



**2008 Academic Program Review
of
Graduate Programs**

**November 2008
Texas A&M University
College Station
Texas**

Table of Contents

I.	Introduction.....	3
I.	Brief History of the Department	5
II.	Overview of the Department.....	7
A.	Faculty.....	7
B.	Administrative.....	11
C.	Fiscal	12
III.	Graduate Program	14
A.	Research.....	14
B.	Educational Programs	23
C.	Student Profiles.....	27
IV.	Strategic Plan/Program Assessment	32
A.	Mission/Purpose Statement.....	32
B.	Outcomes	32
C.	Measures	32
D.	Data Collection	33
E.	Strengths/weaknesses of program.....	33
F.	Departmental Vision.....	35
Appendices		
	List of Faculty	40
	Graduate Handbook	42
	Course Syllabi (400-600 level courses).....	66
	Faculty CVs	167

I. Introduction

The Department of Electrical and Computer Engineering welcomes you to Texas A&M University and thanks you for your service as external reviewers of our graduate programs. We are pleased to have this opportunity to assess our programs as we look for opportunities to continually improve and enhance them. We realize that a strong graduate program is a key part of maintaining an excellent department and improving our academic reputation. Hence, we are grateful for your help in this process.

This self study was prepared for this review and reflects an evaluation of the graduate programs within the department. It includes a brief history of the department, an overview of the department, details on the research and educational activities of the graduate programs, plans for continual assessment and improvement, as well as a strategic vision for the future.

We look forward to your input and eagerly await your recommendations about how we might further improve our programs as we strive for greater excellence. We realize this is a time consuming task and thank you again for your service. We are ready to answer any questions that may arise and would be glad to provide more information should you require it.

Charge to the Review Team

We request that the review team examine the graduate programs within the Department of Electrical and Computer Engineering using the material provided, along with any additional information that you might request. While evaluating the existing programs, please consider the allocation of resources, (i.e., human and fiscal) within the department, the absolute level of support the Department receives from the University, and comment as appropriate on current and potential leveraging of these resources. Also, please address the issue of learning based outcomes:

1. Does the department have ongoing and integrated planning and evaluation processes that incorporate a systematic review of its program(s) and services that (a) results in continuing improvement, and (b) demonstrates that the department is effectively accomplishing its mission?
2. Has the department identified expected outcomes for its educational program(s): does it assess whether it achieves these outcomes; and does it provide evidence of improvement based on the analysis of those results?
3. Does the department demonstrate that each educational program for which academic credit is awarded (a) is improved by the faculty and the administration, and (b) establishes and evaluates program and learning outcomes.

In addition, we ask that you address the impact of the Faculty Reinvestment Program, started by Texas A&M University in 2003. The reinvestment program has resulted in the hiring of almost 500 new faculty members dispersed throughout the University, with a substantial number allocated to our department. The goal is to improve the quality of research and education for Texas A&M students by having more faculty available for

teaching, mentoring and advising and smaller student to faculty ratios. Through this review we plan to track and measure real increases and improvements in the quality of the graduate experiences across all dimensions. We ask that you assess the success of the department in moving its teaching and research agendas forward with these hires.

II. Brief History of the Department

A curriculum in electrical engineering at Texas A&M University had its beginning in the Fall of 1903. The department was then called Physics and Electrical Engineering. The first two degrees in electrical engineering were awarded on June 13, 1905. In the fall of 1909, Electrical Engineering was made a separate department from Physics. Electrical engineering proved to be popular and the department expanded. In 1913-1914 the enrollment was 153, almost half of the total in engineering and about 17% of the total enrollment of Texas A&M University. Enrollment in electrical engineering continued to climb steadily after World War I, from 152 in 1918-1919 to 406 in 1925-1926.

Following World War II, the department and university entered into another phase, developing graduate courses and research. Starting in 1961, different areas of specialization were introduced, such as electromagnetic fields, communications and electronic circuits, digital systems and in 1967 control theory and analog and digital computers. Since the early seventies, the department has had a tremendous growth in research and educational opportunities. This has led to the establishment of eight research areas and a graduate program offering a rich educational experience.

In 1963, the Electric Power Institute (EPI) was founded by Prof. John Dennison with collaboration from Dean Fred Benson. The motivation was to provide a mechanism to maintain the electric power teaching program and develop a research program in the area at a time when most universities were greatly de-emphasizing power. In 1998, EPI changed its name to Electrical Power & Power Electronic Institute (EPPEI) to better reflect the activities in power system and power electronics areas.

In 1997, the department of Electrical Engineering jointly with the Department of Computer Science began to offer degrees in Computer Engineering. The Computer Engineering program has become such a prominent part of the department that in 2005 the department changed its name to Electrical and Computer Engineering.

In 1998, the department received a \$5.1 gift from Texas Instruments to support the development of research and education in the area of analog and mixed signals circuits. As a result, in 1999 the Analog and Mixed Signals Center was formally created. The mission of the Analog and Mixed-Signals Center is to contribute to the advancement of the state-of-the-art in the area of analog mixed-signal circuits and systems. The center plays a key role in the education and training of highly qualified engineers for design and manufacturability of analog and mixed-signal integrated systems.

Recent Significant Developments

In 2003, the department started a satellite program in Electrical Engineering in Doha, Qatar, as part of Texas A&M University at Qatar (TAMUQ). Besides Electrical Engineering, the TAMU branch campus in Qatar offers degrees in Mechanical, Chemical and Petroleum Engineering. Eight faculty have been hired for this program already with

two additional positions currently open. In addition, several of our College Station faculty have temporarily relocated to Doha to help teach courses. Currently, the Qatar program offers undergraduate degrees identical to our program in College Station with specializations available in Power Systems and Telecommunications and Signal Processing. In the near future, TAMUQ will begin to offer graduate programs in Electrical Engineering and other disciplines as well.

Perhaps the most significant development in the department over the last quarter century happened over the last 5 years. During this time the department experienced a period of significant faculty growth as a result of the faculty reinvestment program initiated by then President Robert Gates. The main thrust of this program was to consolidate resources throughout the university with a focus on freeing funds for new faculty positions. Overall, 435 new positions were created from the reinvestment program and they were allocated to colleges in priority order. The College of Engineering received a substantial 112 new faculty positions, of which ultimately 19 were allocated to our department. All 19 “reinvestment” positions have been filled with top quality faculty over the last 4 years or so. In addition, over the same period the department filled several replacement positions. This has brought the size of the ECE faculty from about 50 at the beginning of the reinvestment program to its current size of approximately 70. With the exception of two faculty, the remaining newly hired faculty are the assistant professor level. Currently, the department has two open positions in the electric energy area with emphasis on sustainable energy.

III. Overview of the Department

A. Faculty

Faculty Profiles

As of Fall 2008, the ECE Department faculty consists of 34 Full Professors, 11 Associate Professors, 23 Assistant Professors, and 3 Instructors (non-tenure track), excluding 2 assistant professors hired last Spring who will be joining us in January of 2009. The above numbers include Professors Howze, Maldonado, Watson, Weichold, and Cantrell who hold full time administrative positions and Professor Biard who is a part time Professor. The department also currently has 2 open positions in the energy area to be filled by Fall 2009.

Included in the above count are 6 holders of endowed chairs (Drs. Chang, Dougherty, Georghiadis, Russell, Sanchez and Singh) and 8 holders of endowed professorships (Drs. Bhattacharyya, Datta, Ehsani, Enjeti, Kezunovic, Nguyen, Toliyat, Wright) with two Professorships currently unfilled but to be filled soon. Racial, gender and national origin statistics of the faculty are shown in Table 1.

Table 1 – Faculty Profile

Rank		Ethnicity		Gender		Citizenship	
Full Professors	34	Asian / Pacific Islander	31	Male	61	US Citizen / Perm. Res.	51
Associate Professors	11	Caucasian	34	Female	10	Non US Citizen / Perm. Res.	20
Assistant Professors	23	Hispanic	5				
Lecturers	3	Black	1				

For administrative purposes, the faculty in the ECE Department are divided into seven groups based on their area of specialization. Each group has a designated leader who coordinates the teaching assignments for the group and represents the group in a variety of ways to the department and to outside contacts. Interdisciplinary research activities are encouraged and hence many faculty have affiliations with two or more groups. A complete list of the faculty and their primary group affiliations is given in Appendix A; the 7 groups and their leaders are shown below in Table 2. The number of faculty column does not include the 5 ECE faculty having administrative positions nor the 3 non-tenured track faculty or Dr. Biard who is a part-time Professor.

Table 2 – ECE Groups and their Leaders

Group	Leader	# of Faculty
Analog & Mixed Signal	E. Sanchez-Sinencio	6
Biomedical Imaging & Genomic Signal Processing	S. Wright	8
Computer Engineering	A. Reddy	10
E&M and Microwaves	K. Chang	6
Electric Power & Power Electronics	H. Toliyat	8
Solid State Electronics, Photonics & Nano-Engineering	C. Madsen	11
Telecommunications, Controls & Signal Processing	S. Miller	13

Faculty Hiring and Turnover

Table 3 shows the turnover of faculty over the last several years. Hiring of faculty according to the reinvestment program began in the 2003-2004 academic year. As a result of this program the size of the faculty in the ECE program has grown from roughly 50 to roughly 70. Note that over the 8 years reported in Table 3, the department lost only 9 faculty members due to resignations. This is a remarkably low number for the size of our department. This statistic clearly shows that a great majority of the faculty are, overall, satisfied with the department and the community they live in.

Table 3 – Faculty Hiring and -Turnover

Academic Year	Hired	Resigned	Retired	Deceased	Total Inc/Dec
2000-2001	3	2	0	0	+1
2001-2002	3	4	1	0	-2
2002-2003	5	0	0	0	+5
2003-2004	2	0	1	1	0
2004-2005	6	2	0	0	+4
2005-2006	5	1	1	1	+2
2006-2007	5	0	0	0	+5
2007-2008	5	0	0	0	+5
Total	34	9	3	2	+20

Tenure and Promotion

In addition to yearly evaluations by the department head, faculty members in the ECE Department go through several formal review processes throughout their careers. For junior faculty who have not previously held a tenure track appointment, the first formal review occurs after their third year in the department. For their three year review, faculty submit a package similar to what would be done when applying for tenure, with the exception of no reference letters being requested. This package is reviewed by the

departmental Tenure and Promotion (T&P) Committee which provides a letter to be included with the review package regarding how they are progressing on teaching, research and service. The Department Head considers the departmental committee's review and drafts his own draft letter based on the submitted package, in which a recommendation is made as to whether to retain the faculty or not. The package with the committee's and the department head's letter is forwarded to the dean who tasks the college level promotion committee to review. With input from the dean, a final version of the department head's letter is provided to the faculty under review.

After five years, a faculty member is required to submit an application package for tenure and promotion to Associate Professor. This package is evaluated during the 6th year and a decision is made towards the end of the sixth year. Packages for tenure and/or promotion are first reviewed by the departmental Tenure and Promotion Committee. This committee consists of seven faculty members of the ECE Department who hold the rank of Professor, two of which are appointed by the Department Head while the other five are elected by the faculty. Upon reviewing and discussing each package, the T&P committee members vote (via secret ballot) on each case. The T&P committee provides a letter outlining its review of each candidate and giving the results of the vote. This feedback reflects both the majority and minority opinions of the T&P committee as necessary. Based on the input from the Department T&P committee as well as his own review of the package, the Department Head provides a written recommendation for the case and makes a clear recommendation as to whether to promote/tenure a faculty or not. Both the T&P Committee's letter and the Department Head's letter are added to the package which is then forwarded to the Dean and the college level committee. At this point, the candidate can choose to withdraw the package or have it sent up to the college level. For mandatory tenure cases, unless the faculty resigns, the review package will go forward. The College level T&P committee, which consists of one representative from each department, reviews, discusses and votes on each case. Similarly to the process at the department level, the result of this College level T&P vote is forwarded to the Dean who provides his own letter with his recommendation to the package. The package then goes to the Provost, President and ultimately to the Board of Regents for final approval.

The process for promotion to Professor proceeds in a similar manner as described above for tenure and promotion to Associate Professor. However, in this case there is no mandatory timetable. A candidate can prepare a package any time they feel they are qualified. Note that an exceptional candidate may also apply for tenure and promotion to Associate Professor before the mandatory time frame. Finally, in cases where a faculty member has been hired after previously holding a tenure track position at another university, the timetable for tenure and/or promotion can be adjusted after agreement between the department and the faculty to account for the previous service. That timetable is usually negotiated during the hiring process.

Table 4 shows a recent history of the tenure and promotion process for the ECE Department. Over the last eight years, 10 faculty were given tenure. Eight of those were Assistant Professors who were simultaneously promoted to Associate Professor while the other two were hired at the Associate level and hence were only granted tenure. During

the same 8 year span, 12 faculty members were promoted from the rank of Associate Professor to the rank of Professor. There have only been four cases in the last eight years where a faculty member initiated the tenure or promotion process and did not successfully complete it. In 2001, one faculty member submitted a package for promotion to the rank of Professor which was approved at the department level but denied at the college level. The same faculty member was successfully promoted the next year. In 2004, one faculty member submitted a package for tenure (he was already a full professor). It was denied at the College level. He withdrew his package and resigned. In 2008, one faculty member who had submitted a mandatory package for tenure and promotion to Associate Professor was ultimately denied. Also in 2008, one faculty member submitted a preliminary package for consideration for promotion to Professor. The departmental T&P Committee recommended he not prepare a formal package and he withdrew his package. Hence, in eight years the department has had only two cases where a faculty member has resigned due to an impending negative tenure/promotion decision.

Table 4 – Results of ECE Department Tenure and Promotion Process

Effective Date	Promoted to Associate Professor with Tenure	Tenure Only	Promoted to Professor	Withdrew from Process or Denied
Sept. 2001	1	1	1	1
Sept. 2002	1	0	2	0
Sept. 2003	1	1	1	0
Sept. 2004	0	0	2	1
Sept. 2005	1	0	1	0
Sept. 2006	1	0	1	0
Sept. 2007	1	0	2	0
Sept. 2008	2	0	2	2
Total	8	2	12	4

Teaching Load

The nominal teaching load of tenure track faculty is 3 courses per year. A new faculty member is typically given a reduced teaching load of 2 courses per year for the first two years. In addition, the faculty can buy out courses using the following formula:

- Buyout of 1 course in a 2-course semester – 25% salary for semester
- Buyout of 2 courses in a 2-course semester – 50% salary for semester
- Buyout of 1 course in a 1-course semester – 35% salary for semester

As a university policy, every member is required to comply with a minimum work load requirement for the Fall and Spring semesters and the Department Head is responsible for assigning and monitoring the workloads of the faculty.

B. Administrative

Administrators

The department administration consists of the Department Head, Associate Department Head and the Graduate Coordinator. In addition there are several faculty committees that oversee various aspects of the department. Details of these committee's functions and their composition are provided in a future section.

Support Staff

The department employs approximately 23 full time staff to provide various types of support to the department. Currently there are 3 staff members that provide advising to undergraduate and graduate students, 4 staff members that provide business and accounting support, 2 permanent staff that provide IT support (as well as two GANTS), 4 staff members that provide teaching laboratory support, 7 staff members that provide secretarial support to faculty, and 3 staff that provide administrative support to the department or the department head. The department is in the process currently of hiring an additional advising staff member to assist in undergraduate advising.

Faculty Committees

The Tenure and Promotion Committee

The tenure and promotion (T&P) committee makes recommendations on the tenure and promotion decisions and its membership is partly elected and partly appointed by the department head. This committee also assists with the hiring of faculty, especially in cases where an offer is to be made at a rank above assistant professor. All faculty candidates who are invited for on-campus interviews meet with representatives from the T&P committee and the committee forwards its input to the department head.

Current Committee Members: S. Wright (Chair), S. Bhattacharyya, A. Chan, K. Chang, M. Ehsani, O. Eknayan, W. Shi.

The Undergraduate Studies Committee

This committee is responsible for all matters assuring the quality of our undergraduate education. The committee makes recommendations regarding the undergraduate Electrical Engineering curriculum. Changes to the curriculum are also voted on by the committee. If approved, the changes are then sent to the College of Engineering committee and the University Curriculum Committee.

Current Committee Members: K. Butler-Purry (Chair), S. Bhattacharyya, K. Essler, D. Kundur, L. Kish, W. Shi, J. Silva-Martinez, J. Tyler, S. Wright.

The Graduate Studies Committee

The graduate studies committee is responsible for admission of graduate students that maintains academic standards, ensuring the continued excellence of student research and dealing with other issues that may arise in the discharge of these functions. The

committee consists of one member from each focus area who is typically appointed at the recommendation of the group leader and the approval of the graduate coordinator and the department head.

Current Committee Members: S. Miller (Chair), S. Bhattacharyya, O. Eknayan, G. Huang, J. Ji, K. Narayanan, C. Nguyen, W. Shi, J. Silva.

Distinguished Speaker Committee

This committee screens nominations from the faculty and solicits distinguished researchers to give lectures in the department for the enrichment of the intellectual environment. The number of distinguished lectures given through this series varies from year-to-year but is typically on the order of 4-6 per year.

Current Committee Members: K. Narayanan (Chair), A. Datta, L. Kish, N. Reddy, S. Wright.

Awards Committee

This committee solicits nominations for various faculty and staff awards and makes recommendations to the department head for these awards.

Current Committee Members: A. Datta (Chair), A. Chan, K. Chang, O. Eknayan, H. Toliyat

Chair and Professorship Committee

This committee consists of faculty in the department who are holders of endowed chairs or professorships. This committee makes recommendations to the department head for recipients of chairs and professorships and also serves as the faculty advisory committee providing input to the department head on a variety of issues.

Current Committee Members: (There is no designated chair of this committee) S. Bhattacharyya, K. Chang, A. Datta, E. Dougherty, M. Ehsani, P. Enjeti (currently at TAMUQ), C. Georgiades, J. Howze, M. Kezunovic, C. Nguyen, B. D. Russell, E. Sanchez-Sinencio, C. Singh, H. Toliyat, S. Wright.

C. Fiscal

Budget Information

Table 5 shows the gold plate budget for the ECE department over the past five fiscal years. Research funding is illustrated for the same time period in Table 6. Research funding comes in the form of Contracts Grants and Gifts. In Table 6, contract and grant expenditures are listed under Direct Research Expenditures while Gifts are listed separately. In the case of gifts, the broad areas for their use can be specified but no deliverables can be promised. A portion of each contract or grant is withheld by the Texas Engineering Experiment Station (TEES), through which most proposals are

submitted, as overhead. The usual overhead rate is 46.5% of the direct costs of the project. Some portion of that overhead is returned to the department and is listed in Table 6 as “TEES Overhead Return.” **It is important to note that the data presented in the tables below show only funding obtained from proposals submitted by our faculty through TEES and it does not include proposals submitted through any other venue, including the TAMU Research Foundation. It also does not include funding obtained by our faculty through the Texas Transportation Institute.**

Table 5 – TAMU Funding for the ECE Department

Category	2002-03	2003-04	2004-05	2005-06	2006-07
Faculty and Staff Salaries	5,299,380	5,510,911	5,801,173	6,206,243	6,041,051
Operating Expenses	215,453	215,453	215,453	215,453	215,453
GA Salaries	303,603	197,999	221,156	181,427	309,825
Total Operating & Salaries	5,818,436	5,924,363	6,237,782	6,603,123	6,566,329

Table 6 – External Funding and Research Expenditures for the ECE Department

Type	2002-03	2003-04	2004-05	2005-06	2006-07
Award Amount/Count	4,341,897	5,249,356	3,212,135	4,171,865	5,514,889
Direct Research Expenditures	6,341,481	6,241,694	5,892,112	5,971,005	5,486,869
TEES Overhead Return	269,915	307,051	281,226	279,088	292,280
Gifts	1,985,445	759,177	559,319	682,008	1,262,699
Total External Funding	8,596,841	7,307,922	6,732,657	6,932,101	7,041,848

Faculty Salaries

Table 7 shows statistics of faculty salaries broken down by rank. Faculty salary raises are set by the Department Head. Each faculty member must submit a yearly activity report to the Department Head. After reviewing these reports and meeting with each faculty individually to discuss these reports, the Department Head determines the amount of each faculty member’s raise in salary for the next academic year.

Table 7 – Faculty Salaries by Rank

Monthly Salaries (\$)	Professors	Associate Profs.	Assistant Profs.
High	20,176	11,200	9,961
Low	9,665	8,886	8,972
Median	13,088	10,030	9,409
Average	13,727	10,012	9,407

IV. Graduate Program

A. Research

Research Institutes, Centers and Laboratories

Research in the department is conducted through research institutes, centers, and laboratories. The use of the terms “institute” and “center” at Texas A&M are restricted. The establishment of institutes and centers is a complicated process and requires the approval of the Board of Regents. Currently there is one institute in the department, the Electric Power and Power Electronics Institute, and one center, the Analog and Mixed Signal Center. In addition, there are numerous laboratories in the department which may range from a single faculty member and a few students to a dozen faculty and more than 50 students. They are briefly described below with the name of the faculty member with primary responsibility for the laboratory in parentheses. Further details on any of these labs can be found by visiting the departmental web site.

Analog Mixed Signal Center (Dr. Edgar Sanchez-Sinencio)

The mission of the AMSC is to contribute to the advancement of the state-of-the-art in the area of analog mixed-signal circuits and systems. This is done through education and training of highly qualified engineers for design, testing and manufacturability of RF, analog and mixed-signal and biomedical integrated systems, as well as engaging high tech industries to join the center for mutually beneficial projects. Some of the AMSC’s research directions include: Low-voltage/Low-Power Circuits & Systems. LDO and Switching Converters, ADC & DAC Converters, Broadband and Data Communication Circuits, Biomedical Circuits and Sensor interfaces, and RF & mm-wave Communication Circuits Analog and RF Built-in-Testing.

Genomic Signal Processing (GSP) Laboratory (Dr. Edward Dougherty)

Genomics concerns the study of large sets of genes with the goal of understanding collective gene function, rather than just that of individual genes. *Genomic Signal Processing (GSP)* is the engineering discipline that studies the processing of genomic signals. Since regulatory decisions within the cell utilize numerous inputs, analytical tools are necessary to model the multivariate influences on decision-making produced by complex genetic networks. Genomic signals must be processed to characterize their regulatory effects and their relationship to changes at both the genotypic (observed only in the genome) and phenotypic (readily observable) levels. The aim of GSP is to integrate the theory and methods of signal processing with the global understanding of genomics, with special emphasis on genomic regulation. The Genomic Signal Processing Laboratory at Texas A&M University (<http://gsp.tamu.edu>) focuses on the study of genomic signal processing with special emphasis on cancer diagnosis and therapy. Through tight collaborations with leading cancer research institutes such as the M. D. Anderson Cancer Center and the Translational Genomics Research Institute (TGen), faculty and students in the lab are currently focusing their efforts to explore whether engineering methods applied to genomic data can lead to more accurate diagnosis of the disease and also bring about a dramatic improvement in the success rate of therapeutic interventions.

Magnetic Resonance Systems Laboratory (Dr. Steve Wright)

The primary objective of the MRSL is to develop new methods and technology to improve magnetic resonance imaging and to train students in MRI, RF, applied electromagnetics, and image and signal processing. We are working to apply parallel imaging technology to extend MRI into areas where it has previously been too slow to have an impact. We actively encourage collaborations that can benefit from projects in the lab. The MRSL facilities consist of two laboratories: the research facility, which houses a 4.7 Tesla superconducting magnet and two permanent magnets donated by IGC and computer automated RF measurement facilities up to 500 MHz and printed circuit fabrication tools; the teaching laboratory contains a 1.5 Tesla/31 cm superconducting magnet interfaced to a TecMag Libra imaging system. This system is also available for long term studies requiring many hours of imaging time, such as monitoring growth of plants and animals.

Nano-Bio Systems Laboratory (Research lab) (Dr. Arum Han)

The NanoBio Systems Laboratory consists of a 1000 sq. ft. facility in the ground floor of the Zachry Engineering Center. This laboratory is being used for designing, fabricating, and testing various micro and nano scale fluidic devices and systems for biological applications. The laboratory houses various polymer micro and nanofabrication equipments and a microfluidic experimental station. Some major equipments include: 1) Equipments for polymer micro/nanofluidic system fabrication: Plastic hot embossing/nanoimprinter, PDMS molding station, rapid prototyping machine, electroforming machine, two vacuum ovens, box furnace, spin coater, glove box, ultrasonic bath. 2) Microfluidic experimental station and fluorescent microscopy equipments: One upright fluorescent microscope with video capture capabilities, multiple computer controlled syringe pumps. 3) Equipments for biological experiments: Biosafety cabinet, incubator, freezer (-20 °C), refrigerator, analytical scale, water bath. 4) Equipments for measurement and characterization: Ion channel current measurement system for cell analysis.

Biosensors Lab. (Teaching Lab) (Dr. Arum Han)

The Biosensors Laboratory is an academic laboratory for ECEN 489 Biosensors Lab. taught by Prof. Arum Han. The focus of this undergraduate teaching laboratory is to introduce various micro/nano devices and systems for biological applications, especially focusing on miniaturized biosensors. The laboratory consists of a 600 sq. ft. facility in the 3rd floor of the Zachry Engineering Center and houses various polymer micro and nanofabrication equipments as well as microfluidic and biosensor characterization capabilities. Basics in optical biosensors, electrochemical biosensors, designing and fabricating microfluidic devices (e.g. microfluidic channels, pneumatically actuated microvalves), and biosensor characterization are some of the topics covered in this teaching laboratory. Major equipments include: 1) A laser micromachining equipment for polymer microfabrication. 2) Dimatix material printer for biological material printing

for biosensor applications. 3) An inverted fluorescent microscope with imaging capability for microfluidics characterization. 4) An electrochemical analyzer.

Institute of Solid State Electronics (ISSE) Cleanroom (Dr. Christi Madsen)

The Institute of Solid State Electronics (ISSE) cleanroom at Texas A&M is a new 5000 sq. ft. class 100 and 1000 cleanroom. The facility houses state of the art micro and nano fabrication equipments (Mask aligner, spinner, metal evaporator, RIE, PECVD, oxidation/diffusion furnaces, wire bonder, dicing saw, polisher) and various analysis equipment (Microscope, profilometer, ellipsometer, probe station). The facility has multiple chemical hoods and laminar hoods and is equipped with in-house de-ionized water, vacuum, and nitrogen.

Nanofabrication Facility (Dr. Christi Madsen)

The Nanofabrication Facility, also known as the Aggiefab, has over 4000 square feet of class 100/1000 cleanroom space. The current research activities encompass electro-optic waveguides, lab-on-a-chip, nanoimprinting, micro-electro-mechanical (MEMS) devices, and chalcogenide thin films for nonlinear optics and mid-infrared applications. This facility has its roots in the fabrication facilities developed over the years within the Solid State Group of the Electrical and Computer Engineering Department. The ECE department is currently building, operating, and maintaining the facility. The Nanofabrication Facility is undergoing a major renovation to expand its capabilities. This work will extend into 2008. The goal is for the facility to become a University-wide shared facility.

Electromagnetics & Microwave Laboratory (Dr. Kai Chang)

The EML emphasizes both basic and applied research, theoretical and experimental work. Various courses have been developed to train our students. Our measurement capability has improved dramatically thanks to the equipment grants from the NSF, NASA, HP, Texas Engineering Experimental Station, and the Permanent University Fund. Over \$1 million has been spent on a vector network analyzer operating up to 100 GHz, the antenna measurement anechoic chamber, circuit etching facility, computers, and other general measurement equipment. Our research activities cover a very wide range including electromagnetic theory, numerical methods, scattering, microwave and millimeter wave circuits, MMICs, antennas, and medical applications. The laboratory operates a 40-foot antenna measurement anechoic chamber for frequency range from 2 to 40 GHz. The laboratory has many software tools for circuit designs and electromagnetic field simulations such as ADS, Libra, HFSS, IE3D, and Fidelity.

Sensing, Imaging and Communications Systems Laboratory (Dr. Cam Nguyen)

The center is engaged in a wide range of research focusing on: RF, Microwave and Millimeter-Wave Integrated Circuits and Systems, CMOS RF ICs, Ultra-Wideband (UWB) Integrated Circuits, Antennas, and Communications, Radar and Sensor Systems, Wireless Communications Sensors and Sensor Networks. The laboratory is involved in innovative multidisciplinary research activities for wireless communications radar, and sensing applications. Through our unique research program and environment, our

graduate students acquire both theoretical and practical experience not only in component design but also in system design, integration and test. They are trained to be creative and independent thinkers – yet focus on teamwork. They have experience with RFIC, MIC and MMIC design, fabrication and test. They perform, design and conduct experimental research on novel – yet practical – components and systems using equipment and CAD programs commonly employed in industry. In short, they work just like RF/microwave engineers in industry. Therefore, they readily adapt to the industrial environment and can contribute immediately to projects in industry upon graduation. With this unique theoretical and hands-on practical experience, our graduated students are always in demand and widely sought by industry.

Fluctuations and Noise Exploitation Laboratory (Dr. Laszlo Kish)

Research in the Fluctuations and Noise Exploitation Lab has been addressing random fluctuations, their origin, the limits posed by them, and their potential applications for sensing, communication and computation. The fundamental aspects of information processing include theoretical noise models and the analysis of the impact of noise versus power dissipation and speed in classical and quantum computing, and at the microelectronic/nanoelectronic levels. The sensing applications are based on the exploitation of the stochastic component of sensor signals, which is called fluctuation-enhanced sensing, and sponsored in an Army Research Office subcontract. The noise based communication initiatives established in this lab are the unconditionally secure communication by Kirchhoff-loop and Johnson-like noise; stealth communication; and secure networks. They utilize the fundamental physical properties of thermal noise (or enhanced thermal noise) and achieve parameters that are superior to quantum communication systems. The newest project is the noise-based logic initiative, which uses electronic noises as logic values, and shows new properties such as error-robustness, non-propagating switching errors, reduced power dissipation, and potentially higher performance. Other related projects are stochastic resonance, neural signals and noise mitigation by nonlinear systems.

Advanced Electric Machines and Power Electronics Laboratory (Dr. Hamid Toliyat)

This laboratory performs research in the area of electric machinery and power electronics. It is our goal to explore new electric machines and motor drives topologies for various applications. These applications may vary from new motor drive topologies for computer hard disk to ship propulsion. This laboratory is equipped with a variety of state of the art equipment and is growing.

Power Electronics & Motor Drives Laboratory and Advanced Vehicle Research Program (Dr. Mehrdad Ehsani)

Our research is focused on power electronics and motor drives with regard to vehicle systems as well as other applications such as wind power, space and military systems, power and energy storage system, consumer products and other industrial applications. The lab is a results oriented lab which produces a consistent stream of intellectual property and practical products.

Electric Power and Power Electronics Institute (Dr. Karen Butler-Purry)

The Electric Power & Power Electronics Institute (EPPEI) is aimed at developing a partnership with industry where EPPEI Faculty and students provide a variety of targeted services with tangible benefits and the industry provides funding for this joint effort. The Electric Power Institute (EPI) was formed in 1964 with a mission to foster research interactions between Texas A&M University and the power industry. At that time, the main goal centered on developing a sponsorship program funded by unrestricted grants from the industry to carry out various research projects. After a 30-year history of successful service to the industry and a name update, the Electric Power & Power Electronics Institute (EPPEI) is the result of significant change due to the recent restructuring in the industry. With a new Annual Membership concept introduced in 1998, EPPEI is moving towards new forms of interaction with the industry.

Texas Applied Power Electronics Consortium (TAPC) (Dr. Karen Butler-Purry)

Texas Applied Power electronics Center has been established for interdisciplinary research and development in advanced systems in which power electronics is the enabling technology. Currently, this center is developing several new technologies in the areas of advanced motor drives, high power converters, multiconverter power systems, and new electric and hybrid vehicle propulsion systems, for commercial applications. This work encompasses all aspects, such as theoretical studies, design, numerical simulation and computer modeling, and experimental evaluations. The center has extensive laboratory, and computer facilities to support the projects in the areas mentioned above. For the hybrid vehicle projects, the center has a stationary test bed and a mobile test bed for evaluation of electric motor drives and internal combustion engines for traction applications. The past work of the center has resulted in numerous publications, reports, patents, and computer simulation packages that are available to the industrial members of the consortium associated with this center. Furthermore, it has developed a flexible computer simulation packages for design and evaluation of any type of automobile drive train. In addition, the center has access to several research laboratories of its member faculty, such as the power electronics and motor drives laboratory. The facilities and expertise of the center can be used for any R&D project related to its past activities and present interests. These include studies of advanced motor drives, silicon driven power systems, such as aerospace power systems, ship and military power systems, and other advanced vehicle power systems.

Power Engineering Lab (Dr. Mladen Kezunovic, Dr. Garng Huang)

Serving both education and research purposes, Power Engineering Lab provides the students and trainees with hands-on experience in power engineering. The lab is equipped with computers, various protective relays and relay testing equipment and the most widely used professional software on power system analysis and power electronic simulation. This lab is suitable for hands-on training for short courses and caters to the need of various on-going research projects.

Power System Automation Laboratory (Dr. Don Russell & Dr. Karen Butler-Purry)

The Power System Automation Laboratory at Texas A&M University is committed to developing advanced protection, monitoring, and control systems for electric distribution networks. The availability of economical microcomputing equipment offers the opportunity for developing sophisticated solutions to the needs of utilities and their customers. The Power System Automation Laboratory performs research on the application of such intelligent equipment on the distribution network. Investigations are directed toward enhancing the capabilities of conventional equipment as well as developing systems which perform new functions. Research concepts are tested through the field demonstration of prototype systems on utility circuits. Areas of research cover a broad range of distribution protection, monitoring, and control functions.

Power Systems Engineering Research Center (Dr. Mladen Kezunovic)

The Power Systems Engineering Research Center (PSERC) draws on university capabilities to creatively address these challenges. Under the banner of PSERC, multiple U.S. universities are working collaboratively with industry to: engage in forward-thinking about future scenarios for the industry and the challenges that might arise from them; to conduct research for innovative solutions to these challenges using multidisciplinary research expertise in a unique multi-campus work environment; to facilitate interchange of ideas and collaboration among academia, industry and government on critical industry issues; and to educate the next generation of power industry engineers. PSERC provides: efficient access to experienced university researchers in an array of relevant disciplines and geographically located across the U.S., leading-edge research in cost-effective projects jointly developed by industry leaders and university experts; and high quality education of future power engineers. The multidisciplinary expertise of PSERC's researchers includes power systems, applied mathematics, complex systems, computing, control theory, power electronics, operations research, non-linear systems, economics, industrial organization and public policy. PSERC partners with private and public organizations that provide integrated energy services, transmission and distribution services, power system planning, control and oversight, market management services, and public policy development.

Power System Control and Protection Lab (Dr. Mladen Kezunovic)

Power System Control and Protections Lab performs analysis, control and protection of power systems research. Their goals include fault location algorithms, digital simulators, substation automation, power quality, EMS/SCADA, maintenance strategies for equipment such as transformers and circuit breakers, etc. The lab is equipped with several computers which can also be used for course projects focused on protective relaying and fault analysis.

Electro-Optics Laboratories (Dr. Ohannes Eknayan)

The Electro-optics laboratories are housed in the Wisenbaker Engineering Research Center building (6 labs, 5500sq. ft) and used primarily for graduate research activities. Senior students who are interested in pursuing graduate studies in electro-optics and

participate in summer undergraduate research program also make some use of the facilities. The laboratories include: High power Ar laser, semiconductor lasers, photodetectors, optical power meters, broadband Er:fiber light sources, tunable L-C band laser, optical spectrum analyzers, fiber cleavers and splicers, vibration-isolated tables, spectrometers, micropositioners, Faraday isolators, microwave signal sources and spectrum analyzers, personal computer-based data acquisition and signal processing systems, digital oscilloscopes, power supplies and amplifiers.

Wavelet Innovation Laboratory (Dr. Andrew K. Chan)

It is our goal to research the novel technique in wavelet application area. Our research varies in Medical Diagnosis, Industrious Detection, Image Segmentation, and Remote Image Procession.

Wireless Communications Laboratory (Dr. Costas Georghiades)

Ours is one of the first laboratories dedicated to high quality cutting-edge research and development of wireless communication systems in the state of Texas. Our mission is three-fold: to lead a culture of excellence and integrity in the nation's research of wireless communications; to challenge and educate young minds, preparing them for an exciting future; to synergize with industries to establish strong long-lasting partnerships.

The purpose of the Laboratory is to pursue research in communications, with emphasis on wireless systems, from the algorithm design to implementation. The WCL consists of two parts: a) a software laboratory and b) a hardware laboratory that provide an ideal environment for relevant cutting-edge wireless communications research. Our laboratory has a tradition of recruiting top faculty and students providing a stimulating environment for both technical and personal growth. There are currently nine tenured or tenure-track faculty dedicated to research in the WCL. Research expertise covers all important aspects of physical layer communication from source coding (i.e., data compression) to channel coding, and receiver design. The WCL houses over forty plus graduate students who work with faculty in the laboratory. WCL students are recruited from the best schools in electrical engineering around the world. Research in the WCL is conducted through student thesis supervision by faculty, collaboration with post doctoral fellows, research associates and colleagues, as well as partnerships with industries.

Multimedia Lab (Dr. Zixiang Xiong)

The Multimedia Laboratory focuses on research on multimedia (audio/images/video) compression and communication over IP and wireless networks. It has a dozen high-end Dell PCs, several laptops, and video cameras.

Storage Systems Laboratory (Dr. Reddy)

The lab carries out research related to storage systems, file systems and networked storage systems. The lab has investigating hybrid storage systems employing both solid state storage devices and magnetic disk drives. The lab has access to several storage devices, computers and servers. The lab has recently developed multiview storage

systems for active storage, virtual allocation that separates storage allocation from file system creation and policy-directed hybrid storage systems.

VLSI Circuits and CAD Laboratory (VCC-LAB) (Dr. Sunil Khatri)

The VCC-LAB conducts research in the areas of deep sub-micron VLSI design and CAD. The VLSI design focus is on circuits for extreme low power, variation and radiation tolerance, extreme high speed and circuit structures for 3D integration. The VLSI CAD focus includes logic and combinatorial optimization, and hardware acceleration of core CAD algorithms on FPGAs and GPUs.

Computer Engineering Laboratory (Multi Use Facility, Dr. Narasihma Reddy)

The computer engineering lab carries out research on a wide range of research topics with a focus on VLSI, Computer Aided Design, Networking and Computer Systems. The faculty in the lab conducts research in various areas intersecting these main areas of focus. The lab has access to several servers, experimental testbeds, measurement and testing equipment, simulators and desktop workstations.

Multimedia Communication and Networking Laboratory (Dr. Mi Lu, Dr. Narasihma Reddy, Dr. Srinivas Shakkottai, and Dr. Alex Sprintson)

This lab carries out research in various areas related to communication networks and the networking support for multimedia communication. The range of topics covered include Communication Network Security, Network protocols, Network Coding, Wireless Networks, Network QoS, P2P Networks, Network economics, Network survivability and robustness, and Multimedia content delivery. This lab has recently developed protocols for high-speed networks, techniques for network anomaly detection, network coding techniques for improving reliability and performance, wireless QoS, and models for network economics.

VLSI CAD Laboratory

(Dr. Gwan Choi, Dr. Jiang Hu, Dr. Sunil Khatri, Dr. Peng Li, and Dr. Weiping Shi)

This lab explores many problems in the Computer Aided Design of VLSI circuits and their scaling to smaller dimensions. The lab looks at all the issues of VLSI design from circuit design to physical design to architectural aspects of design. The lab develops algorithms for CAD of the VLSI circuits. The lab is currently developing techniques for employing multicore processors, GPUs and FPGAs to speed up the design, simulation and testing of the VLSI circuits.

The Networking and Information Systems Laboratory (Dr. Xi Zhang)

The Networking and Information Systems Laboratory actively conducts the cutting-edge research in the areas of wireless communications networks, mobile computing, and Internet through protocols/algorithms designs, systems modeling, and experimental/testbeds techniques. The current active research projects/topics include the cross-layer design and optimizations for QoS guarantees over mobile wireless networks, cognitive radio and cooperative communications/relay networks, effective capacity and effective bandwidth theories for wireless networks, DS-CDMA, MIMO-OFDM and space-time coding,

adaptive modulations and coding (AMC), wireless diversity techniques and resource allocations, wireless sensor and Ad Hoc networks, target localization wireless sensor networks, vehicular Ad Hoc networks, multi-channel MAC protocols, wireless and wired network security, wireless and wired multicast networks, channel coding for mobile wireless multimedia multicast, network protocols design and modeling, statistical communications theory, information theory, and random signal processing.

Publication Statistics

The publication activity of the ECE Department faculty is shown in Table 9. Also shown is the number of editorial positions held within the department. Given the number of faculty in the department ranged from around 50 at the beginning of this time period to closer to 70 at the end, it can be seen that a majority of the faculty in the department are holding editorial positions as well as other professional service activities which bring high visibility to the program.

Table 9 – Faculty Publication Statistics

Academic Year	# of Refereed Journal Publications	# of Conference Publications	# of Editor/Assoc. Editorships
2002-2003	156	230	
2003-2004	160	283	45
2004-2005	305	277	48
2005-2006	274	276	45
2006-2007	253	330	41

Sources of Funding

Funding for the research efforts in the department comes from a variety of sources. Table 10 shows the total number of proposals funded per year and the corresponding total amount for proposals submitted through the Texas Engineering Experiment Station (TEES) alone (irrespective of when the proposals were submitted). The numbers do not include gifts or proposals funded through the Research Foundation, the Texas Transportation Institute (TTI) or TAMU. Table 11 shows the distribution of the sources of research funding for the department. It is seen that a significant part of our research funding comes from federal government agencies which would include sources such as NSF and various DoD agencies. Private industry contributes a smaller amount but is also significant. Total external research funding was shown previously in Table 6 in Section III-C.

Table 10 - Six Year Award History

Fiscal Year	Amount (Millions)	Award Count
2003	\$4.342	83
2004	\$5.249	76
2005	\$3.212	48
2006	\$4.172	64
2007	\$5.515	85
2008	\$9.684	107

Table 11 – Source of Awards

Funding Source	Fiscal Year 2007				Fiscal Year 2008			
	Award Amount	% of Total	Award Count	% of Total	Award Amount	% of Total	Award Count	% of Total
Federal	2,729,653	49%	27	32%	5,437,329	56%	41	38%
Federal Flow-through	914,185	17%	18	21%	1,305,389	13%	26	24%
Foreign	348,576	6%	4	5%	486,241	5%	12	11%
Non-Profit Organization	718,764	13%	9	10%	996,908	10%	9	9%
Private	320,126	6%	14	16%	991,001	10%	9	8%
Private University	73,684	1%	3	4%	75,000	1%	2	2%
State Agency – Non-TX	309,900	6%	9	11%	247,128	3%	7	7%
State Agency TX	100,000	1%	1	1%	145,400	2%	1	1%
Total	5,514,888	100.00%	85	100.00%	9,684,396	100%	107	100%

B. Educational Programs

Degrees Offered/Program Requirements

The department offers degree programs in both Electrical Engineering and Computer Engineering. In both cases, there are three different degree programs: Doctor of Philosophy (PHD), Master of Science (MS) and Master of Engineering (MEN). The MS program is a research oriented master’s degree and requires the completion of a master’s thesis while the MEN program is our non-thesis master’s degree program and consists primarily of coursework. The following paragraphs give an overview of the degree requirements for each degree program. Full details are provided in Appendix 1 in the graduate student handbook which is provided to all incoming students at orientation or when they check in with the graduate office upon arriving on campus.

Doctor of Philosophy

Students who already have a master’s degree upon entering the PHD program are required to complete 18 hours of “classroom” work and a total of 64 credit hours. We also offer what is referred to as a “direct PHD” whereby a student can enter the PHD program directly upon completion of their bachelor’s degree. In that case, the student is required to complete 42 hours of “classroom” work and 96 hours overall. Details of restrictions on the use of undergraduate courses, directed studies, seminar, etc. are provided in Appendix 1. PHD students are required to pass a preliminary examination which consists of a written and an oral examination and a final defense of their dissertation, both of which are administered by the student’s supervisory committee. Details of the examinations are provided in the next section.

Master of Science

The MS program requires a total of 32 credit hours of which 24 hours must be “classroom” work. The remaining 8 hours are generally covered by research, internship, or directed studies hours. The MS student is also required to conduct research and defend a thesis based on that research. There is no comprehensive examination for the MS degree programs.

Master of Engineering

The MEN degree is a purely coursework degree. The degree program requires 30 credit hours of which 27 must be traditional “classroom” work. The remaining 3 hours can be filled with additional coursework or with directed studies, internship, or seminar hours.

Student Supervisory Committees and Examinations

For the MS and PHD degrees, the student, with the advice and consent of his/her supervisor, will form a supervisory committee. That committee will consist of at least four faculty members. At least two committee members are to be from within the student’s focus area, one is to be from within the department but outside of the focus area, and one committee member is to be from outside the department. Here, focus area refers to the 7 administrative groups in the department. So for example, a student who is conducting research within the Analog and Mixed Signal (AMS) area would have two committee members from the AMS group, one member from within the department but outside of the AMS group, and one outside the department. It is understood that many faculty have interests that may span several groups. Hence, for the purposes of committee assignments, each faculty member is considered to have one primary group affiliation. One exception to the above committee structure requirement is that the MS students in the computer engineering program are allowed to have a committee consisting of only three members (two from within the CE group and one outside the department).

The preliminary examination for PHD students consists of both a written and an oral component. It is required that PHD students schedule their preliminary examination by the end of the second year in the program. PHD students who did not previously obtain a masters degree (i.e, direct PHDs) are allowed an extra semester before they must schedule their exam. There are two formats for the written portion that are used as described in the following:

Format 1 (individual exams): Each committee member prepares a written examination for the student. The format and scope of each written examination is determined by the committee member. While the outside (of the department) member has the option to waive the written examination, all other committee members must give an exam. Each committee member grades the exam he/she administered and makes a pass/fail judgment on the written exam. The student is considered to have failed the preliminary examination if he/she fails more than one individual written examination.

Format 2 (common exams): A particular focus group can choose to administer a common written preliminary exam to all students in its group. The common exam is periodically administered (e.g., once per semester) on a date specified by the group. The scope and format of the exam is published well in advance of the exam date. All students wanting to take the preliminary examination during that semester all take the same exam. Faculty from the group grade and discuss the results of the exam and determine a passing threshold for the exam.

The written examination is then followed by an oral examination. For students who have taken the written exam under Format 1 above, the oral exam must be scheduled within three weeks of the written exams. No such time constraint exists for students taking a common written exam. Typically students will give an oral presentation on a topic related to their proposed area of research. In many cases, students will have made some initial progress in their research and will present this during the oral exam, but this is not necessary. The supervisory committee will question the candidate in order to determine if the student has the required background necessary to perform research in the proposed field. Often the committee will also provide follow-up questions on the written examinations. After the oral examination is completed, each committee member will cast a pass/fail vote. The student is determined to have passed the preliminary examination if no more than one failing vote is cast.

PHD students must also provide a written proposal for their dissertation that is not to exceed 10 pages. The student's supervisory committee must approve this proposal. Often this is done in conjunction with the oral preliminary examination, but this can be done later for those who take the prelim exam early in their program.

Finally, at the end of the program, the PHD student must defend their dissertation in an oral examination before their committee. Each committee member must also approve the written dissertation.

Similar to the PHD students, MS students must provide a research proposal which is approved by the supervisory committee and then defend their thesis in an oral examination before the committee. Committee members must also approve the written thesis. No preliminary or qualifying exam is required for the MS degree.

National Rankings

Table 12 shows a history of the graduate program rankings as compiled by US News & World Report. In that table, the entry "NR" means the program was not ranked in that year. Rankings among both public institutions and among all schools are shown in the table.

Table 12 – US News & World Report Graduate Program Rankings

Year Results Released		2000	2001	2002	2003	2004	2005	2006	2007	2008
EE	All	16	NR	NR	17	19	18	25	21	18
	Public	10	NR	NR	10	12	11	15	13	11
CE	All	NR	NR	NR	NR	21	23	21	25	29
	Public	NR	NR	NR	NR	11	14	12	15	15

Graduation Rates

Table 13 shows the number of graduates for each program by semester for the past 5 years.

Table 13 – Number of Graduates by Program and by Semester

Semester		Electrical Engineering			Computer Engineering		
		MEN	MS	PHD	MEN	MS	PHD
2007	Fall	15	13	6	6	3	0
	Summer	3	3	13	1	1	2
	Spring	8	6	7	3	1	3
	Total	27	22	26	10	5	5
2006	Fall	7	5	15	2	1	1
	Summer	2	8	8	1	2	2
	Spring	18	9	12	4	4	0
	Total	27	22	36	7	7	3
2005	Fall	5	16	7	3	2	5
	Summer	4	11	5	4	3	1
	Spring	7	10	6	2	0	0
	Total	16	37	18	9	5	6
2004	Fall	7	6	15	3	3	0
	Summer	4	14	15	0	0	1
	Spring	6	3	5	3	1	1
	Total	17	23	35	6	4	2
2003	Fall	0	7	9	1	5	1
	Summer	2	10	6	0	2	2
	Spring	6	16	9	0	1	1
	Total	8	33	24	1	8	4

C. Student Profiles

Graduate Student Cross Sections

As with most engineering programs throughout the country, our graduate program is largely composed of international students. While the department is aggressively recruiting domestic students for the graduate program and the numbers do seem to be slowly improving, there is still room for significant improvement in this area. Table 14 below shows statistics of the composition of our graduate student body over the last 6 years based on 12th class day rosters. Tables 15-16 show a more detailed cross-section of our incoming graduate classes over the last 3 years. While our graduate student body remains largely dominated by students from India and China, the steady increase in the percentage of students in the “other” category shows that we are building a more internationally diverse student body.

Table 14 – Composition of Graduate Students in the ECE Department

Semester	Domestic (% of total)	Female (% of total)	Minority (% of domestic)	Total Enrollment
Fall 2002	47 (14%)	49 (15%)	4 (9%)	330
Fall 2003	60 (17%)	59 (17%)	4 (7%)	356
Fall 2004	75 (20%)	62 (17%)	13 (17%)	367
Fall 2005	75 (22%)	49 (14%)	13 (17%)	345
Fall 2006	77 (20%)	57 (15%)	17 (22%)	392
Fall 2007	96 (20%)	80 (16%)	20 (21%)	490
Fall 2008	92 (19%)	79 (16%)	17 (19%)	495

Table 15 – New Graduate Students by Degree Program and Group

Area	Fall 2008				Fall 2007				Fall 2006			
	MEN	MS	PhD	Total	MEN	MS	PhD	Total	MEN	MS	PhD	Total
AMS	1	6	9	16	4	8	5	17	2	14	5	21
Bio/GSP	0	4	5	9	1	4	6	11	0	4	3	7
CE	1	20	8	29	3	27	7	38	0	11	3	14
Controls	0	7	2	9	2	3	3	8	1	4	1	6
EM	0	2	2	4	0	4	7	11	0	2	2	4
EPPE	1	9	9	19	0	12	13	25	0	10	8	18
SS/Nano	0	2	5	7	3	6	7	16	0	6	3	9
TSP	0	16	16	32	25	5	12	42	14	13	11	39
Total	3	66	56	125	38	69	60	168	17	64	36	118

Table 16 New Graduate Students by Nationality

Country	Fall 2008 (% of total)	Fall 2007 (% of total)	Fall 2006 (% of total)
India	45 (36%)	67 (40%)	42 (35%)
China	30 (24%)	31 (18%)	18 (15%)
USA	17 (14%)	25 (15%)	16 (13%)
Korea	5 (4%)	17 (10%)	14 (12%)
Tiawan	2(2%)	10 (6%)	10 (8%)
Others	27 (21%)	20 (15%)	18 (11%)

Standardized Test Scores

Average GRE scores for incoming graduate students are shown in Table 17. Note that in 2004, the Educational Testing Service replaced the analytical test with the writing test. Hence, the analytical averages reported in Table 17 starting in 2004 represent those students who took their GRE exams prior to 2004. As time progressed, there are fewer and fewer students with analytical scores and hence the average listed under GRE (A) for 2007 may not be very meaningful as there were only a couple of students at that point who still had analytical scores.

Table 17 - Standardized Test Scores of Incoming Graduate Students

Semester	GRE (Q)	GRE (V)	GRE (W)	GRE (A)
Fall 2002	778	560	--	713
Fall 2003	776	553	--	741
Fall 2004	769	538	4.6	735
Fall 2005	776	555	4.4	733
Fall 2006	775	522	4.1	729
Fall 2007	777	532	4.0	633
Fall 2008	782	507	3.9	--

Applications

With the exception of a temporary slowdown in 2004-005, the number of applications to our graduate programs has been encountering rapid growth. Applications for the Fall 2008 semester are over 2000, which represents about 1/6 of the total graduate applications to the entire university. As a result, we are able to be quite selective in our admissions. Unfortunately, we have to turn away many very qualified applicants in order to keep the enrollment numbers to a manageable level.

The number of students that enter the program each year is roughly controlled by the number of admissions we grant. As seen in Table 18, over the past several years we have seen a fairly consistent retention rate hovering around 20%. Hence we typically admit about 5 times more students than we would like to see attend. We did have an anomaly

in the Fall Semester of 2007 where the percentage of admitted students that actually attended rose inexplicably to 32%. This created a substantially larger class than intended. If this change in the retention rate continues, then we will have to dramatically reduce the number of admissions.

It should be noted that a very positive trend can be seen from the data in Table 18. Although our selectivity has hovered around 30% over the last 7 years (and somewhat below that in the last year), our retention rate is steadily increasing. That is, even though we are remaining just as careful about who we admit, we are able to convince more of those students that we accept to attend our program. This seems to indicate that applicants are viewing our program more favorably than in the past. It appears that our reputation is improving among applicants to the graduate program. This would also be confirmed by the steep increase in the volume of applications we are receiving.

Table 18 – Applications to the ECE Graduate Programs by Semester

Applications	2002			2003			2004		
	Spr	Sum	Fall	Spr	Sum	Fall	Spr	Sum	Fall
Denied	99	8	956	115	16	1027	68	1	660
Accepted	57	10	440	80	6	442	45	11	308
Total	156	18	1396	195	22	1469	113	12	908
Selectivity (%)	36.5	55.6	31.5	41.0	27.3	30.1	39.8	91.7	33.9
Attended			75			81			69
Retention Rate			17%			18%			22%
Applications	2005			2006			2007		
	Spr	Sum	Fall	Spr	Sum	Fall	Spr	Sum	Fall
Denied	66	2	778	85	5	948	54	0	1163
Accepted	35	4	302	57	3	536	72	9	507
Total	105	6	1080	142	8	1484	126	9	1670
Selectivity (%)	33.3	66.7	28.0	40.1	37.5	36.1	57.1	100	30.4
Attended	7	3	62	21	4	121	24	7	153
Retention Rate	21%			25%			31%		
Applications	2008								
	Spr	Sum	Fall						
Denied	90	6	1470						
Accepted	49	4	535						
Total	139	10	2005						
Selectivity (%)	35.3	40	26.7						
Attended			126						
Retention Rate	24%								

Financial Support

Graduate students find support in a variety of forms. Research assistants (RAs) are funded by individual faculty members through contracts, grants and gift monies.

Teaching Assistants (TAs) are hired by the department to teach the laboratory component of undergraduate and graduate lab courses. Some students are also hired as Graduate Assistant – Non-Teaching (GANT). These students usually have responsibilities that are not research oriented, but do not involve direct teaching of students. For example, the department webmaster is usually hired as a GANT or a student may be hired to help a professor develop new material for a course which may be introduced in a future semester. Many of our graduate students are also given fellowships or one-time scholarships. These awards do not require any particular service (i.e., research or teaching) on the part of the student, but rather provide a stipend to support the student’s studies. Fellowships come in a variety of amounts and from a variety of sources. One-time competitive scholarships are typical in the amount of \$1,000 but they also qualify the student to pay the in-state tuition rate (fellowship will also qualify the student for in-state tuition). For out-of-state students, the tuition break they receive is on the order of \$5,000 per year and it is much larger than the stipend itself. Tables 19 and 20 show the number of students supported via these various mechanisms for the past several years.

Table 19 - Graduate Assistant Support by Semester

Support	FY 2005			FY 2006		
	Fall04	Spring05	Summer05	Fall05	Spring06	Summer06
RA	132	121	115	101	98	80
TA	22	35	5	27	27	7
GANT	14	13	7	10	6	6
Support	FY 2007			FY 2008		
	Fall06	Spring07	Summer07	Fall07	Spring08	Summer08
RA	82	73	80	88	100	110
TA	30	36	13	38	31	11
GANT	7	6	10	15	6	16

Table 20 - Scholarship/Fellowship Support by Year

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
One-Time Scholarships	42	65	116	54	64
Fellowships	10	15	17	26	36

Internships

It is common for many of our graduate students to spend one or more semesters working at various industry or government labs on an internship. These internships offer valuable work experience as well as a source of funding to support their studies. They also offer students a chance to get a good foot in the door towards a potential full time job when they graduate. We have seen a substantial increase in the number of internships taken over the past few years as shown in Table 21. This is a sign of a healthy job market in the electrical and computer engineering fields and a high demand of our students.

Table 21 – Number of Graduate Students on Internships by Semester

	2002	2003	2004	2005	2006	2007	2008
Spring	8	5	4	11	9	8	17
Summer	24	15	26	18	2	74	83
Fall	12	5	9	10	30	16	21

V. Strategic Plan/Program Assessment

In order to provide continual assessment of our graduate programs, the department has established a mechanism by which the effectiveness of its programs will be measured. Based on the mission of the department, we have established a set of core outcomes which should be achieved by our graduate programs. In order to measure the extent to which these outcomes are being achieved, a set of measurables have been defined for each outcome. The mission statement, set of outcomes, measures, and the data collection procedures are described in the following sections.

A. Mission Statement

The mission of the department of Electrical and Computer Engineering is threefold:

- To create new knowledge and challenge minds by participation in the process of discovery and invention.
- To educate electrical and computer engineers with a solid background of fundamentals stimulating their imaginations and preparing them for an exciting future.
- To serve society through research, education and outreach activities.

This mission statement has been in place for a number of years and encompasses all aspects of the department, not just the graduate programs.

B. Outcomes

In order to help the department fulfill its mission, the graduate program seeks to achieve the following outcomes:

- **Outcome 1:** The graduate programs in Electrical and Computer Engineering should attract quality students.
- **Outcome 2:** The graduate programs in Electrical and Computer Engineering should produce graduate students capable of performing quality research.
- **Outcome 3:** The graduate programs in Electrical and Computer Engineering should produce students in demand from both industry and academia.

The second outcome would not necessarily apply to our Master of Engineering programs as those are non-research oriented degree programs. However, many of our MEN students have the necessary tools to participate in research activities, even though they may have not yet had such experiences.

C. Measures

The extent to which the graduate program is achieving these outcomes will be measured using the following metrics:

- **Outcome 1** – Quality of Incoming Students

- GRE scores of incoming graduate students
- Admission selectivity
- Number of students receiving prestigious fellowships (e.g., NSF fellowships, Hertz Fellowships, Graduate Merit Fellowships)
- **Outcome 2 – Quality of Student Research**
 - Number of student publications in journals and conferences
 - Number of student research awards (e.g., best paper awards)
 - Number of patents
- **Outcome 3 – Demand of Graduates**
 - Salaries of graduates (as compared to national averages)
 - Percentage of graduates employed in engineering positions upon or soon after graduation
 - Number of graduates in faculty positions

D. Data Collection

Data collection will be coordinated through the Department Graduate Office. Statistics regarding the measures associated with Outcome 1 have been collected for a number of years. Some are presented in this self-study. Statistics regarding the measures associated with Outcomes 2 and 3 will be collected through the use of an exit interview. Starting with the Fall 2008 semester, anytime a graduate student applies for graduation, they will be asked to complete an exit survey which will provide us with the measures specified. The Graduate Studies Committee will review the data collected and make recommendations for improvements on a yearly basis.

E. Strengths/Weaknesses of the Program

The following list of strengths and weaknesses of the programs was compiled by the Department Head and Graduate Coordinator in consultation with the faculty advisory committee (i.e., the Chair and Professorship Committee). Most of the items in these lists are documented by various measures in this self-study.

Program Strengths

- From a programmatic standpoint, there are a number of research groups that have developed international recognition. Among those areas are Genomic Signal Processing, Telecommunications, Analog and Mixed Signal, Power Systems and Power Electronics and Biomedical Imaging.
- Fundamental to a strong graduate program are high caliber students. We are able to attract a high number of very high quality students from the best programs throughout the world. These students make it possible to carry on top caliber research in a variety of specializations. As mentioned previously in this self-study, we have seen a significant increase in both the quantity and quality of applicants to our department in

recent years. We view this as evidence that the reputation of our graduate programs is improving.

- Another aspect of a strong graduate program is high quality faculty. We are particularly excited about the large number of young faculty (over 20) we have hired over the last 5 years. These new hires were recruited from top research programs throughout the country. We have started to see some fruits of this hiring spree as four of our junior faculty have been awarded prestigious NSF Career Awards in the last year alone (from a total of 7 Career Awards throughout the College during the same time). In addition, we have experienced a substantial increase in the amount research funding over the last 3 years with the amount of funding almost doubling in FY 08 compared to the previous year. All of the awards were either from individual PIs or groups of faculty and none was from one-time major awards. As the young faculty we hired recently continue to mature we will see more accomplishments and continued exposure for our programs.
- As mentioned previously in this self-study, our department has experienced a very low turnover of faculty over the last eight years. It is our belief that this is largely due to the attractive professional environment created by the Department, College, University and the community as a whole. Faculty in the ECE Department are provided with every opportunity to succeed and overall are happy with their professional and personal environment. This leads to stability in the faculty which is a major benefit to the programs.
- One emerging strength is our branch campus in Qatar, Texas A&M University at Qatar (TAMUQ). It is clear that this program will provide researchers in the ECE Department with access to a large source of external funding which may not be readily accessible to faculty in peer institutions. We already have two large research contracts funded by companies in Qatar (Qtel, RasGas) which support both the program in Qatar and also research efforts in College Station. In addition, the department has had several research grants funded by the Qatar National Research Foundation (QNRF). Access to these sources of funding may cause a non-trivial increase in the department research funding in coming years. At the same time the creation of a graduate program at TAMUQ will provide opportunities for our students to obtain international experience by spending time there.

Program Weaknesses

- As with many engineering programs throughout the country, our graduate programs suffer from a noticeable lack of domestic students. The department, college and university administration has put significant effort and resources into improving this situation. We have seen some gradual improvement in this area, but we still have a long way to go in this respect.
- Coupled with the above issue is a limited amount of funds available for graduate fellowships. Currently, we have endowments that are sufficient to support about 4 graduate fellowships per year. Ideally, for a program the size of ours, we would like to have at least 5 times this level. We use the fellowships that we have to recruit a

few domestic students, but having more fellowship monies available would help our ability to attract more such students.

- Although research funding has been steadily increasing in recent years, reaching a departmental record level of almost \$10M in FY 08, there is still margin for improvement compared to other peer departments of comparable size. One noticeable weakness in the department is the absence of major, multi-year research programs/centers that involve multiple faculty and can act as a funding buffer for individual faculty grants while reducing the variance of the departmental funding levels over time.
- Although the department has grown substantially over the last five years through the reinvestment program, the operational budget of the department has not grown proportionally. This means that the department has very limited funds for new staff, technicians and teaching assistants. Having better support in this area would enable the faculty to be more productive.
- While space has been adequate over the last few years, as the faculty has grown, the size of the graduate student population is growing as well. As junior faculty become more productive, they will take on more graduate students and we will need more space for graduate offices and labs. We are already experiencing the effects of lack of space and this will continue to get worse in time.

F. Departmental Vision

General Philosophy - The single most important guiding principle in maintaining a quality program that continually improves in time is the insistence on hiring faculty with strong fundamentals who are able to apply their expertise to diverse areas of research. With the constantly changing world we live in, in which knowledge increases exponentially fast, the time-constant of interest in any particular research area is of the order of 3-4 years and only faculty with strong fundamental expertise that can be applied to diverse problems can be successful in the long run. Quality faculty tend to help hire other quality faculty and, thus, the “quality cycle” is sustainable and tends to move the department upward. Also, quality faculty tend to attract good graduate students, which is the other important ingredient for a strong research program. Once quality faculty and graduate students are present, the department then must do what it can to facilitate their growth by removing as many administrative obstacles from their way as possible and providing them with the resources they need to the extend possible. It is also important for us to be outward looking. In other words, our faculty should be collaborating in research with others at other institutions and be visible in professional society meetings and through professional service positions.

As a result of the reinvestment program, the size of our faculty has grown from about 50 to approximately 70 over the last five years. Of those 70 faculty, approximately 65 are actively involved in research activities. The remainder are, for the most part, in full time administrative positions. Based on a faculty of this size, we believe the following goals

to be realistic:

Graduate Student Supervision – We would like to see an average load of 4 PHD students and 2 MS students per faculty member. This will provide a manageable research team that will be able to provide a fairly productive level of research. Of course, we understand that there will be great variability in this number. Some faculty will have many more students, and some will have less, but this seems to be a reasonable target number.

Program Student Population – Based on the above mentioned faculty load, the number of graduate students in the program would be maintained at about 260 PHD students and 130 MS students. Assuming that we also maintain approximately 130 MEN students as well, this would lead to a program size of 520 students. This is not too far from our current population and so we will need to be vigilant to carefully control the number of new students so that we do not grow too far beyond the current population.

Funding – Ideally, we would like each faculty member (on average) to provide RA support for three PHD students as well as funding to cover their summer salaries and to buy out of one course every other year as well as adequate travel and equipment monies. Based on this model, the required level of external research funding for the department would be approximately \$13M per year. Based on the current funding trends, we feel that it is an achievable goal. Furthermore, this level of funding will generate a significant amount of revenue to the department through overhead on contracts and grants. This will enable the department to provide greater support to faculty and students through TAs, GANTs and Fellowships. It will also enable the department to provide seed money to groups of researchers who have novel ideas for promising new research initiatives.

Faculty Hiring – Although we have completed the hiring associated with the reinvestment program, it is anticipated that a number of new faculty will need to be hired each year as a result of occasional retirements, resignations, etc. We will continue to hire quality faculty throughout the country as we have for the past several years. We will also continue to focus on hiring those that in addition to their intellectual strength have the potential to generate funds for developing and sustaining their research programs. It is these human resources that are the key to our future success. As talented as our hired faculty are, the department must then assure that they have adequate resources and the proper professional environment to flourish.

External Visibility – We have built one of top programs in Electrical and Computer Engineering. However, while we have a solid reputation throughout the world, we believe that our reputation does not yet reflect our recent growth and improvement. In order to improve our reputation amongst our peers, it is imperative that our faculty and students are participating in activities that will bring visibility to our programs. Hence, our faculty need to be encouraged and supported in participation in international conferences, professional service, and educational outreach activities. Furthermore, we need to be vigilant in helping our students to obtain high profile external funding such as NSF Fellowships upon entering the program and also to place them in academic positions

amongst our peer educational institutions upon graduation.

Strategic Research Areas

The college of engineering and the university are currently going through a strategic planning process and as part of that process our department has submitted four two-page white papers describing four theme areas our faculty believe we have strengths in and are areas we should be focusing on in the future. The titles and summaries of these four areas are provided below:

1. *Imaging and Sensing Technologies for Personalized Medicine*

Advances in technology have played a major role in the dramatic increase in life expectancy from 45 years in 1900 to over 70 years in 2000. Molecular imaging promises to usher in an era of “personalized medicine” where our emerging understanding of the human genome, coupled with a revolution in drug discovery and development, will enable disease to be diagnosed and treated well before its emergence as a health problem. The benefit to society could be immense. Imaging and sensing are critical technologies allowing us to “close the loop” between diagnosis and treatment with real-time feedback of the response of disease to treatment. Electrical and Computer Engineers will play a leading role in developing this critical technology: imaging and sensing across scales, from the whole body to the cellular and molecular level.

2. *Genomic Systems Medicine*

Genomic Systems Medicine concerns the use and adaptation of time-tested engineering systems approaches, including control theory, statistical estimation and detection theory, information theory and signal processing, for the management and treatment of diseases, such as cancer. By modeling the multivariate interactions between genes as a genetic regulatory network and by using engineering approaches to favorably affect its behavior, the expectation is to dramatically increase the success rate of current therapies. The Electrical and Computer Engineering Department at Texas A&M University has been a leader in this area over the last few years and has strong funding and research collaborations with the Translational Genomics Research Institute (TGen), a leading cancer research institute in the US and internationally. Investment of resources by the college and the university in this emerging area will ensure that Texas A&M University will continue to be a leader nationally and internationally.

3. *Reliable and Secure Telecommunication Systems and Networks*

The reliability and secure operation of telecommunication systems is vital to our nation's economy and security. Telecommunication systems are currently so pervasive in our every day lives, from cell phones to wi-fi networks in homes and businesses to satellite communications, not to mention the huge impact and widespread use of the internet, that any disruption invariably leads to significant economic loss. At the same time, as energy resources become more scarce and transportation costs rise, the instant connectivity provided by high speed networks helps reduce the need for physical presence, thereby reducing energy consumption. In the area of security and information gathering, again, telecommunication systems

are key. Clearly, the underlying technologies that allow us to collect, process and communicate information over distances are enabling technologies crucial to many functions in our daily lives. TAMU has all of the ingredients and it is uniquely positioned to be a world leading institution in the area of design, analysis, deployment, management, performance evaluation, and security of next generation wireline and wireless telecommunication networks, including optical, wireless, and cellular systems.

4. Electric Power Conversion Technologies for Energy Sustainability

The United States' electricity infrastructure is one of the greatest engineering marvels of the 20th century. However, to meet the rising electric power demand of the 21st century, while reducing the deleterious effects of energy generation on the environment, significant improvements in electric systems and electric power conversion technologies are necessary. Examples include increasing the efficiency and reducing harmful emissions in coal-plant power generation, developing technologies for low cost and efficient use of fuel-cell powered distributed generation, developing further 'plug-in hybrid vehicles' for transportation, improving energy sustainability by building technologies to utilize wind and solar energy generation and making efficient use of biofuels. Our power systems and power electronics faculty in the department work directly to solve the above problems; however, a large number of other faculty in the department and across the college have core expertise that can be used to provide efficient solutions to the above problems, such as faculty in nano electronics, materials, nano-bio, control systems and genomics in the our department and faculty in every other department in the college.

Appendices

List of Faculty

Graduate Handbook

Course Syllabi

Faculty CVs

November 2008

**TEXAS A&M UNIVERSITY
COLLEGE STATION
TEXAS**

Appendix A – List of ECE Faculty

Name	Group
Bhattacharyya, S.P.	Control Systems
Biard, B.	Solid State Electronics, Photonics & Nano-Engineering
Braga-Neto, U.	Biomedical Imaging & Genomic Signal Processing
Butler-Purry, K.	Electric Power & Power Electronics
Cantrell, P.E.	Computer Engineering
Chamberland, J-F	Telecommunications & Signal Processing
Chan, A.K.	Electromagnetics & Microwaves
Chang, K.	Electromagnetics & Microwaves
Cheng, M.	Solid State Electronics, Photonics & Nano-Engineering
Cheng, X.	Solid State Electronics, Photonics & Nano-Engineering
Choi, G.S.	Computer Engineering
Cui, R.	Telecommunications & Signal Processing
Datta, A.	Control Systems
Dougherty, E.	Biomedical Imaging & Genomic Signal Processing
Ehsani, M.	Electric Power & Power Electronics
Eknoyan, O.	Solid State Electronics, Photonics & Nano-Engineering
Enjeti, P.	Electric Power & Power Electronics
Entesari, K	Analog & Mixed Signal
Geroghiades, C.	Telecommunications & Signal Processing
Halverson, D.R.	Telecommunications & Signal Processing
Han, A.	Biomedical Imaging & Genomic Signal Processing
Harris, Rusty	Solid State Electronics, Photonics & Nano-Engineering
Hemmer, P.	Solid State Electronics, Photonics & Nano-Engineering
Howze, J.W.	Control Systems
Hoyos, S.	Analog & Mixed Signal
Hu, J.	Computer Engineering
Huang, G.M.	Electric Power & Power Electronics
Huff, G.	Electromagnetics & Microwaves
Ji, J.	Biomedical Imaging & Genomic Signal Processing
Kameoka, J.	Solid State Electronics, Photonics & Nano-Engineering
Karsilayan, A.	Analog & Mixed Signal
Kezunovic, M.	Electric Power & Power Electronics
Khatri, S.	Computer Engineering
Kish, L.B.	Solid State Electronics, Photonics & Nano-Engineering
Kundur, D	Telecommunications & Signal Processing
Li, P.	Computer Engineering

Liu, T.	Telecommunications & Signal Processing
Lu., M.	Computer Engineering
Madsen, C.	Solid State Electronics, Photonics & Nano-Engineering
Maldonado, T.	Solid State Electronics, Photonics & Nano-Engineering
Michalski, K.A.	Electromagnetics & Microwaves
Miller, S.	Telecommunications & Signal Processing
Narayanan, K.	Telecommunications & Signal Processing
Nevels, R.D.	Electromagnetics & Microwaves
Nguyen, C.	Electromagnetics & Microwaves
Pfister, H.	Telecommunications & Signal Processing
Reddy, A.L.N.	Computer Engineering
Righetti, R.	Biomedical Imaging & Genomic Signal Processing
Russell, B.D.	Electric Power & Power Electronics
Sanchez-Sinencio, E.	Analog & Mixed Signal
Savari, S.	Telecommunications & Signal Processing
Shakkotai, Skrinivas	Computer Engineering
Shi, W.	Computer Engineering
Silva-Martinez, J	Analog & Mixed Signal
Singh, C.	Electric Power & Power Electronics
Sprintson, A.	Computer Engineering
Strieter, F.	Solid State Electronics, Photonics & Nano-Engineering
Su, C.B.	Solid State Electronics, Photonics & Nano-Engineering
Toliyat, H.	Electric Power & Power Electronics
Wang, H.	Solid State Electronics, Photonics & Nano-Engineering
Watson, K.	Computer Engineering
Weichold, M.H.	Solid State Electronics, Photonics & Nano-Engineering
Wright, S.M.	Biomedical Imaging & Genomic Signal Processing
Xiong, Z.	Biomedical Imaging & Genomic Signal Processing
Xiong, Z.	Telecommunications & Signal Processing
Yoon, B.J.	Biomedical Imaging & Genomic Signal Processing
Zhang, X.	Computer Engineering
Zou, J.	Solid State Electronics, Photonics & Nano-Engineering
Zourntos, T.	Control Systems

Appendix B – Graduate Handbook

TEXAS A&M UNIVERSITY

Department of Electrical and Computer Engineering



Graduate Student Handbook Fall of 2008



DR. COSTAS GEORGHIADES



DR. SCOTT MILLER

PEOPLE TO CONTACT

Dr. Costas Georghiadis	Department Head
Dr. Karen Butler-Purry	Associate Department Head
Dr. Scott Miller	Graduate Coordinator
Ms. Debbie Hanson	Senior Administrative Coordinator
Ms. Tammy Carda	Senior Academic Advisor I
Ms. Janice Allen	Scholarship/Fellowship Administration
Ms. Linda Currin	Payroll Administration



Graduate Studies Committee

Dr. S. Miller:
(Telecommunications and Signal Processing)

Graduate Coordinator

Dr. S.P. Bhattacharyya:
(Controls)

Dr. J. Silva-Martinez:
(Analog & Mixed Signals)

Dr. C. Nguyen:
(Electromagnetics & Microwave)

Dr. J. Ji:
(Biomedical Imaging and Genomic Signal Processing)

Dr. O. Eknoyan:
(Solid State Electronics, Photonics and Nano-Engineering)

Dr. G. Huang:
(Electric Power and Power Electronics)

Dr. W. Shi:
(Computer Engineering)

Dr. K. Narayanan:
(Telecommunications and Signal Processing)

Requirements for Graduate Electrical Engineering Degrees in the Department of Electrical and Computer Engineering

Master of Engineering Degree

1. Total Number of Hours (30)
2. A minimum of 27 classroom hours (excludes 681, 684, 685).
 - Classroom hours must be taken from courses within the College of Engineering and College of Science.
 - At least 18 classroom hours must be ECEN courses.
3. Transfer hours allowed from another institution (6)
 - Transfer hours must be from a “peer institution.”
 - Transfer hours are subject to the approval of the GSC.
4. Undergraduate hours allowed (8)
 - Only 400 level undergraduate courses can be included on degree plan.
5. Seminar (681), Internship (684), Directed Studies (685) hours allowed (3)
 - Research (691) hours are not allowed on an MEN degree plan.
6. Final examination may be waived for any MEN student maintaining a GPR of at least 3.0. A petition to waive the final exam must be submitted through the Graduate Office.
7. A final project report is required to be submitted to the Graduate Office. A graded project report from any ECEN graduate course can be used to fulfill this requirement.
8. Composition of supervisory committee
 - At least two members from within the ECE Department.
 - At least one member from outside the ECE Department.
 - The default MEN committee consists of:
 - Prof. S. Miller (ECE)
 - Prof. G. Huang (ECE)
 - Prof. W. Lively (CPSC)
 - In the near future, the MEN committee requirement will be removed and only the Graduate Coordinator’s signature will be needed on various forms.

Requirements for Graduate Electrical Engineering Degrees in the Department of Electrical and Computer Engineering

Master of Science Degree

1. Total Number of Hours (32)
2. A minimum of 24 classroom hours (excludes 681, 684, 685, 691).
 - Classroom hours must be taken from courses within the College of Engineering and College of Science.
 - At least 15 classroom hours must be ECEN courses.
3. A minimum of 5 hours of research (691) must be included on the degree plan. A maximum of 8 research hours can be included.
4. Transfer hours allowed from another institution (6)
 - Transfer hours must be from a “peer institution.”
 - Transfer hours are subject to the approval of the GSC.
5. Undergraduate hours allowed (8)
 - Only 400 level undergraduate courses can be included on degree plan.
6. Seminar (681), Internship (684), Directed Studies (685) hours allowed (3)
7. Final defense of thesis is required for all MS students.
 - A thesis proposal must be approved by the supervisory committee and submitted to the Graduate Office prior to the defense.
 - Date and location of the thesis defense must be scheduled through the Graduate Office so that official notification can be provided to OGS.
 - Thesis must be submitted to committee members at least two weeks before defense.
8. Composition of supervisory committee
 - At least two members from within the ECE Department and within the student’s focus area.
 - At least one member from within the ECE Department but outside the student’s focus area.
 - At least one member from outside the ECE Department.

Requirements for Graduate Electrical Engineering Degrees in the Department of Electrical and Computer Engineering

Doctor of Philosophy Degree

1. Total Number of Hours (64 or 96)
 - For students who already hold a Master's degree, 64 total hours are required.
 - For "direct PHD" students, 96 hours are required.
2. A minimum of 18 (or 42) classroom hours (excludes 681, 684, 685, 691).
 - 18 hours required for students with a previous Master's degree and 42 for direct PHD students.
 - Classroom hours must be taken from courses within the College of Engineering and College of Science.
 - At least 9 (or 24) classroom hours must be ECEN courses.
3. A maximum of 6 transfer hours allowed from another institution (or 24 hours for direct PHDs)
 - Transfer hours must be from a "peer institution."
 - Transfer hours are subject to the approval of the GSC.
4. Undergraduate hours allowed (8)
 - Only 400 level undergraduate courses can be included on degree plan.
 - If you used 400 level hours on your Master's degree plan, then you must reduce the number of allowed undergraduate hours by that amount.
5. No more than 2 credit hours of Internship (684) are allowed.
6. No more than 3 credit hours of Directed Studies (685) are allowed.
 - Students working on a research project should enroll in Research (691) hours.
7. All PHD students are required to pass a preliminary examination.
 - PHD students are required to schedule their prelim exam by the end of their 4th semester (excluding summers) or 6th semester for direct PHDs. Students who have not scheduled their prelim by the appointed time will be blocked from further registration until they do so.
 - OGS must be officially notified of the exam schedule at least three weeks prior to the exam. This should be done through the graduate office.
 - Student must download the checklist and signature page from the OGS web site. The checklist must be signed by the advisor and Graduate Coordinator prior to the exam.
 - The prelim exam consists of a written and an oral examination.
 - The written portion will consist of one of two formats:

- Format A - Individual exams administered by student's supervisory committee members.
 - Only the outside committee member may waive the exam. All ECE committee members must give a written exam.
 - The scope and format of the individual exams will be specified to the student by the committee members.
 - All written exams must be administered within 3 weeks prior to the scheduled oral examination date.
 - Format B – Common exam administered by student's focus group.
 - Exam given once per semester on a date specified by group.
 - All students taking their prelims from that group in that semester will take the same written exam.
 - Three week time window does not apply to the common exam.
 - Currently, only the TSP group is using the common exam format.
 - Students who fail the prelim exam will have one opportunity to retake the exam within 6 months of the original exam date.
8. Final defense of dissertation is required for all PHD students.
- A dissertation proposal must be approved by the supervisory committee and submitted to the Graduate Office prior to the defense. Typically this proposal is submitted in conjunction with the preliminary exam, but it can be submitted afterwards.
 - Date and location of the final defense must be scheduled through the Graduate Office so that official notification can be provided to OGS.
 - Dissertation must be submitted to committee members at least two weeks before defense.
9. Composition of supervisory committee
- At least two members from within the ECE Department and within the student's focus area.
 - At least one member from within the ECE Department but outside the student's focus area.
 - At least one member from outside the ECE Department.

Requirements for Graduate Computer Engineering Degrees *in the Department of Electrical and Computer Engineering*

Master of Engineering Degree

1. Total Number of Hours (30)
2. A minimum of 27 classroom hours (excludes 681, 684, 685).
 - Classroom hours must be taken from courses within:
 - College of Engineering
 - College of Science
 - College of Business (*at most one course, and only from the INFO Dept.*)
 - A minimum of 24 classroom hours from
 - Electrical Engineering
 - Computer Science
 - A minimum of 13 classroom hours from Electrical Engineering
3. Transfer hours allowed from another institution (6)
 - Transfer hours must be from a “peer institution.”
 - Transfer hours are subject to the approval of the GSC.
4. Undergraduate hours allowed (9)
 - Only 400 level undergraduate courses can be included on degree plan.
5. One hour of seminar is allowed (ECEN/CPSC 681) but is NOT required.
6. Internship (684), Directed Studies (685) hours allowed (3)
 - Research (691) hours are not allowed on an MEN degree plan.
7. Students may petition for exemption from the final oral exam with approval of the student’s committee chair. A petition to waive the final exam must be submitted through the Graduate Office.
8. A report is required in at least one of the EE or CS courses. This report must be presented either prior to the approval of an application for exemption from the final oral exam (requires a minimum GPR of 3.0), or at the time of the final oral exam.
9. Composition of supervisory committee
 - At least two within the Computer Engineering Group from ECEN.
 - At least one member from outside the ECE Department.
 - In the near future, the MEN committee requirement will be removed and only the Graduate Coordinator’s signature will be needed on various forms.

Requirements for Graduate Computer Engineering Degrees in the Department of Electrical and Computer Engineering

Master of Science Degree

1. Total Number of Hours (32)
2. A minimum of 24 classroom hours (excludes 681, 684, 685, 691).
 - Classroom hours must be taken from courses within:
 - College of Engineering
 - College of Science
3. Transfer hours allowed from another institution (6)
 - Transfer hours must be from a “peer institution.”
 - Transfer hours are subject to the approval of the GSC.
4. Undergraduate hours allowed (9)
 - Only 400 level undergraduate courses can be included on degree plan.
5. Seminar (681), Directed Studies (685) hours and Research (691)
 - 8 hours maximum of these courses
 - 4 hours minimum of research (691)
 - One hour of seminar is allowed (ECEN/CPSC 681) but is NOT required.
6. Final defense of thesis is required for all MS students.
 - A thesis proposal must be approved by the supervisory committee and submitted to the Graduate Office prior to the defense.
 - Date and location of the thesis defense must be scheduled through the Graduate Office so that official notification can be provided to OGS.
 - Thesis must be submitted to committee members at least two weeks before defense.
7. Composition of supervisory committee
 - At least two within the Computer Engineering Group from ECEN.
 - At least one member from outside the ECE Department.

Requirements for Graduate Computer Engineering Degrees in the Department of Electrical and Computer Engineering

Doctor of Philosophy Degree

1. Total Number of Hours (64 or 96)
 - For students who already hold a Master's degree, 64 total hours are required.
 - For "direct PHD" students, 96 hours are required.

2. A minimum of 18 (or 42) classroom hours (excludes 681, 684, 685, 691).
 - 18 hours required for students with a previous Master's degree and 42 for direct PHD students.

3. Undergraduate hours allowed (8)
 - Only 400 level undergraduate courses can be included on degree plan.
 - If you used 400 level hours on your Master's degree plan, then you must reduce the number of allowed undergraduate hours by that amount.

4. Two credit hours of Seminar (ECEN/CPSC 681) are allowed but NOT required.

5. All PHD students are required to pass a preliminary examination.
 - PHD students are required to schedule their prelim exam by the end of their 4th semester (excluding summers) or 6th semester for direct PHDs. Students who have not scheduled their prelim by the appointed time will be blocked from further registration until they do so.
 - OGS must be officially notified of the exam schedule at least three weeks prior to the exam. This should be done through the graduate office.
 - Student must download the checklist and signature page from the OGS web site. The checklist must be signed by the advisor and Graduate Coordinator prior to the exam.
 - The prelim exam consists of a written and an oral examination.
 - The written portion will consist of individual exams administered by student's supervisory committee members.
 - Only the outside committee member may waive the written exam. All ECE committee members must give a written exam.
 - The scope and format of the individual exams will be specified to the student by the committee members.
 - All written exams must be administered within 3 weeks prior to the scheduled oral examination date.
 - Students who fail the prelim exam will have one opportunity to retake the exam within 6 months of the original exam date.

