Computer Engineering

Prospective students should use this checklist (http://www.uab.edu/graduate/images/acrobat/checklist/compeng.pdf) to obtain specific admissions requirements on how to apply to Graduate School.

Degree Offered: PhD
Director: Dr. Karthikeyan Lingasubramanian
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Website: https://www.uab.edu/engineering/ece/

Program Information
The PhD degree prepares students for professional and research careers in industry and academia. The PhD in Computer Engineering is awarded by UAB and is offered through a program shared with the University of Alabama in Huntsville (UAH), allowing both UAB and UAH to contribute to the program.

Admission Requirements
Requirements for admission to the PhD program include the following:

1. A bachelor's degree in an accredited electrical or computer engineering program or a bachelor's degree in a related program acceptable to the graduate faculty in Electrical and Computer Engineering;
2. A score of at least 550 on the verbal and quantitative sections of the Graduate Record Examination (GRE);
3. An acceptable score on the TOEFL examination for international students whose native language is not English;
4. An overall GPA of at least 3.0 on a 4.0 point scale, or at least 3.0 for the last 60 semester hours completed; and
5. Three letters of evaluation concerning the applicant's previous academic and professional work.

Students not having a bachelor's degree in electrical or computer engineering may be required to complete prerequisite courses.

Financial Support
Fellowships and/or assistantships may be available for well-qualified students admitted into the PhD 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.

Additional Information
Deadline for Entry Term(s): Each semester
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.)

For detailed information, contact
Dr. Karthikeyan Lingasubramanian, Graduate Program Director
UAB Department of Electrical and Computer Engineering. BEC 255E
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Web: https://www.uab.edu/engineering/ece/

Course Descriptions
See the graduate catalog of the University of Alabama at Huntsville (UAH) for doctoral courses at that university.

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.

Program Requirements
The course of study leading to the PhD includes a minimum of 48 semester hours of coursework beyond the bachelor's degree (excluding dissertation research). A student's dissertation committee may allow appropriate coursework pursued in completing a master's degree to be counted towards the 48 hour coursework requirement. A maximum of nine semester hours credit of thesis/research work from the master's degree may be counted toward the 48 hour coursework requirement for the PhD. PhD requirements include the following:

1. A major consisting of a minimum of 18 semester hours of approved coursework in computer engineering;
2. A minor consisting of a minimum of 12 semester hours of approved coursework in mathematics, theoretical or formal methods as related to computer engineering;
3. A minor consisting of a minimum of 12 semester hours of approved coursework in electrical or computer engineering;
4. Additional coursework consisting of a minimum of 6 semester hours of approved coursework in supportive fields;
5. Successful completion of a preliminary examination;
6. Successful completion of a qualifying examination that includes a presentation of the dissertation research proposal. Successful completion of the qualifying examination leads to admission to candidacy;
7. Successful completion of a minimum of 18 semester hours in EE 799 Dissertation Research; and
8. Successful completion of a final examination on the dissertation.

Courses
EE 511. Facilities Engineering. 3 Hours.
General engineering project planning, applying codes and standards, preliminary design, economic forecasting, environmental planning/reports, site selection, population displacement, cash flow, specifications and plans.
EE 512. Practical Computer Vision. 3 Hours.
Fundamentals and applications of computer vision: image preprocessing, detection, segmentation, registration, classification and recognition, texture and color, visual tracking.

EE 518. Wireless Communications. 3 Hours.
Wireless communication system topics such as propagation, modulation techniques, multiple access techniques, channel coding, speech and video, coding, and wireless computer networks. EE 318 (Methods of System Analysis) is a prerequisite for this course.

EE 523. Digital Signal Processing. 3 Hours.
Digital filter analysis and design. FET algorithms. Applications of DSPs in engineering problems such as data acquisition, control, and I/O. Lecture and computer laboratory. EE 318 (Methods of System Analysis) is a prerequisite for this course.

EE 526. Control Systems. 3 Hours.
Theory of linear, continuous-feedback control systems using complex frequency techniques. Block diagram manipulation, performance measures, stability, root locus, construction and locating roots (positive and negative feedback), gain adjustment, and altering dynamic properties. Discrete transforms using z-transform and z-plane root locus.

EE 527. Controls and Automation. 3 Hours.
Power control devices and applications. Relay logic and translation to other forms. Analog and digital computers. Proportional-integral-derivative (PID) control techniques. Modern laboratory instrumentation and man-machine interface software. Lecture and laboratory. EE 233 Engineering Programming Method, EE 318 (Methods of System Analysis), and EE 351 (Electronics) are prerequisites for this course.

EE 531. Analog Integrated Electronics. 4 Hours.
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 emphasizing design techniques. EE 351 (Electronics) is a prerequisite for this course. EE 318 (Methods of System Analysis) is a prerequisite or may be taken concurrently with the course.

EE 532. Introduction to Computer Networking. 3 Hours.
Introduction to computer networking and engineering standards related networking. Network hardware, Ethernet, token ring, ISDN, ATM, networking protocols including TCP/IP protocol suite, Internetworking, LANS, and typical applications. Prerequisites: EE 134 [Min Grade: C] and EE 210 [Min Grade: C]

EE 533. Engineering Software Solutions. 3 Hours.
Project planning, specification, design, implementation and testing of software solutions for engineers. Waterfall model of development and agile development methods will be covered. Lecture and computer laboratory. Four projects. EE 333 (Engineering Programming using Objects) is a prerequisite for this course.

EE 534. Power and Radio-Frequency Semiconductor Electronics. 3 Hours.
Fundamentals of integrated circuit design for radio-frequency and power converter circuits. Course contents will include basics of RF circuit theory, matching networks, high frequency MOS model, low-noise-amplifier, voltage controlled oscillator, fundamentals of power electronics, power semiconductor switches, steady-state equivalent circuit modeling, DC transformer model, basic AC equivalent circuit modeling, linearization and perturbation, etc. Will require accomplishing a computer aided design, simulation and chip layout of an integrated circuit design project.

EE 537. Introduction to Embedded Systems. 3 Hours.
Applications of microprocessors in engineering problems such as data acquisitions control, and real-time input/output.

EE 538. Computer Architecture. 3 Hours.
Advanced microprocessor topics including cache design, pipelining, superscalar architecture, design of control units, microcoding, and parallel processors. Comparison of advanced, contemporary microprocessors from Intel and IBM. EE 337 (Introduction to Microprocessors) is a recommended prerequisite for this course.

EE 543. Medical Imaging Processing. 3 Hours.
A lab-based introduction to processing analysis and display techniques for medical imaging.

EE 544. Real-Time Process & Protocols. 3 Hours.
Hands-on laboratory course covering topics in real-time computer systems such as algorithms, state-machine implementations, communication protocols, instrumentation, and hardware interfaces.

EE 547. Internet/Intranet Application Development. 3 Hours.
Focus on the development of applications and models using Internet/Intranet Technologies such as JavaScript, Conferencing systems, Dynamic HTML, server side scripting, multi-tier models and XML. Lecture and computer laboratory. Prerequisites: EE 233 [Min Grade: C]

EE 548. Software Engineering Projects. 3 Hours.
Builds on the Object-Oriented concepts covered in EE 333. Coverage for Unified Modeling Language is expanded and design patterns are incorporated. Provides a project environment for implementation of systems using Object Oriented techniques. Prerequisites: EE 333 [Min Grade: C]

EE 552. Digital Systems Design. 3 Hours.
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 DA tools. Lecture and laboratory. Prerequisites: EE 337 [Min Grade: C]

EE 558. Medical Instrumentation. 3 Hours.
Fundamental operating principles, applications and design of electronic instrumentation used in measurement of physiological parameters. Class design project. Prerequisites: EE 351 [Min Grade: C]

EE 561. Machinery II. 3 Hours.
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. EE 361 (Machinery I) is a prerequisite for this course.

EE 571. Power Systems I. 3 Hours.
Components of power systems. Performance of modern interconnected power system under normal and abnormal conditions. Calculation of inductive and capacitive reactances of three-phase transmission lines in steady stated. EE 351 (Electronics) is a prerequisite for this course.

EE 572. Power Systems II. 3 Hours.
EE 573. Protective Relaying of Power Systems. 3 Hours.
Operating principles of protective relays. Protection of transmission lines, generators, motors, transformers, and buses.

EE 574. Industrial Power Systems. 3 Hours.

EE 585. Engineering Operations. 3 Hours.
Economic, procedural, planning, and control aspects of engineering projects.

EE 590. Special Topics in (Area). 1-6 Hour.
EE 591. Special Problems in (Area). 1-6 Hour.
Topic assigned with course.

EE 601. Electrical and Computer Engineering Seminar. 1-3 Hour.
Consists of research presentations and colloquia delivered by faculty, research assistants, and invited guests in various state-of-the-art and popular topics related to Electrical and Computer Engineering. Required of all full-time Electrical and Computer Engineering graduate students.

EE 605. Embedded Systems for Industrial Scholars. 3 Hours.
Embedded systems are commonplace in the integration age. From consumer applications to medical applications, embedded systems are within practically every system. Engineers developing all kinds of systems should be at least familiar with the possibilities available with embedded systems. This introductory course will cover basics of developing systems with embedded computing components. Various popular systems and languages will be exposed. Topics covered will include: Significance of embedded systems, embedded systems design, rapid system prototyping of embedded systems, use of FPGAs and other modern design strategies.

EE 610. Technical Communication for Engineers. 3 Hours.
A workshop-oriented course providing students with the opportunity to produce technical memoranda, a proposal, and a conference and/or refereed-journal paper and to make oral presentations related to these work products utilizing appropriate software presentation aids. Successful performance on a written pre-test required.

EE 616. Design of CMOS Analog Integrated Circuits. 3 Hours.
This course will cover basic building blocks of CMOS analog VLSI design, MOSFET theory, short channel effects and nonlinear effects, current mirrors, current-reference generator, operational transconductance amplifier, switched capacitor architecture, analog-to-digital converter and digital-to-analog converter. Students will be required to develop a computer aided design, simulation and chip layout of an analog integrated circuit design project.

Prerequisites: EE 605 [Min Grade: C] and EE 606 [Min Grade: C] and EE 607 [Min Grade: C] and EE 608 [Min Grade: C] and EE 609 [Min Grade: C] and EE 611 [Min Grade: C] and EE 612 [Min Grade: C] and EE 613 [Min Grade: C]

EE 621. Random Variables and Processes. 3 Hours.
Theory underlying analysis and design of communication, stochastic control, data gathering, and data analysis systems.

Prerequisites: EE 421 [Min Grade: C]

EE 622. Advanced Communication Theory. 3 Hours.
Analysis of performance of analog modulation techniques in presence of noise.

Prerequisites: EE 421 [Min Grade: C]

EE 623. Computer Vision. 3 Hours.
Advanced topics in computer vision: image segmentation, registration, and visual tracking. (EE 412:512 - Practical Computer Vision or EE 300 - Engineering Problem Solving + EGR 265 - Mathematical Tools for Engineering Problem Solving or other equivalent courses).

EE 624. Digital Communications. 3 Hours.
Design of digital communications systems.

EE 625. Information Theory and Coding. 3 Hours.
Channel models and block codes, block code ensemble performance analysis, convolutional codes and ensemble performance, sequential decoding of convolutional codes.

EE 626. Digital Image Processing. 3 Hours.
Digital image processing fundamentals, image transformations, image enhancement, image restoration, image segmentation, and image presentation.

Prerequisites: EE 318 [Min Grade: C]

EE 627. Wireless Communications. 3 Hours.
Wireless communication system topics such as propagation, modulation techniques, multiple access techniques, channel coding, speech and video coding, and wireless computer networks.

EE 628. Telecommunications I. 3 Hours.
Advanced topics.

EE 629. Telecommunications II. 3 Hours.
Advanced Topics.

EE 632. Introduction to Computer Networking. 3 Hours.

Prerequisites: EE 333 [Min Grade: C] and EE 210 [Min Grade: C]

EE 633. Experiments in Computer Networking. 3 Hours.
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.

EE 634. Introduction to Neural Networks. 3 Hours.
Neural network topologies and learning algorithms with an emphasis on back propagation. Applications and limitations of networks. Designing networks for specific uses. Individual software project. A grade of C or better in EE 210 (Digital Logic) is required for this course.

EE 635. Telecommunication Systems. 3 Hours.
System organization and structure; data transmission.

EE 636. Advanced Digital Design. 3 Hours.
Large-scale class project. Sample topics include math coprocessors, text coprocessors, CRT controllers, and data encryption devices.

EE 637. Design of Modern Computer with Digital Integrated Circuits. 3 Hours.
This course will cover the basic design flow of digital computing chips. Students will be exposed to all levels of the chip design flow. The course will involve design projects that utilize the industry-grade software suite from Cadence. The course will use Silicon based Metal Oxide Semiconductor Field Effect Transistor (MOSFET) technology, which is current, for computer chip design. It will also briefly introduce two of the popular emerging technologies, Carbon based transistors and interconnects and 3-Dimensional ICs. Requires a basic understanding of transistors and digital logic.
EE 639. Embedded Systems. 3 Hours.
Topics covering both hardware and software issues. Individual or group term project. Course is for MSEEE and PhD in Computer Engineering.

EE 640. Object-Oriented Design. 3 Hours.
Study and practice of the object-oriented methodology for developing software designs. Implementation consequences. Application of object-oriented methodologies to specific problems using an object-oriented language. A grade of C or better in EE 333 (Engineering Programming using Objects) or other software design experience using C is required for this course.

EE 641. Modern Control Theory. 3 Hours.
State variable models for discrete-time systems. Sampled-data systems. State feedback and pole placement. State estimation. Control Systems (EE 426) is a suggested prerequisite for this course.

EE 642. Intelligent Systems. 3 Hours.

EE 650. Software Engineering. 3 Hours.
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.

EE 651. Software Engineering Large Systems - I. 3 Hours.
Introduces advanced integrated software systems development paradigms. Notions of process and integrated system views are extensively covered. Modeling-in-the-large and modeling-in-the-small are discussed and related to levels in Object Oriented Design and Programming.

EE 652. Software Engineering Large Systems - II. 3 Hours.
Builds on the advanced integrated software systems development paradigms covered in EE 651/751. 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.

EE 653. Electronic Power Switching Circuits. 3 Hours.
Power semiconductor devices. Switching circuit analysis, AC voltage controllers, controlled rectifiers, DC-to-DC converters, inverters, and cyclo-converters.
Prerequisites: EE 351 [Min Grade: C]

EE 654. Mobile Computing. 3 Hours.
Fundamental and advanced concepts in mobile computing. Develop user interface, application logic, and backend services, using advanced integrated development environments. Individual and team projects. Programming required.

EE 655. Cloud Computing. 3 Hours.
This course covers fundamental and advanced concepts in cloud computing, including evaluation of current market offerings. Students will also design and implement systems integrating multiple cloud computing services.

EE 656. Introduction to Big Data Analytics. 3 Hours.
Introduction to the field of big data analytics, including technologies, and challenges, architecture and hypothesis testing.

EE 661. Advanced Synchronous Machines. 3 Hours.
Effects of synchronous machine design on generated voltage and harmonics. Time domain modeling and simulation of machine dynamics for transient stability analysis.

EE 662. Advanced Induction Machines. 3 Hours.
Time domain modeling of induction machines. Simulation of induction machine dynamics including motor starting transients.

EE 663. Control of Synchronous Machines. 3 Hours.

EE 671. Computer Applications in Power Systems. 3 Hours.
Analysis of power systems operation.

EE 6716. CMOS Analog Integrated Circuits. 3 Hours.
This course will cover basic building blocks of CMOS analog VLSI design, MOSFET theory, short channel device and nonlinear effects, current mirrors, current-reference generator, operational trans conductance amplifier, switched capacitor architecture, analog-to-digital converter and digital-to-analog converter. Students will be required to develop a computer aided design, simulation and chip layout of an analog integrated circuit design project.

EE 672. Power System Overvoltages. 3 Hours.
Events causing overvoltages, and protection of system.

EE 673. Reliability of Power Systems. 3 Hours.
Component reliability using standard industrial techniques.

EE 674. Economic Operation and Control of Power Systems. 3 Hours.
Economic control of thermal generating stations and hydrothermal stations. Computer control of power systems.

EE 682. Electromagnetic Field Theory I. 3 Hours.
Application of Maxwell's equations to problems of electrical engineering; boundary-value problems, wave propagation, waveguides, radiation, and scattering; and surface waves.

EE 683. Complex Frequency Techniques in Process Control. 3 Hours.
S-plane techniques; characterization of processes; design of controllers.

EE 688. Enterprise Perspectives in Information Engineering. 3 Hours.

EE 690. Special Topics in (Area). 1-6 Hour.
Special Topics in (Area).

EE 691. Special Problems in (Area). 1-6 Hour.
Special Problems in (Area).

EE 697. Graduate Project. 3 Hours.
Graduate project for Plan II Masters students.

Non-Thesis Research.

EE 699. Thesis Research. 1-12 Hour.
Master's Degree Thesis.
Prerequisites: GAC M
EE 701. Electr & Comptr EGR Sem. 1-3 Hour.  
Consists of research presentations and colloquia delivered by faculty, research assistants, and invited guests in various state-of-the-art and popular topics related to Electrical and Computer Engineering. Maximum of 3.0 credit hours applicable toward M.S.E.E. degree.

EE 716. Design of CMOS Analog Integrated Circuits. 3 Hours.  
This course will cover basic building blocks of CMOS analog VLSI design, MOSFET theory, short channel device and nonlinear effects, current mirrors, current-reference generator, operational transconductance amplifier, switched capacitor architecture, analog-to-digital converter and digital-to-analog converter. Students will be required to develop a computer aided design, simulation and chip layout of an analog integrated circuit design project.

EE 723. Computer Vision. 3 Hours.  
Advanced topics in computer vision: Image segmentation, registration, and visual tracking. Linear algebra, PDE or basic computer vision (EE 412/512 - Practical Computer Vision or EE 300 - Engineering Problem Solving + EGR 265 - Mathematical Tools for Engineering Problem Solving or other equivalent courses).

EE 724. Digital Communications. 3 Hours.  
Design of digital communications systems.

EE 725. Information Theory and Coding. 3 Hours.  
Channel models and block codes; block code ensemble performance analysis; convolutional codes and ensemble performance; sequential decoding of convolutional codes.

EE 726. Digital Image Processing. 3 Hours.  
Digital image processing fundamentals, image transformations, image enhancement, image restoration, image compression, image segmentation, and image presentation. 
Prerequisites: EE 318 [Min Grade: C]

EE 727. Wireless Communications. 3 Hours.  
Wireless communication system topics such as propagation, modulation techniques, multiple access techniques, channel coding, speech and video coding, and wireless computer networks.

EE 728. Telecommunications I. 3 Hours.  
Advanced Topics.

EE 729. Telecommunications II. 3 Hours.  
Advanced Topics.

EE 732. Introduction to Computer Networking. 3 Hours.  
Computer network fundamentals. Layered network OSI model and correspondence to real systems. Discussion of Ethernet, Token Ring, TCP/IP, LAN, and other protocols. Exploration of the Internet and similar systems. Network application models. Simulation of networks. Digital Logic(EE 210) and Introduction to Microprocessors (EE 337) are recommended prerequisites for this course.

EE 733. Experiments in Computer Networking. 3 Hours.  
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.

EE 734. Introduction to Neural Networks. 3 Hours.  
Neural network topologies and learning algorithms with an emphasis on back propagation. Applications and limitations of networks. Designing networks for specific uses. Individual software project. EE 426 (Control Systems) and a grade of C or better in EE 210 (Digital Logic) are prerequisites for this course.

EE 737. Design of Modern Computers with Digital Integrated Circuits. 3 Hours.  
This course will be focused on teaching the basic design flow of digital computing chips. The students will be exposed to all levels of the chip design flow. The course will involve design projects that utilize an industry-grade software suite from Cadence. The course will use Silicon based Metal Oxide Semiconductor Field Effect Transistor (MOSFET) technology, which is current, for computer chip design. It will also briefly introduce two of the popular emerging technologies, Carbon based transistors and interconnects (3-DimensionalICs). Requires basic understanding of transistors and digital logic.

EE 740. Object-Oriented Design. 3 Hours.  
Study and practice of the object-oriented methodology for developing software designs. Implementation consequences. Application of object-oriented methodologies to specific problems using an object-oriented language. Requires a knowledge of software design experience using C.

EE 742. Intelligent Systems. 3 Hours.  

EE 746. Batch Control. 3 Hours.  
Theory, analysis, and synthesis of batch processing control systems.

EE 747. Distributed Control Systems. 3 Hours.  
Application of distributed control to process, integration, and operator interfaces.

EE 748. Process Analyzers. 3 Hours.  
Automated analytical techniques for identifying chemical process streams.

EE 750. Software Engineering. 3 Hours.  
Introduces classical software lifecycles and software development paradigm. Provides state-of-the-art practical experience in proposal development and software systems design. Develops integrated skills drawing experience from computer engineering, computer science, communication, system engineering, and problem solving.

EE 751. Software Engineering Large Systems - I. 3 Hours.  
Introduces advanced integrated software systems development paradigms. Notions of process and integrated system views are extensively covered. Modeling-in-the-large and modeling-in-the-small are discussed and related to levels in Object Oriented Design and Programming.

EE 752. Software Engineering Large Systems - II. 3 Hours.  
Builds on the advanced integrated software systems development paradigms covered in EE 651/751. 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.

EE 754. Mobile Computing. 3 Hours.  
Fundamental and advanced concepts in mobile computing. Develop user interface, application logic, and backend services, using advanced integrated development environments. Individual and team projects. Programming required.

EE 755. Cloud Computing. 3 Hours.  
This course covers fundamental and advanced concepts in cloud computing, including evaluation of current market offerings. Students will also design and implement systems integrating multiple cloud computing services.
EE 756. Introduction to Big Data Analytics. 3 Hours.
Introduction to the field of big data analytics, including technologies, and challenges, architecture and hypothesis testing.

EE 761. Advanced Synchronous Machines. 3 Hours.
Effects of synchronous machine design on generated voltage and harmonics. Time domain modeling and simulation of machine dynamics for transient stability analysis.

EE 762. Advanced Induction Machines. 3 Hours.
Time domain modeling of induction machines. Simulation of induction machine dynamics including motor starting transients.

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Component reliability using standard industrial techniques.

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Events causing overvoltages, and protection of system.

EE 773. Reliability of Power Systems. 3 Hours.
Component reliability using standard industrial techniques.

EE 774. Economic Operation and Control of Power Systems. 3 Hours.
Economic control and operation of thermal generating stations and hydrothermal stations. Computer control of power systems.

EE 782. Multivariable Systems. 3 Hours.
Analysis and design of multiple-output, multiple-input control systems.

EE 788. Enterprise Perspectives in Information Engineering. 3 Hours.

EE 790. Special Topics in (Area). 1-6 Hour.
Special Topics In (Area).

EE 791. Individual Study in (Area). 1-6 Hour.
Individual Study In (Area).

EE 798. Non-Dissertation Research. 1-12 Hour.
Non-Dissertation Research.

EE 799. Dissertation Research. 1-12 Hour.
Doctoral Dissertation Research.

Prerequisites: GAC Z