ELECTRICAL ENGINEERING (M.S.)

Academic Year

2011-2012

School

Graduate School School Web site

School Dean

Henry Flores, Ph.D. hflores@stmarytx.edu

Department

Engineering

Program Director

Djaffer Ibaroudene, Ph.D. dibaroudene@stmarytx.edu

Admission Requirements

To be considered for admission into St. Mary's University Graduate School, you will need to submit the following (along with application):

- (2) Letters of Recommendation
- (2) Official Transcripts reflecting your degree earned.
- Official GRE/GMAT/MAT
- Official TOEFL (80 Computer based) (international students only)
- Financial Guarantee (international students only)

Program Specific Admission Requirements

Admission is granted to those with high promise for success in graduate study. Applicants demonstrate this potential through previous academic records and testing.

To be considered for admission to the M.S.E.E. program, applicants must:

1. Have a Bachelor of Science (B.S.) degree in electrical engineering, computer engineering or a closely related discipline. Applicants who earned a bachelor's degree in a closely related discipline, such as physics or mathematics, may be admitted with the provision that they take the prerequisite courses listed below. The Graduate Program Director will evaluate applicants from other disciplines on an individual basis.
2. Have a minimum Grade Point Average (GPA) of 3.00 (A = 4.00) for their bachelor's degrees.
3. Have a minimum GRE quantitative score of 600 and a minimum GRE analytical score within the 50th percentile.

4. Applicants who fail to meet any of the above standards may be admitted on a conditional basis. The graduate program director evaluates these cases on an individual basis.
5. Submit the TOEFL scores (international students only) and show a minimum of 213 in the computer-based test or 550 in the paper-based test.
6. Submit a completed application form, a written statement of purpose indicating the applicant's interests and objectives, two letters of recommendation concerning the applicant's potential for succeeding in the graduate program and official transcripts of all college level work.

Prerequisites

EG 2141 Logic Design Laboratory
EG 2152 Circuit Laboratory
EG 2341 Fundamentals of Logic Design
EG 2352 Circuit Analysis I
EG 2353 Circuit Analysis II
EG 3372 Signals and Systems

Degree Requirements

Electrical Engineering (30 hrs)
Non-Thesis

Course #	Course Title	Hours
Engineering Courses Required (15hrs):		
EG6308	Random Variables & Stochastic Processes	3
EG6350	Digital Signal Processing I	3
EG6362	Computer Vision & Pattern Recognition	3
EG6365	Automatic Control System (S/G)	3
EG6367	Communication Systems (S/G)	3
Engineering Electives (15hrs):		
EG6301	Statistical Data Analysis	3
EG6311	Wireless Communication	3
EG6312	Data Mining	3
EG6318	Introduction to VSLI	3
EG6328	Software Engineering	3
EG6338	Special Topics	3
EG6345	Digital Control Systems	3

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Course #	Course Title	Hours
EG6356	Computer Networking	3
EG6357	Computer Controlled Systems	3
EG6358	Stochastic Control Theory	3
EG6359	Optical Communications	3
EG6360	Digital Signal Processing II	3
EG6364	Digital Speech Processing	3
EG6370	Parallel Processing	3
EG6374	Computer Architecture	3
EG6376	Neural Networking	3
EG6378	Microprocessors	3
EG6380	Microcomputer Interfacing	3
EG6386	Engineering Problem Solving	3
EG6388	Data Acquisition, Presentation, & Analysis	3
EG6390	Digital System Design with VHDL	3
EG6392	Network Programming	3
EG6396	Computer Security	3
EG6397	Fault-Tolerant Computing	3
EG7304	Requirements Engineering	3
EG7305	Object-Oriented Analysis, & Design Methodologies	3
EG7306	Total Quality Systems	3
EG7155	Internship	1
EG7255	Internship	2
EG7355	Internship	3
	Total hours	**30**

Electrical Engineering (30 hrs)
Thesis

Course #	Course Title	Hours
Engineering Courses Required (15hrs):		
EG6308	Random Variables & Stochastic Processes	3

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Course #	Course Title	Hours
EG6350	Digital Signal Processing I	3
EG6362	Computer Vision & Pattern Recognition	3
EG6365	Automatic Control System (S/G)	3
EG6367	Communication Systems (S/G)	3
Engineering Electives (12hrs):		
EG6301	Statistical Data Analysis	3
EG6311	Wireless Communication	3
EG6312	Data Mining	3
EG6318	Introduction to VSLI	3
EG6328	Software Engineering	3
EG6338	Special Topics	3
EG6345	Digital Control Systems	3
EG6356	Computer Networking	3
EG6357	Computer Controlled Systems	3
EG6358	Stochastic Control Theory	3
EG6359	Optical Communications	3
EG6360	Digital Signal Processing II	3
EG6364	Digital Speech Processing	3
EG6370	Parallel Processing	3
EG6374	Computer Architecture	3
EG6376	Neural Networking	3
EG6378	Microprocessors	3
EG6380	Microcomputer Interfacing	3
EG6386	Engineering Problem Solving	3
EG6388	Data Acquisition, Presentation, & Analysis	3
EG6390	Digital System Design with VHDL	3
EG6392	Network Programming	3
EG6396	Computer Security	3
EG6397	Fault-Tolerant Computing	3

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Course #	Course Title	Hours
EG7304	Requirements Engineering	3
EG7305	Object-Oriented Analysis, & Design Methodologies	3
EG7306	Total Quality Systems	3
EG7155	Internship	1
EG7255	Internship	2
EG7355	Internship	3
Thesis required (3hrs):		
EG6339	Thesis Direction	3
	Total hours	**30**

Department Courses and Descriptions

EG 6308 **Random Variables and Stochastic Processes** (3)
Introduction to the underlying theory of stochastic processes. Topics include: Random sequences and convergence; autocorrelation, autocovariance, stationarity, ergodicity; stochastic calculus (continuity, differentiability, integrability); Poisson process; white-noise process; Gaussian process; random walk, Brownian motion, Wiener process; Markov chains; Markov processes; linear systems driven by random inputs.

EG 6350 **Digital Signal Processing I (S/G)** (3)
Discrete time signals & systems, z-transform, discrete fourier transform, flow graph and matrix representation of digital filters, digital filter design techniques and computation of the discrete fourier transform (FFT).

EG 6362 **Computer Vision and Pattern Recognition** (3)
Digital image characterization, image transforms, image enhancement, image restoration, image encoding, image analysis, applications of digital image processing to robotics. Prerequisite: EG 6350.

EG 6365 **Automatic Control Systems (S/G)** (3)
This course introduces students to the theory and practice of control systems engineering. The topics include basic concepts and mathematical foundations for analysis and design of continuous control systems, transfer function techniques and state- variable analysis, frequency and time do main design and analysis of control systems.

EG 6367 **Communication Systems (S/G)** (3)
Introductory information theory, frequency response of linear systems, analog-to-digital conversion, time multiplexing of signals, Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM), quantization noise, Amplitude Modulation (AM) and Frequency

EG 6301 **Statistical Data Analysis** (3)

An applied approach to statistical inference in engineering and scientific work. Tests of hypothesis, regression analysis, analysis of variance and experimental design.

EG 6311 **Wireless Communications** (3)
This course addresses wireless communications in four parts. The first part addresses wireless sys tems with an overview of wireless channels, propagation characteristics, wireless system architecture and elements. The second part reviews wireless communications techniques, including modulation, diversity and combining, and multiple access. The third part introduces analysis and simulation methods and procedures for system performance evaluation. The fourth part presents various wireless communications systems and applications. Topics include: Introduction to Wireless Communications; The Cellular Concept; Wireless Channel Environment; Statistical Communications Theory; Path Loss Prediction; Received-Signal; Envelope and Phase Characteristics; Modulation Techniques; Diversity and Combining Technique; Multiple-Access Schemes; System Performance Evaluation; Wireless Systems and Applications.

EG 6312 **Data Mining** (3)
Recent advances in database technology along with the phenomenal growth of the Internet have resulted in an explosion of data collected, stored, and disseminated by various organizations. Because of its massive size, it is difficult for analysts to sift through the data even though it may contain useful information. Data mining holds great promise to address this problem by providing efficient techniques to uncover useful information hidden in the large data repositories. The key objectives of this course are two-fold: (1) to teach the fundamental concepts of data mining and (2) to provide extensive hands-on experience in applying the concepts to real-world applications. The core topics to be covered in this course include classification, clustering, association analysis, and anomaly/novelty detection. Students will develop and/or apply data mining techniques to applications such as network intrusion detection, Web traffic analysis, business/financial data analysis, text mining, bioinformatics, Earth Science, and other scientific and engineering areas.

EG 6318 **Introduction to VLSI Design** (3)
This course provides an introduction to VLSI (very large scale integrated) systems, and presents the concepts and techniques for the design and fabrication of VLSI integrated circuits. Topics include: basic semiconductor theory; p-n junctions; MOS transistors; integrated circuit fabrication technology; VLSI layout; digital MOS circuit design; memory and processor design; and testing of VLSI circuits.

EG 6328 **Software Engineering** (3)
This course surveys the entire software engineering field. It presents the management and technical aspects of the software development process. Software architectures, paradigms, and life-cycles are briefly discussed and compared. It covers topics in software management, problem specification and analysis, system design techniques, documentation, system testing and performance evaluation, and system maintenance. The technical aspects include software requirement analysis, design methodologies, system implementation, and testing techniques. Software verification and validation, quality assurance, and configuration management are also introduced.

EG 6338 **Special Topics** (3)

EG 6339 **Thesis Direction** (3)
The thesis is a culminating experience which provides a record of a student's achievement in the program. The thesis requires research leading to the discovery or new knowledge or enhancement of existing knowledge in the field of interest. A project that helps solve a practical problem may also be acceptable. The thesis is a complete documentation of the research study, including the theoretical background, description of the problem, the method used to investigate or solve the problem, presentation of results, interpretation of results, and explanation of the significance of the results.

EG 6345 **Digital Control Systems** (3)
Analysis and design of discrete-time linear systems, sampling and reconstruction, open-loop and closed-loop discrete-time systems, system time-response characteristics, stability analysis techniques, digital controller design, pole-assignment design and state estimation. Prerequisite: EG 6365.

EG 6356 **Computer Networking (Protocols, Modeling and Analysis)** (3)
Networks types, layered communication architectures, data link layer, network layer, transport layer, polling and random access in data network, local area network, introduction to circuit switching, call processing in digital circuit switching systems, the evolution toward integrated networks.

EG 6357 **Computer-Controlled Systems** (3)
Control theory relevant to analysis and design of computer-controlled systems, computer control, computer-oriented mathematical models, process-oriented models, disturbance models, design of digital controllers, state-space design method, pole placement design based on input-output models, optimal design methods, identification, adaptive control and implementation of digital controllers. Prerequisite: EG 6345.

EG 6358 **Stochastic Control Theory** (3)
Analysis and synthesis of dynamic systems, stochastic processes, stochastic state models, parameter optimization, minimal variance control strategies, prediction and filtering theory, linear stochastic control theory. Emphasis is given to discrete-time systems.

EG 6359 **Optical Communications** (3)
Study of wave propagation in single mode and multimode optical fibers, light emitting diodes and laser diodes, detectors, and communication networking. Students should have a reasonable background in Electromagnetic field theory and solid state devices.

EG 6360 **Digital Signal Processing II** (3)
Finite world length effects in digital filters, discrete orthogonal transforms such as Walsh-Hadamnd, Haar, slant and discrete cosine, power spectrum estimation and digital signal processing applications. Prerequisite: EG 6350.

EG 6364 **Digital Speech Processing** (3)
Fundamentals of digital speech processing, digital models for the speech signal, time do main models for speech processing, digital representation of the speech wave form, short-time fourier analysis, linear predictive coding of speech. Prerequisite: EG 6350.

EG 6370 **Parallel Processing** (3)

Topics in parallel architectures, including systolic architectures, wave front arrays, interconnection networks, reconfigurable architecture. Design of algorithms for use on highly parallel machines. Application to artificial intelligence.

EG 6374 **Computer Architecture** (3)
Overview of basic concepts. Memory systems design, semiconductor memories, cache memory, and virtual memory. Pipeline design techniques and memory structure in pipeline computers. Design constraints for high-performance machines. Vector computers, multiprocessors, and algorithms. Prerequisite: Consent of instructor.

EG 6376 **Neural Networks** (3)
Neuron model and network architecture; Heb net; perception learning rule; ADALINE and MADALINE architectures and algorithms; back propagation algorithm; pattern classification; pattern association competitive neural networks. Prerequisite: Consent of instructor.

EG 6378 **Microprocessors** (3)
Overview of number systems, codes and digital devices. An introduction to microcomputers and microprocessors. Assembly language programming. A survey of a number of microprocessor families. Microcomputer structure, bus structure, bus protocols, and system expansion.

EG 6380 **Microcomputer Interfacing** (3)
Programming parallel ports and Input/Output. Interfacing a microcomputer to keyboards, to alphanumeric displays, and interfacing microcomputer parts to high-power devices. Review of operational amplifiers and circuits, sensors, and transducers. D/A converter operation and interfacing, A/D converter operations and interfacing. Prerequisite: EG 6378.

EG 6386 **Engineering Problem Solving** (3)
This course covers elementary applied mathematics, basic numerical methods, and problem solving methodology. MATLAB and its associated Toolboxes are used for computations. Topics include introduction to problem solving, introduction to MATLAB, scalar, and array computation, control flow, matrix computation, plotting capabilities, solution to systems of linear equations, interpolation and curve fitting, polynomial analysis, numerical integration and differentiation, ordinary differential equations, matrix decomposition and factorization.

EG 6388 **Data Acquisition, Presentation, and Analysis** (3)
Principles, methods, and applications of data acquisitions, presentation, and analysis. Topics covered include methods of analog-to-digital conversion, the Nyquist criteria and aliasing errors, signal processing, the use of analog and digital filters, system identification, frequency-spectral estimation, techniques for clear and concise presentation of data, and error analysis of computational results. Hands-on experiments and applications will be emphasized. Lab VIEW software and the associated hardware will be used. Oral and written presentations of application projects will be required of each student.

EG 6390 **Digital Systems Design Using VHDL** (3)
Brief review of combinational and sequential circuit design principles; VHDL basic language organization; structural modeling in VHDL; date flow modeling in VHDL; VHDL technology

information; describing synchronous behavior in VHDL; algorithmic modeling in VHDL. Prerequisite: undergraduate logic design course.

EG 6392 **Network Programming** (3)
Introduction to networks; Client-server model and software design; concurrent processing in client-server software; program interface to protocols; socket interface; algorithms and issues in client-server software design; connectionless servers (UDP); connection-oriented servers (TCP); client-server concurrencies; application level gateways; remote procedure calls (RPC). Prerequisites: EG 6356 and working knowledge of C programming language.

EG 6396 **Computer Security** (3)
This course covers the theory and practice of computer security, focusing in particular on the security aspects of the web and internet. It surveys cryptographic tools used to provide security, such as shared key encryption, public key encryption, key exchange, and digital signature. It then reviews how these tools are utilized in the Internet protocols and applications such as SSL, PGP, S/MIME, and others. System security issues, such as viruses, intrusion, firewalls, and other will also be covered.

EG 6397 **Fault Tolerant Computing** (3)
This course covers the theory and practice of fault tolerant systems, focusing in particular on techniques for achieving high reliability in computational systems with software, hardware, and networking components. Approaches for testing, fault handling and assessing reliability will be examined. It discusses reliability measures, error detection and correcting codes, fault-tolerant networks, redundant disks (RAID), software fault-tolerance, case studies of fault-tolerant systems, and others.

EG 7155 **Internship** (1)
An experimental approach to advanced engineering topics through work in a company or organization. Industry/University cooperation is required. Topics vary depending on the needs of the sponsoring company or organization and the academic needs of the student. Students may start an internship projects anytime after enrolling in any Engineering program. A minimum of three credit hours is required. Credit hours may be completed in increments of 1, 2, or 3 credit hours per semester. Prerequisite: Consent of the Graduate Program Director.

EG 7255 **Internship** (2)
An experimental approach to advanced engineering topics through work in a company or organization. Industry/University cooperation is required. Topics vary depending on the needs of the sponsoring company or organization and the academic needs of the student. Students may start an internship projects anytime after enrolling in any Engineering program. A minimum of three credit hours is required. Credit hours may be completed in increments of 1, 2, or 3 credit hours per semester. Prerequisite: Consent of the Graduate Program Director.

EG 7355 **Internship** (3)
An experimental approach to advanced engineering topics through work in a company or organization. Industry/University cooperation is required. Topics vary depending on the needs of the sponsoring company or organization and the academic needs of the student. Students may start an internship projects anytime after enrolling in any Engineering program. A minimum of three credit hours is required. Credit hours may be completed in increments of 1, 2, or 3 credit hours per semester. Prerequisite: Consent of the

Graduate Program Director.

EG 7306 **Total Quality Systems** (3)
Total quality management philosophy, with emphasis on statistical quality strategies. Statistical process control; supplier certification; benchmarking; simultaneous engineering; re-engineering; quality teams; quality audits; Kaizen; quality function deployment, Malcolm Baldrige National Quality Award guidelines. Prerequisite: Consent of Instructor

Department Faculty

Electrical Engineering (M.S.) Faculty Website

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