to me. The weakest instructors happen to be the adjuncts, but then some of them are superb because they bring real-world experience into the classroom.

I attended SLCC for all preliminary classes. Naturally, they teach "easier" material, but I found them to be as good at teaching as the professors and adjuncts at Wash U. There are a few exceptions, but most are well qualified and effective at teaching… and like at Wash U., some are truly superb!

(b) For the most part I think the instruction has been comparable to other institutions I have attended. (Foreign instructors that we could not understand were the exception!)

(c) The instruction at Wash U is definitely more rigorous and intense. I think the Community Colleges don't always stress the importance of certain issues as far as needing to know them and build on them later in the program.

16. Have you had an adequate ability to interact with instructors at WU outside the classroom? If not, is this because of your schedule, the instructor's schedule, or a combination of both?

(a) Interaction has been limited for me, primarily because of the way I structure my own time. Some instructors are hard to meet after hours because, well, the program is night-school oriented. Students pack classes into a few slots and this prevents them from meeting instructors with any flexibility. Adjunct professors are often available only on the evenings they teach, Wash U. professors like to go home before 9pm. Meeting instructors outside of class sometimes works, sometimes doesn't… it's a combination of conflicts between both parties' schedules. I have found email to be effective when asking specific questions.

(b) I would say NO and mostly due to a combination of both.

(c) No because of both.

17. In the past, there has been some indication that Saturday morning classes would be preferred to having full evening laboratory courses. However, each time that JEE2500 or JEE4160 has been offered on Saturday morning, attendance has been poor with many students skipping the 8:00AM lecture and coming late to the 9:30 AM laboratory. Comment on the current schedule for the various laboratory courses. Is the current Monday/Wednesday late evening schedule for JEE2500 better than the all one night schedule used for JEE4160 and JEE4800? How well is the Tuesday evening lecture and Thursday evening lab working for JEE4550? Do you have any other practical suggestions for scheduling *laboratory courses?*

(a) The same-day lecture/lab is sure convenient, but often leaves my head buzzed because there is no time for the lecture to "sink-in" before heading to the lab. The biggest problem I had with this format was that attending a Tuesday lecture/lab using two time slots, automatically eliminates taking an additional class on Tuesday/Thursday. Maybe this important, maybe not. In practice, it has not changed my graduation date, though I might have had to sacrifice on particular elective choice. Some students grumble about missed scheduling opportunities.

Saturday lab sounds interesting to me! How about lecture during the week, then just the lab on Saturday? Obviously your experience with 8:00 A.M. lectures indicates that is too early for night-school students!

(b) I definitely think Saturdays will be bad for the majority of students, and I think I prefer having the JEE4550 schedule over the schedule I had for the other labs. It is much better having lecture a day or two BEFORE the lab and not the same night…it gets to be too long!

(c) I don't think you'll ever please everyone. Late night classes are a pain, but is it worth giving up your Saturday's? I think that depends on work schedules. In my case the night classes work better ***because I work all day on Fri and Sun, so Sat is my only day off.***

18. On a previous survey, JEE4550 was noted to be a very difficult course requiring considerable time and effort. However, this comment may have had more to do with the instructor, who is no longer teaching this course, than the course itself. How does the time and effort for JEE4550 now compare to other laboratory courses such as JEE2500, JEE4160, and JEE4800? How does it compare to lecture courses such as JEE3149 and JEE3790? Does the content of the course need to be changed somehow to provide a better learning experience?

(a) (I may be a bit repetitious here.) JEE4550 my standout favorite of all the courses I've taken. However, there are some significant hurdles which could have been better addressed with lectures, notably, operation and coordination between the 68K trainer and FPGA board, a review of combinational logic, state machines, and how to implement them in with the FPGA PRO design software. The other problem this semester was equipment in poor repair, lack of replacements, and slow repair. Both of these problems have seriously interfered with many students ability to master the lessons and enjoy the lab.

This is certainly a design intensive course! I think student design presentations might benefit other students who are struggling. The course certainly shares a quality of many programming classes, and that is a lot of time is needed outside of class. In this regard, it is unlike the JEE2500 and JEE416 labs where there is just one night of lab, followed by a write-up. I'll bet students would be better prepared mentally if this expectation were clear before taking the class.

(b) This class stinks for a couple reasons…one being the use of Assembly Language, and the other being that most of us have no previous work with this type of class and we feel like we are just thrown into it without enough instruction and understanding so we feel like we are not learning nearly as much as we could or should if things were different.

(c) Like I said before, this lab horrible. There is not enough time to do the projects given and there is definitely not enough background given on assembly language, hardware, or the equipment used in the lab. Also, I think the TA should hold a weekend help session.

19. In the near future, JEE4550 will be changed to use C++ programming instead of Assembly Language programming. Is this a step in the right direction for this course? In you opinion, how important is a course in embedded processing such as JEE4550 to the JEE curriculum? Should it be made an elective instead of a required course?

(a) I've heard some students complain about using assembler, but I think it would be a mistake to use C. First, programming at this level is best done with assembler. Part of the goal of problem solving with hardware/software is the ability to manipulate cpu registers and logic signals in realtime. Higher level languages obscure this control, or eliminate it altogether. And the complaint is unfounded, since assembler programming at this level is relatively easy.

Of course, I'm really interested in the embedded systems aspect of EE. In fact, I originally hoped to pursue an undergraduate degree in CoE, but circumstances changed. Nonetheless, JEE4550 is one of the two courses that provides intense design experience. If it is **too** intense, then perhaps it could be split into two classes, or offered as an elective, but certainly not eliminated!

(b) ABSOLUTELY a step in the right direction.

(c) I think if you made this class an elective, its reputation would render it an empty course. I do like the idea of making it a C++ based course since we are required to take Scientific Computer Programming which is also C based. Assembly language isn't used these days as often as C is.

20. There is some thought being given to offering a second advanced electronic circuits laboratory similar to the day school ESE350 if an evening instructor can be found. Would you have been interested is taking this course instead of JEE4550?

(a) It sounds like a reasonable alternative to me. I would probably take both. Perhaps a reasonable compromise to the JEE4550 requirement would be to require one or the other.

(b) YES.

21. The MATLAB analysis program is now being used extensively in courses such as JEE3149, JEE3790, and JME/JEE4310. Students entering the JEE program are now required to take JCS1002, a 1 credit hour course in MATLAB Skills, prior to taking these courses. Do you believe that this will be a significant help in mastering these courses?

(a) A lot of industry uses computer simulation and computer-based problem solving. I took JCS1002 before it was a requirement. It was a useful course because it enabled me to "break the ice" and understand how the language worked, but about half of the problems were fluff. MATLAB is very useful for solving problems graphically and preparing graphs for presenting solutions.

An idea to consider is a 3-hour course geared specifically to EE majors (with analogs for ME and CE majors) that offers instruction for all the main software tools used throughout the curriculum: MATLAB, Pspice, Assembler, FPGA Pro. Even Word, Excel, Powerpoint, and Access. Just brainstorming here, but students could attend most lectures, complete a quiz or workshop for each section, then spend extra time on "advanced projects" in say 5 out of 8 units and prepare a 5-minute Powerpoint presentation.

(b) AGAIN…ABSOLUTELY!!!

(c) Yes. I think it would be of great help.

22. The use of the PSpice electronic circuit simulation program has become pervasive throughout the electronics industry. In the WU day school, PSpice is introduced in the ESE180 Introduction to Electrical Engineering course. In the evening school, JEE students take JEE2500, Electrical and Electronics Laboratory, instead of the Introduction to Electrical Engineering course. PSpice is now being introduced to JEE students in JEE2800 and JEE2900 and being used extensively in JEE3920. How important is it for PSpice to be included in JEE2500? Should at least 1 or 2 lectures in JEE2500 be devoted to PSpice? Should most of the experiments call for circuit simulation using PSpice? How would you prefer to see PSpice brought into the curriculum?

(a) Pspice should be used early and often. Not too early, because you probably need to know a few things before using the simulator makes much sense.

(b) As I said earlier I DEFINITELY wish I had INSTRUCTION in PSpice!

(c) I think they are fine the way they are. However, 1 credit hour PSpice elective class isn't a bad idea.

23. Are there any specific electives your would like to see taught as part of the JEE program which are not currently available? Would you like to see at least one "Computer Science" elective count toward the degree?

(a) Already there is the option for JEE students to take one day school course. Earlier, I recommended requiring 5 electives, instead of just 4. If so, then perhaps allowing one to be a Computer Science or accepting more CoE courses as electives would work well. And maybe a second day school course could be allowed. (Unfortunately, I did not have the time to take advantage of this opportunity.)

(b) I would definitely like to see more electives, but there needs to be a better way for us to find out about what a class is all about instead of just written explanations because often times when reading the descriptions of the courses we have no idea what is about because we have never heard of the topics desrcribed.

24. JEE students can currently join the WU day school Student Section of IEEE. However, most meetings are held during the noon hour or during evening hours when JEE students are in class, so there is little participation. Would you like to see a separate Student Section of IEEE for the JEE students? Since the meetings would have to be on Friday evenings or Saturday mornings, do you think JEE students would have time to participate? Would you be willing to be leaders of such a section?

(a) Good idea, but I'm not sure you'd get enough participation to make it worth the effort. I have a Student Membership in the IEEE, #41575366 (and ACM, #3369683), and never attended any meetings or even knew when they were held. I enjoy the publications and can embellish my resume.

(b) I would definitely LIKE to be a part of this, but my schedule would not allow it.

25. What are your ideas on how to improve the current JEE program? Please try to be specific.

(a) Split JEE2800 Intro into DC and AC courses. Split JEE327 into static and rotating machine courses. Require an additional elective, and offer more electives perhaps by allowing more selection from day-school offerings. Devise homework/testing strategies that devalue cheating activity while encouraging the learning process. Increase emphasis on open-ended design problems and computer-based solutions.

Add a regular speaker's forum, perhaps every other Friday evening. Offer free pizza, chips, and soft drinks. (That's the carrot. As a stick, one or two classes could require at least one attendance and a report.)

(b) I think most everything was covered in the previous questions, but if I think of anything else I will let you know.

(c) I think it's already a great program. It just needs some fine tuning (i.e. the Digital Lab).

E. Minutes of the External Advisory Board Meeting in Nov 2005

Minutes of the External Advisory Board Meeting for the ESE department

Electrical and Systems Engineering
External Advisory Board Teleconference
with Browser Access to Presentations and Departmental Websites
Nov. 18, 2005, 1:00 – 3:00 pm, Jolley Hall, Room 431
Minutes compiled by Chrysanthe Preza, Hiro Mukai & Martin Arthur

Agenda

Introductions: Board Members, ESE Representatives
State of the Department presented by Martin Arthur
- Faculty
- Undergraduate Programs: EE, SSE, JEE
- Graduate Programs
- Financial Situation
- Research Activities

Key issues
- Increasing the size of our merged faculty (8 EE, 6 SSM)

- Preparing for our new chair coming in January & new faculty to be hired

Encouraging increased pursuit of external funding
Attracting the best graduate students
Improving our undergraduate programs & preparing for ABET
Panel discussion

Goal

The goal of this meeting was to discuss a set of issues related to the growth of the ESE department and to focus on topics related to that growth including improvement of our undergraduate programs in preparation for the upcoming ABET review.

Summary of points discussed

- Faculty size and the use of adjunct faculty
  - The board noted the reduction in the regular faculty from 26 to 15, 4 of which moved to Computer Science and Engineering, which accounted for a proportional reduction in the teaching load and research activities.
  - At least 6 faculty need to be added in ESE.
  - The department should reduce its reliance on adjunct faculty with (in part) new hires as planned.
  - To support the need for more faculty members, Dr. Kumar suggested that we benchmark ourselves against comparable institutions, for example, Princeton.
  - The board emphasized that, given the small size of our department, we need to select a few subjects and plan to excel in them.
  - Job 1 is to revitalize the Department with new hires.

- Present faculty search with a commitment from SEAS to hire 2-3 faculty

- In recruiting new faculty, Dr. Sommerer suggested a package deal to go for a center of excellence in one subject which perhaps crosses a few departments. This plan will foster loyalty and facilitate an NSF or DARPA grant. We need to own that research area. So we should recruit a promising associate professor (emerging star) and hire 2 assistant professors in the same theme. This approach is in contrast to getting three assistant professors in three different areas, but it requires betting on one specific area.
- Drs. Summerer and Kumar suggested that hot areas are wireless networking and sensor networks. These areas would work well for ESE given the current strength in signal processing and control. The strong universities are UC Berkeley, Illinois, UCLA, Carnegie Mellon, among others. We need to contact faculty members at these institutions to help us look for promising assistant and associate professors.
- DARPA is presently a potential source for well connected senior personnel for sensor networks.
- We should recognize that the Dean Search could be a lengthy process with a significant impact on ESE hiring.

- Attracting the best graduate students and increased research funding
  - Dr. Das suggested that we seek donations for endowment for ESE graduate student funds (one million dollars per student).
  - We should consider establishing planned giving for graduate students in ESE.
  - A member noted that the return on the WU endowment is lower than those for the other universities and that bringing that return in line with other institutions might be a source of graduate student support.
  - Consider Concentrating on agencies that now fund ESE research.

- Our concerns with regard to ABET
  - Identify the impact of first course (ESE 102) on EE Program.
  - Concern about the Senior Design course in the EE program. Current idea is to split this course in two semesters and have local companies be involved. The consensus is that ESE needs to demonstrate strength in Senior Design for all three programs.
  - Increased service provided by ESE. ESE 317 and ESE 230 are core courses for our SSE and EE programs. They may, however, not be doing the best job for our students, because of their service role. They account for most of our undergraduate credit hours, but for example, fewer than 10% of the students in ESE 230 (Introduction to Networks) are EE majors.

- Impact of new Chairman's arrival in January.
  - EAB members requested a meeting with Arye Nehorai
  - Plan the next EAB meeting in the spring of 2006 (within 6 months).
  - That meeting should focus on our undergraduate programs and the upcoming ABET visit.

F. Minutes of the External Advisory Board Meeting in June 2006

Dept of Electrical and Systems Engineering
External Advisory Board Teleconference with Internet Browser Access to Presentations
June 7, 2006, 12 noon – 2 pm, Jolley Hall, Room 431
Minutes compiled by Chrysanthe Preza and edited by Hiro Mukai

Participants

On-site:

ESE Representatives: Martin Arthur, John Corrigan, Norman Katz, Hiro Mukai, Arye Nehorai, Chysanthe Preza

Via telephone:

Mr. Jerome Brasch, President, Brasch Manufacturing Co., Inc.
Dr. Santanu Das, Chairman of the Board and C.E.O., TranSwitch Corporation
Dr. Panganamala R. Kumar, Professor, Department of ECE, University of Illinois at Urbana-Champaign
Dr. Kathy Rink, Assistant Group Leader (in place of Dr. Keh-Ping Dunn who was on travel) MIT Lincoln Laboratory
Mr. David Schepers, P.E., Vice President, Energy Delivery Services, Ameren Services
Dr. Kenneth D. Senne, Technology Investment Officer, MIT Lincoln Laboratory
Dr. John C. Sommerer, Director, Applied Physics Lab, the Johns Hopkins University
Mr. Gregory A. Sullivan, CEO, Global Velocity, Inc.

Goal

The goal of this meeting was for the EAB members to meet with the new ESE Department Chair, Arye Nehorai, to discuss a set of issues related to the growth of the ESE department and to focus on topics related to our undergraduate programs in preparation for the upcoming ABET review.

Agenda

- Introductions: Board Members and ESE Representatives
- Future of the Department presented by Arye Nehorai
- Review of our ABET-Accredited Programs presented by Hiro Mukai
- Panel discussion

Questions/Discussion about the Future of the Dept

1. Is there enough space for new hires? Answer: This is a future concern and A. Nehorai is talking with the Dean about this.
2. Is there enough capital for growth in the devices area? Answer: The department gave a nice start-up package to the new faculty member. Also facilities available in the Physics Dept can be used by the ESE faculty. We will need more funding and we need to get the industry involved
3. The EAB members suggested that the ESE department should also pursue partnerships with device industry not in the local area.

Discussion about the Undergraduate Recruitment (*Day School Programs*)

Das: Talk with David Jolley in the Dean's office for donations to support our recruitment activity to host students on campus (cost $500/student on the average).

Sommerer: Add new 1-unit courses for freshmen.

Das: A good book for an introductory course in EE is "Electrical Engineering Uncovered". - Preza: We have used this book in ESE 102 Introduction to Electrical and Computer Engineering.

Kumar: Have you explored potential for interdisciplinary programs? - Nehorai: Environmental program is successful.

Das: Offer summer internships with companies – get funding from alumni (cost $3K-4K/student). This can help retention of EE students and build a stronger EE program.

Mukai: We have some internships available, open to junior students mostly, but more students are interested in this than available positions. Perhaps we can create a program or a clearing house for summer internships based on a network of alumni and friends.

Brasch: The Joint EE program is a very good idea.

Mukai: This is a burden on us but the Dept is compensated for it

Presentation/Discussion of the 3 programs

BS in EE*: educational objectives – Are these appropriate? Does our program meet them?*

Kumar: The objectives look fantastic. Do you meet objectives in communications? How good are your labs? Mukai gave a description of the ESE lab facilities and discussed undergraduate research opportunities.

Schepers: Do you require courses in electrical power? Corrigan discussed all the power courses that students can take. H. Mukai discussed the importance of the capstone design course.

Kumar: How do you staff all the elective courses? Answer: We use adjunct faculty.

Senne: How do you teach students to work on a team? Answer: The lab exercises are performed in teams of 2 or 3 and as well as the capstone design project. We are currently evaluating a proposal for the capstone design project with interdisciplinary teams of EE and BME students

Brasch: Are students advised adequately for choosing elective courses? Answer: Students meet with their advisor every semester before registration.

Suggestion: Get Intel and Cisco to look at hiring ESE graduates. Use placement records to attract new students.

Rink: I do recruitment at Wash U but there is a low turnout of EE students. Suggestion: Encourage students to go to the career center and sign up for campus interviews. Response: We need to follow up on this.

BS in SSE*: educational objectives – Are these appropriate? Does our program meet them?*

No comments about the educational objectives.

Brasch: Do the required courses meet the ABET requirements? Answer: Yes, we have been so far accredited for full 6 years each time we applied, that is the last 4 times.

Das: What is the reason for having applied operations research? Answer: Systems engineers often perform the task of operations research.

Kumar: What is the number of EE and SSE students? Answer: We have 18 EE graduates and 16 SSE graduates this year.

Kumar: Broader definitions of systems exist in other universities. Answer: Yes, especially for graduate research. However for our undergraduate program we focus on control engineering and operations research.
Sommerer: The SSE program is unique and it offers an opportunity to recruit students.
Rinks: I agree that the SSE program is unique. The SSE students that MIT Lincoln lab hires are very strong.
Mukai: We do get freshmen who choose Wash U because of our unique SSE program.
Sommerer: What fraction of the students has an undergraduate research experience? Answer: About 10% of the students. Additionally the SSE capstone design project relies on a client and it is in many cases research-oriented.
EAB member: The placement statistics and placement examples for the SSE are excellent!

Joint UMSL/WU BS in EE*: educational objectives – Are these appropriate? Does our program meet them?*
Schepers: Are the evening students more practical engineers? Answer: Yes, the program aims to produce well-educated, sophisticated engineers for the local industry. Only 10-15% of the students go to graduate school immediately after graduation, mainly through the University of Missouri – Rolla Extension Center on the UMSL campus.
Brasch: This is a great service to the community!

Final Q and A:
Kumar: What is the long term vision in terms of using adjunct faculty members? Answer: We would like to increase the regular faculty to 23-25 in the future and decrease the number of adjunct faculty members.
Sullivan: What percent of SSE faculty have been at WU over 25 years? What are your plans as people start to retire? It is important to have new people in the pipeline. - Answer: The program has been stable over the last 15 years. Nehorai: We just hired one new PhD in Systems. The Dean would like to see some retirements.
Kumar: The EAB should meet with the Dean in the near future.

Local discussion after the meeting:
- Post documents on the website
- Ask the EAB members to review the material and make comments.
- Put the EAB on a mailing list and keep them updated
- News Items on the Departmental Web page and Newsletter – to reach other people