

# Electrical Engineering (Ph.D.\*, M.S.E.E.)

Degree Offered: M.S.E.E.  
Director: Dr. Yehia Massoud  
Phone: (205) 934-8440  
E-mail: [massoud@uab.edu](mailto:massoud@uab.edu)  
Web site: [www.eng.uab.edu](http://www.eng.uab.edu)

## Faculty

**Dale W. Callahan**, Associate Professor (Electrical and Computer Engineering); Wireless Communication, Digital Signal Processing, Telecommunication

**David A. Conner**, Professor Emeritus (Electrical and Computer Engineering); Electrical Networks, Electromagnetics, Mathematical Modeling of Electrical Phenomena

**Gregory A. Franklin**, Assistant Professor (Electrical and Computer Engineering); Electric Utility Power Systems, Power System Protection and Control, Power Line Communication

**David G. Green**, Instructional Associate Professor (Electrical and Computer Engineering); Computer Networking, Software Engineering, Embedded Computer Systems

**M. R. Haider**, Assistant Professor (Electrical and Computer Engineering); Analog, Mixed-signal, and RF Circuit and System Design, Low-power Electronics, Implantable Systems, Inductive Powering, Energy Harvesting, Impulse-based Wireless Communication

**Thomas C. Jannett**, Professor and Graduate Program Director (Electrical and Computer Engineering); Control Systems, Biomedical Instrumentation, Modeling and Simulation, Intelligent Sensor Networks

**Jon R. Marstrander**, Instructor (Electrical and Computer Engineering); Electronics, Digital Systems, Digital Signal Processing, Image Processing

**Yehia Massoud**, Professor and Chair (Electrical and Computer Engineering); Electronic Design and Applications in Nanotechnology and Biotechnology

**Dalton Nelson**, Assistant Professor (Electrical and Computer Engineering); Fuzzy Logic and Intelligent Control Methodologies

**Murat M. Tanik**, Professor (Electrical and Computer Engineering); Software Systems Engineering, Integrated Systems Design, Process Engineering

**Gregg L. Vaughn**, Professor (Electrical and Computer Engineering); Digital Signal Processing, Applications of Microprocessors, Digital Communication

## Program Information

The Master of Science in Electrical Engineering (M.S.E.E.) prepares students for a professional career in industry or entry into a doctoral program or professional school. The M.S.E.E. program builds upon the broad foundation provided by a Bachelor of Science in Electrical Engineering by supplying depth in specific areas of electrical and computer engineering through advanced coursework and a thesis or project experience.

## Admission Requirements

Requirements for admission to the electrical engineering master's degree program include the following:

1. A bachelor's degree in electrical or computer engineering.
2. A 3.0 (A = 4.0) or better GPA in all junior and senior electrical and computer engineering and mathematics courses attempted;
3. Three letters of evaluation concerning the applicant's previous academic and professional work; and
4. An acceptable score on the GRE General Test and the TOEFL, if applicable.

## Financial Support

Assistantships may be available for well-qualified students admitted into the M.S.E.E. program. In order to be considered for financial aid for the coming academic year, the completed application materials must usually be received at UAB by April 1.

There are a number of minority fellowships available through the Graduate School. Contact the UAB Graduate School directly for further information.

## Program Requirements

Assuming that a student possesses appropriate academic preparation for this degree, 33 semester hours of course work will be required beyond the bachelor's degree. This work must be distributed as follows:

### *Plan I (Thesis Option)*

1. Twelve semester hours of graduate-level courses appropriate to the student's area of technical specialization;
2. Six semester hours of graduate-level courses in an area related to the student's area of technical specialization; and
3. Six semester hours of courses having a mathematical emphasis; and

4. Successful completion and oral defense of a thesis developed through registration for at least nine semester hours of EE 699.

### ***Plan II (Nonthesis Option)***

1. Twelve semester hours of graduate-level courses appropriate to the student's area of technical specialization;
2. Twelve semester hours of graduate-level courses in an area related to the student's area of professional emphasis (these courses may address technical subjects or subject matter appropriate to an emphasis in engineering management or entrepreneurship);
3. Six semester hours of courses having a mathematical emphasis; and
4. Successful completion of a project developed through registration for at least 3 semester hours of EE 697.

### **Additional Information**

Deadline for Entry Term(s):	Fall, Spring, Summer
Deadline for All Application Materials to be in the Graduate School Office:	Six weeks before term begins
Number of Evaluation Forms Required:	Three
Entrance Tests	GRE (TOEFL and TWE also required for international applicants whose native language is not English.)
Comments	GRE and evaluation forms requirements waived for persons holding registration as professional engineers
Graduate Catalog Description	<a href="http://main.uab.edu/show.asp?durki=95253">http://main.uab.edu/show.asp?durki= 95253</a>

For detailed information, contact

Dr. Yehia Massoud, Graduate Program Director  
 UAB Department of Electrical and Computer Engineering, BEC 259D  
 1530 3rd Avenue South, Birmingham, Alabama 35294-1170.

Telephone 205-934-8440

E-mail [massoud@uab.edu](mailto:massoud@uab.edu)

Web [www.eng.uab.edu](http://www.eng.uab.edu)

## Course Descriptions

Unless otherwise noted, all courses are for 3 semester hours of credit. Course numbers preceded with an asterisk indicate courses that can be repeated for credit, with stated stipulations.

### Electrical and Computer Engineering (EE)

**518. Wireless Communications.** Wireless communication system topics such as propagation, modulation techniques, multiple access techniques, channel coding, speech and video coding, and wireless computer networks. Prerequisite: Coursework in systems analysis or permission of instructor.

**523. Digital Signal Processing.** Digital filter analysis and design. FFT algorithms. Applications of DSPs in engineering problems such as data acquisition, control, and I/O. Lecture and computer laboratory. Prerequisite: Coursework in systems analysis or permission of instructor.

**527. Industrial Control.** Power control devices and applications. Relay logic and translation to other forms. Programmable logic controllers. Proportional-integral-derivative (PID) control techniques. Modern laboratory instrumentation and man-machine interface software. Lecture and laboratory. Prerequisites: Coursework in programming, systems analysis, and basic electronics, or permission of instructor.

**531. Analog Integrated Electronics.** Advanced analysis and design using op-amps, with emphasis on error analysis and compensation. Applications include signal conditioning for instrumentation, instrumentation amplifiers, nonlinear and computational circuits, Butterworth and Chebyshev filter design, power amplifier design, voltage regulator design, and oscillators. A-to-D and D-to-A conversion methods. Laboratory exercises emphasize design techniques. Lecture and laboratory. Prerequisites: Coursework in systems analysis and basic electronics, or permission of instructor. 4 hours.

**532. Introduction to Computer Networking.** Computer networking and engineering standards related to networking. Network hardware, Ethernet, token ring, ISDN, ATM, networking protocols including TCP/IP protocol suite. Internetworking, LANs, and typical applications. Required use of computer laboratory's networking. Lecture and computer laboratory. Prerequisites: Coursework in programming and digital logic.

**533. Engineering Software Solutions.** Project planning, specification, design, implementation, and testing of software solutions for engineers. Waterfall model of development and agile development methods will be covered. Use of software tools. Four projects. Lecture and computer laboratory. Prerequisite: Coursework in object-oriented programming or permission of instructor.

**537. Microprocessor Applications.** Application of microprocessors in engineering problems such as data acquisition, control, and real-time input/output. Lecture and laboratory. Prerequisite: Coursework in microprocessors and assembly language programming, or permission of instructor.

**538. Intermediate Microprocessors.** Advanced microprocessor topics including cache design, pipelining, superscalar architecture, design of control units, microcoding, and parallel processors. Comparison of advanced contemporary microprocessors. Prerequisite: Coursework in microprocessors and assembly language programming, or permission of instructor.

**542. Computer Networking Protocols.** Hands-on laboratory course covering topics in networking. TCP/IP, routing, LAN configurations, windows and Linux configurations, protocol analysis. Lecture and laboratory. Prerequisite: Coursework in networking.

**547. Internet/Intranet Application Development.** Development of applications and models using Internet/Intranet technologies such as Java, JavaScript, conferencing systems, Dynamic HTML, server side scripting, multi-tier models, and XML. Lecture and computer laboratory. Prerequisite: Coursework in object-oriented programming or permission of instructor.

**548. Software Engineering Projects.** Builds on Object-Oriented concepts. Coverage for Unified Modeling Language is expanded and Design Patterns are incorporated. Provides a project environment for implementation of systems using Object-Oriented techniques. Lecture and computer laboratory. Prerequisite: Coursework in object-oriented programming or permission of instructor.

**552. VHDL Digital Systems Design.** Computer Design Automation using VHDL. Architectural, behavioral, and logical descriptions of digital systems. Logic verification and simulation. Projects involve designing complex integrated circuits using modern tools. Lecture and laboratory. Prerequisite: Coursework in microprocessors and assembly language programming.

**558. Medical Instrumentation.** Fundamental operating principles, applications, and design of electronic instrumentation used in measurement of physiological parameters. Class design project. Prerequisite: Coursework in electronics.

**561. Machinery II.** Physical principles of DC machines. Mathematical analysis of generator designs using equivalent circuits and magnetization curves. Calculation of motor speed, torque, power, efficiency, and starting requirements. Solid-state speed control systems. Prerequisite: Coursework in electrical machinery.

**571. Power Systems I.** Components of power systems and per-unit representation. Introduction to symmetrical components. Modeling of generators, transformers, and transmission lines for system studies. The power-flow problem and the power system stability problem. Prerequisite: Coursework in electrical machinery.

**572. Power Systems II.** Modeling of generators, transformers, and transmission lines for system studies. Introduction to symmetrical components. Calculation of short-circuit currents due to balanced and unbalanced faults. Determination of interrupting ratings of circuit breakers. Transient stability of power systems. Derivation of swing equation and solution by numerical method. Equal area criterion. Power system design project required. Prerequisite: Permission of instructor.

**573. Protective Relaying of Power Systems.** Symmetrical components, sequence networks, and short-circuit calculations. Instrument transformers and their performance under fault conditions. Protective devices and protective relaying units. Protection schemes and relay coordination for transformers, transmission lines, buses, and generators. Prerequisite: Coursework in electrical machinery.

**574. Industrial Power Systems.** One-line diagrams/load analysis. Medium and low voltage feeder design, voltage regulation, and short-circuit analysis. Selection of protective devices. Grounding and lightning protection. Term project. Prerequisite: Permission of instructor.

**585. Engineering Operations.** Economic, procedural, planning, and control aspects of engineering projects. Prerequisite: Permission of instructor.

**\*590. Special Topics in (Area).** Prerequisite: Permission of instructor. 1-12 hours.

**\*591. Special Problems in (Area).** Prerequisite: Permission of instructor. 1-12 hours.

**\*595. Integrated System Design.** Successful completion and oral defense of a team design project. Prerequisite: Permission of instructor.

**601. Electrical and Computer Engineering Seminar.** Research presentations delivered by faculty, students, and invited guests. Technical writing and development of verbal presentations. Writing a research paper. Maximum of 3 credit hours applicable toward the M.S.E.E. degree. Prerequisite: permission of instructor. 1-3 hours.

**605. Information Engineering Seminar.** Guest speakers will address various industry topics, trends and directions. Students will complete a set of exercises to assess individual learning styles, leadership attributes, management styles, and professional goals. Prerequisite: Graduate status in Master of Engineering Program (IEM).

**606. Technical Project Management.** Focuses on the concepts of project management and the development of practical strategies for managing technical projects. Prerequisite: Graduate status Master of Engineering Program (IEM).

**607. Information Engineering Technologies.** Provides an overview of the technologies for information engineering. Prerequisite: Graduate status in Master of Engineering Program (IEM).

**608. Strategic Management.** Addresses strategic decisions and simulations. The focus is on decision-making under conditions of uncertainty. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, and EE 606.

**609. Information Engineering Software.** Software and software design issues for information engineering. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, and EE 607.

**610. Technical Communication for Engineers.** Workshop-oriented course producing technical memoranda, proposals, and conference and/or refereed-journal papers with oral presentations related to these work products. Prerequisite: Graduate standing in Engineering and successful performance on a written pretest.

**611. Special Topics in Information Engineering.** Exploration of a current topic related to information engineering. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, EE 606, EE 607, EE 608, and EE 609.

**612. Technical Entrepreneurship.** Covers technical business startups including proposals, finance, product development, market strategy, strategic alliances, and leadership. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, EE 606, and EE 608.

**613. Information Engineering Security.** Security, privacy, and related issues/technologies for information engineering. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, and EE 607, EE 609, and EE 611.

**614. Technology Ventures.** Catalog Data: Development and defense of a technical business plan. Examines legal, regulatory, and other related issues that impact the venture. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, EE 606, EE 608, and EE 612.

**615. Information Engineering Design.** System design of information engineering systems. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, EE 607, EE 609, EE 611, and EE 613.

**616. Information Engineering Project.** Project will allow students an opportunity to develop ideas and a body of work related to a specific area of interest under the direction of a faculty member/technical advisor. Prerequisite: Graduate status in Master of Engineering Program (IEM), EE 605, EE 606, EE 607, EE 608, EE 609, EE 611, EE 612, and EE 613.

**621. Random Variables and Processes.** Theory underlying analysis and design of communication, stochastic control, data gathering, and data analysis systems. Prerequisite: Coursework in communication systems or permission of instructor.

**622. Advanced Communication Theory.** Analysis of performance of analog modulation techniques in presence of noise. Prerequisites: Coursework in communication systems and random variables and processes.

**624. Digital Communications.** Design of digital communication systems. Prerequisites: Coursework in communication systems and random variables and processes.

**625. Coding and Information Theory.** Entropy, channels and channel capacity, RLL codes, error correcting codes, cyclic codes, cryptography, convolutional codes, trellis coded modulation. Prerequisite: Coursework in random variables and processes.

626. **Digital Image Processing.** Digital image processing fundamentals, image transformations, image enhancement, image restoration, image compression, image segmentation, and image presentation. Prerequisite: Coursework in systems analysis.

628. **Telecommunications I.** Advanced topics. Prerequisite: Permission of instructor.

629. **Telecommunications II.** Advanced topics. Prerequisite: Permission of instructor.

632. **Introduction to Computer Networking.** Computer networking fundamentals. Layered network model and correspondence to real systems. Discussion of Ethernet, token ring, TCP/IP LAN and other protocols. Exploration of Internet and similar systems. Network application models. Simulation of networks. Permission of instructor.

633. **Experiments in Computer Networking.** Detailed exploration of particular issues in network protocols and network application models. Development of series of programs to explore the details of network protocols and network application models. Prerequisite: Coursework in computer networking including TCP/IP protocols.

635. **Telecommunication Systems.** System organization and structure. Data transmission. Prerequisite: Permission of instructor.

639. **Advanced Microprocessors.** Topics covering both hardware and software issues. Individual or group term project. Prerequisite: Permission of instructor.

640. **Object-Oriented Design.** Study and practice of the object-oriented methodology for developing software designs. Implementation consequences. Application of object-oriented methodologies to specific problems using object-oriented language. Prerequisite: Coursework in object-oriented programming.

641. **Modern Control I.** Discrete-time and sampled-data and systems. State variable models, state feedback and estimation. Optimal control and estimation. Predictive control.. Prerequisite: Coursework in control systems or permission of instructor.

642. **Intelligent Systems.** Organization and characteristics of intelligent systems. Optimization. Evolutionary algorithms. Neural network and fuzzy logic algorithms. Intelligent control. Prerequisite: Permission of instructor.

643. **System Identification and Adaptive Control.** Modeling of systems using structure identification, parameter estimation, and model validation. Controller design based on input-output models. Parameter adaptive control. Prerequisite: Permission of instructor.

650. **Software Engineering.** Introduces classical software lifecycles and software development paradigms. Provides state of the art practical experience in proposal development and software design. Develops integrated skills drawing experience from computer engineering, computer science, communication, systems engineering, and problem solving. Prerequisite: Permission of instructor.

651. **Software Engineering Large Systems I.** Introduces advanced integrated software systems development paradigms. Notions of process and integrated system views. Modeling-in-the-large and modeling-in-the-small are discussed and related to levels in Object Oriented Design and programming. Prerequisite: Permission of instructor.

652. **Software Engineering Large Systems II.** Builds on the advanced integrated software systems development paradigms. Components are introduced as elements of large system implementations. In the context of a design taxonomy, advanced Object-Oriented design and development techniques are reviewed. Prerequisites: Permission of instructor.

657. **Enterprise Information Architecture Engineering.** Study and practice of the enterprise architecture engineering for developing multi-tiered enterprise level systems. Methodologies for design and implementation of large-scale information systems. Distributed computing, clients, servers, operating systems and databases. Prerequisite: Permission of instructor.

661. **Advanced Electrical Machinery I.** Synchronous machine theory. Prerequisites: Permission of instructor.

662. **Advanced Electrical Machinery II.** Induction machine theory. Prerequisite: Permission of instructor.

663. **Control of Synchronous Machines.** Methods for control of synchronous machines. Prerequisite: Permission of instructor.

671. **Computer Applications in Power Systems.** Analysis of power systems operation. Prerequisite: Permission of instructor.

672. **Power System Overvoltages.** Events causing overvoltages. System protection. Prerequisite: Permission of instructor.

673. **Reliability of Power Systems.** Component reliability using standard industrial techniques. Prerequisite: Permission of instructor.

674. **Economic Operation and Control of Power Systems.** Economic control of thermal generating stations and hydrothermal stations. Computer control of power systems. Prerequisite: Permission of instructor.

682. **Multivariable Systems.** Analysis and design of multiple-output, multiple-input control systems. Prerequisite: Permission of instructor.

\*690. **Special Topics in (Area).** Prerequisite: Permission of instructor. 1-12 hours.

\*691. **Special Problems in (Area).** Prerequisite: Permission of instructor. 1-12 hours.

\*697. **Project.** Graduate project for Plan II Master's students. Prerequisite: Permission of instructor. 3 hours.

\*698. **Nonthesis Research.** Does not count towards a degree. 1-12 hours.

\*699. **Master's Thesis.** Master's thesis for Plan I Master's students. Prerequisite: Admission to candidacy. 1-12 hours.