

# ELECTRICAL & COMPUTER ENGR (ECE)

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**ECE 6001. Technology Entrepreneurship: Teaming, Ideation, Entrepreneurship, Intrepreneurship, and Leadership. 3 Credit Hours.**  
Principles of entrepreneurship and intrapreneurship: teaming, ideation, and leadership. Customer discovery, cognitive biases, rapid prototyping, business models, negotiation, and capital raises will be also covered.

**ECE 6100. Advanced Computer Architecture. 3 Credit Hours.**  
Comprehensive coverage of the architecture and system issues that confront the design of high-performance workstation/PC computer architectures with emphasis on quantitative evaluation. Credit is not allowed for both ECE 6100 and any of the following courses: ECE 4100, CS 4290, CS 6290.

**ECE 6102. Dependable Distributed Systems. 3 Credit Hours.**  
Concepts, theory, and practice of dependable distributed systems. Techniques for tolerating hardware and software faults. Security aspects such as confidentiality, availability, and integrity.

**ECE 6110. CAD for Computer Communication Networks. 3 Credit Hours.**  
Investigation of the methodologies and algorithms used for designing and optimizing computer/communications networks with a focus on the algorithmic aspects of network design.

**ECE 6115. Interconnection Networks for High-Performance Systems. 3 Credit Hours.**  
This course teaches the fundamentals of Interconnection Networks (topology, routing, flow-control, microarchitecture and system interface), which form the communication backbone of computer systems, from on-chip many-core to HPC datacenters.

**ECE 6121. Combinatorial Strategies for Engineers. 3 Credit Hours.**  
Modern counting theory and algorithmic approaches necessary for discrete computation.

**ECE 6122. Advanced Programming Techniques. 3 Credit Hours.**  
Covers a number of advanced topics in programming methods, data management, distributed computing, and advanced algorithms used in typical engineering applications. Credit will not be awarded for ECE 6122 and ECE 4122.

**ECE 6130. Advanced VLSI Systems. 3 Credit Hours.**  
An advanced treatment of VLSI systems analysis, design, and testing with emphasis on complex systems and how they are incorporated into a silicon environment. Credit is not allowed for both ECE 4130 and ECE 6130.

**ECE 6132. Computer-aided VLSI System Design. 3 Credit Hours.**  
Theory and practice of computer-aided VLSI digital systems design. Logic synthesis, semi-custom VLSI design, high-level synthesis, low-power systems, and hardware/software co-design. Individual and group projects.

**ECE 6133. Physical Design Automation of VLSI Systems. 3 Credit Hours.**  
Various design automation problems in the physical design process of VLSI circuits including clustering, partitioning, floor planning, placement, routing, and compaction.

**ECE 6135. Digital Systems in Nanometer Nodes. 3 Credit Hours.**  
An advanced treatment of design challenges, such as power, variability, and reliability associated with digital integrated circuits and systems in nanometer nodes.

**ECE 6140. Digital Systems Test. 3 Credit Hours.**  
Introduction to the basic concepts in digital systems testing. Advanced topics in fault modeling and simulation, test pattern generation, and design for testability.

**ECE 6200. Biomedical Applications of Microelectromechanical Systems. 3 Credit Hours.**  
MEMS processing technologies, design of fabrication process flows, and applications of the technologies to the development of biomedical micro instrumentation and detection methodologies.

**ECE 6229. Introduction to Microelectromechanical Systems. 3 Credit Hours.**  
Introduction to Micro-Electro-Mechanical systems: Microfabrication techniques including: photolithography, etching, physical and chemical vapor deposition, electroplating, bonding and polymer processing. Application to sensors and actuators. Credit not allowed for both ECE 6229 and ME 6229 or CHBE 6229.

**ECE 6250. Advanced Digital Signal Processing. 3 Credit Hours.**  
An introduction to advanced signal processing methods that are used in a variety of applications areas.

**ECE 6254. Statistical Machine Learning. 3 Credit Hours.**  
An introduction to the theory of statistical learning and practical machine learning algorithms with applications in signal processing and data analysis.

**ECE 6255. Digital Processing of Speech Signals. 3 Credit Hours.**  
The application of digital signal processing to problems in speech communication. Part of this goal requires a laboratory project.

**ECE 6258. Digital Image Processing. 3 Credit Hours.**  
An introduction to the theory of multidimensional signal processing and digital image processing, including key applications in multimedia products and services, and telecommunications.

**ECE 6260. Data Compression and Modeling. 3 Credit Hours.**  
Theory and algorithms of signal encoding and decoding for data compression. Applications in information systems, digital telephony, digital television, and multimedia Internet.

**ECE 6270. Convex Optimization: Theory, Algorithms, and Applications. 3 Credit Hours.**  
This course provides an introduction to convex optimization, covering the mathematical fundamentals of convex analysis and duality theory, algorithms, and modelling of practical applications.

**ECE 6271. Adaptive Filtering. 3 Credit Hours.**  
Basic theory of adaptive filter design and implementation. Steepest decent, LMS algorithms, nonlinear adaptive filters, and neural networks. Analysis of performance and applications.

**ECE 6272. Fundamentals of Radar Signal Processing. 3 Credit Hours.**  
Signal modeling including radar cross section, multipath, and clutter. Properties of the ambiguity function and coded waveforms. Algorithms for Doppler processing, detection, and radar imaging.

**ECE 6273. Methods of Pattern Recognition with Application to Voice. 3 Credit Hours.**  
Theory and application of pattern recognition with a special application section for automatic speech recognition and related signal processing.

**ECE 6274. Statistical Natural Language Processing. 3 Credit Hours.**  
Foundations of statistical natural language processing established for text data analysis, language engineering, information extraction, and statistical inference. Applications using large text datasets are illustrated.

**ECE 6276. DSP Hardware Systems Design. 3 Credit Hours.**

A study of theory and practice in the design and implementation of DSP algorithms on programmable processors, multiprocessors, and ASICs.

**ECE 6279. Spatial Array Processing. 3 Credit Hours.**

Introduce application areas where signals are sampled over space and time. Transfer knowledge of time-based techniques to spatial processing. Develop algorithms unique to spatial processing.

**ECE 6280. Cryptography & Security. 3 Credit Hours.**

Algebraic and number theory approaches to cryptographic techniques, information security, secret key and public key encryption, signature schemes, hash functions, message authentication, and key distribution. Credit not allowed for both ECE 6280 and CS 6260.

**ECE 6282. Radar Imaging. 3 Credit Hours.**

An indepth study of digital signal processing methods for Synthetic Aperture Radar (SAR) image formation. Methods are also applicable to sonar.

**ECE 6283. Harmonic Analysis for Signal Processing. 3 Credit Hours.**

Explores the role of sparse representations in signal processing. Specific topics include: frame decompositions, approximation theory, inverse problems, imaging, and compressed sensing.

**ECE 6320. Power Systems Control and Operation. 3 Credit Hours.**

Introduction to methods used in the real-time operation and control of power systems as well as to the hardware and software technology of energy management systems (EMS). Credit will not be awarded for both ECE 6320 and ECEP 6301.

**ECE 6321. Power System Stability. 3 Credit Hours.**

Techniques for stability analysis of electric power systems and applications of these methods.

**ECE 6322. Power System Planning and Reliability. 3 Credit Hours.**

To introduce basic concepts as well as analysis and optimization techniques underlying reliability assessment of electric power systems and planning techniques. Credit will not be awarded for both ECE 6322 and ECEP 6305.

**ECE 6323. Power System Protection. 3 Credit Hours.**

Theory and practice of modern power system protection techniques. Credit will not be awarded for both ECE 6323 and ECEP 6351.

**ECE 6330. Power Electronic Devices and Subsystems. 3 Credit Hours.**

Physical considerations involved in the fabrication and use of power semiconductor devices and high-frequency magnetic transformers and inductors.

**ECE 6331. Power Electronic Circuits. 3 Credit Hours.**

The analysis, control, and design of switching power converters: rectifiers, cycloconverters, voltage-sourced and current-source inverters, dc-dc converters, pfc and resonant converts.

**ECE 6332. Power Electronic CAD Laboratory. 1 Credit Hour.**

To introduce the use of CAD tools in the simulation, analysis, and design of power electronic circuits and systems.

**ECE 6335. Electric Machinery Analysis. 3 Credit Hours.**

An introduction to the analysis and basic construction principles of rotating electric machines and transformers, including ac synchronous and induction machines and dc machines. Credit is now allowed for both ECE 4335 and ECE 6335.

**ECE 6336. Dynamics and Control of Electric Machine Drives. 3 Credit Hours.**

A study of the dynamics and control of electric machinery and variable speed machine drive systems.

**ECE 6337. Electricity Markets. 3 Credit Hours.**

Comprehensive introduction to markets for electrical energy, including economic theory, market design, utility models, effects of the physical grid, and grid services.

**ECE 6350. Applied Electromagnetics. 3 Credit Hours.**

The methodology and application of advanced electromagnetic theory.

**ECE 6360. Microwave Design. 3 Credit Hours.**

Applications of electromagnetic theory to microwave components and systems. Introduction to the latest characterization and design techniques including monolithic microwave integrated circuit (MMIC) technology.

**ECE 6361. Microwave Design Laboratory. 3 Credit Hours.**

This laboratory course will teach microwave measurement/design fundamentals for both passive and active components. Students will use both CAD tools and network analyzers.

**ECE 6370. Electromagnetic Radiation and Antennas. 3 Credit Hours.**

The fundamentals of electromagnetic radiation and antennas.

**ECE 6374. Cyber-Physical Security in Electric Energy Systems. 3 Credit Hours.**

This course provides an introduction to cyber-physical infrastructure for protection and control of electric energy systems, communication protocols, standardization and practices for cyber security.

**ECE 6375. Radio Wave Propagation in the Earth and Space Environment. 3 Credit Hours.**

How the Earth's atmosphere, space plasma environment, and solar space weather, vary to affect communication, navigation, space science, and remote sensing, across the electromagnetic spectrum.

**ECE 6380. Introduction to Computational Electromagnetics. 3 Credit Hours.**

The practical application of the finite-difference time-domain and finite element techniques to electromagnetic problems. Computer projects are required.

**ECE 6390. Satellite Communications and Navigation Systems. 3 Credit Hours.**

To introduce satellite communications and navigation system design including microwave transmission, satellite transponders, earth station hardware, and satellite networks. A design project is required.

**ECE 6412. Analog Integrated Circuit Design. 3 Credit Hours.**

Design of analog circuits using CMOS and bipolar technologies.

**ECE 6414. Analog Integrated System Design. 3 Credit Hours.**

Design of analog systems using CMOS and bipolar technologies. A higher level of design for analog and digital systems is presented.

**ECE 6420. Wireless IC Design. 3 Credit Hours.**

Wireless system specifications are translated to architectures and building blocks compatible with silicon technology. The course focuses on the analysis and design of these blocks.

**ECE 6422. Interface IC Design for MEMS and Sensors. 3 Credit Hours.**

Design of high-performance integrated interface circuits for various MEMS and sensing devices. System level issues in integrated microsystems.

**ECE 6435. Neuromorphic Analog VLSI Circuits. 3 Credit Hours.**

Large-scale analog computation for sensory and motor processing. Analog building blocks are presented, leading to VLSI systems inspired by neurobiological architectures and computational paradigms.

**ECE 6444. Silicon-Based Heterostructure Devices and Circuits. 3 Credit Hours.**

Theory and design of novel silicon-germanium microelectronic devices and circuits. Materials, device physics, fabrication, measurement, circuit design, and system applications.

**ECE 6445. Power IC Design. 3 Credit Hours.**

Analysis and design of linear dc-dc regulators and switched-inductor dc-dc supplies with CMOS and BiCMOS integrated circuits (ICs).

**ECE 6450. Introduction to Microelectronics Technology. 3 Credit Hours.**

Presents the fundamentals of microelectronics material, device, and circuit fabrication.

**ECE 6451. Introduction to the Theory of Microelectronics. 3 Credit Hours.**

Basis of quantum mechanics, statistical mechanics, and the behavior of solids to serve as an introduction to the modern study of semiconductors and semiconductor devices.

**ECE 6453. Theory of Electronic Devices. 3 Credit Hours.**

Presents the fundamentals of electronic device operation.

**ECE 6455. Semiconductor Process Control. 3 Credit Hours.**

This course is designed to explore methods of applying statistical process control and statistical quality control to semiconductor manufacturing processes. Students will be required to complete a design project.

**ECE 6456. Solar Cells. 3 Credit Hours.**

To provide a practical understanding of semiconductor materials and technology as it relates to design and development of efficient solar cells and photovoltaic systems.

**ECE 6458. Gigascale Integration. 3 Credit Hours.**

Hierarchy of physical principles that enable understanding and estimation of future opportunities to achieve multibillion transistor silicon chips using sub-0.25 micron technology.

**ECE 6460. Microelectromechanical Devices. 3 Credit Hours.**

Fundamental concepts for design of microelectromechanical devices (MEMS), including mechanical and thermal behavior of materials and structures, transduction principles, transducer design, and modeling.

**ECE 6461. Carbon and Molecular Nanoelectronics. 3 Credit Hours.**

In this course carbon nanotubes are used as a framework to teach quantum transport as the foundation for all emerging nanoelectronic devices.

**ECE 6465. Memory Device Technologies and Applications. 3 Credit Hours.**

This course covers semiconductor memory technologies SRAM, DRAM, FLASH and emerging non-volatile NVMs, including bit-cell design, peripheral circuitry, array architecture, scaling trend and in-memory computing.

**ECE 6500. Fourier Techniques and Signal Analysis. 3 Credit Hours.**

Introduction to the use of Fourier Methods for analysis of signals.

**ECE 6501. Fourier Optics and Holography. 3 Credit Hours.**

Applications of the Fourier transform and linear systems theory to the analysis of optical propagation, diffraction imaging, holography, wavefront modulation, and signal processing.

**ECE 6510. Electro-Optics. 3 Credit Hours.**

Study of the fundamental principles and primary applications of lasers, and of detectors of optical radiation.

**ECE 6515. Nanophotonics. 3 Credit Hours.**

Design of nano-structures to guide light and to develop a new set of optical devices.

**ECE 6520. Integrated Optics. 3 Credit Hours.**

Theory and design of optical waveguides and optical waveguide devices.

**ECE 6522. Nonlinear Optics. 3 Credit Hours.**

Provides an introduction to the field of nonlinear optics, exploring the physical mechanisms, applications, and experimental techniques.

**ECE 6530. Modulation, Diffractive, and Crystal Optics. 3 Credit Hours.**

Provides a working knowledge of temporal and spatial optical modulation, diffractive optical devices, and crystal optics.

**ECE 6540. Organic Optoelectronics. 3 Credit Hours.**

Fundamental understanding of the optical and electronic properties of organic materials and devices that form the basic of the emerging technological area of printed flexible optoelectronics.

**ECE 6542. Optoelectronics: Devices, Integration, Packaging, Systems. 3 Credit Hours.**

Optoelectronic devices (detectors, emitters, modulators) from the practical realized and theoretical performance perspective. Explores monolithic and hybrid integration of devices, packaging, and system implementation.

**ECE 6543. Fiber-optic Networks. 3 Credit Hours.**

Architectural, performance and design aspects of fiber-optic communications networks, components, and technologies. Relationship between the physical network implementation and the higher-level network architecture.

**ECE 6550. Linear Systems and Controls. 3 Credit Hours.**

Introduction to linear system theory and feedback control. Topics include state space representations, controllability and observability, linear feedback control. Credit will not be awarded for both ECE 6550 and AE 6530.

**ECE 6551. Digital Control. 3 Credit Hours.**

Techniques for analysis and synthesis of computer-based control systems. Design projects provide an understanding of the application of digital control to physical systems.

**ECE 6552. Nonlinear Systems and Control. 3 Credit Hours.**

Classical analysis techniques and stability theory for nonlinear systems. Control design for nonlinear systems, including robotic systems. Design projects.

**ECE 6553. Optimal Control and Optimization. 3 Credit Hours.**

Optimal control of dynamic systems, numerical optimization, techniques and their applications in solving optical-trajectory problems.

**ECE 6554. Adaptive Control. 3 Credit Hours.**

Methods of parameter estimation and adaptive control for systems with constant or slowly varying unknown parameters. MATLAB design projects emphasizing applications to physical systems.

**ECE 6555. Optimal Estimation. 3 Credit Hours.**

Techniques for signal and state estimation in the presence of measurement and process noise with the emphasis on Wiener and Kalman filtering.

**ECE 6558. Stochastic Systems. 3 Credit Hours.**

Advanced techniques in stochastic analysis with emphasis on stochastic dynamics, nonlinear filtering and detection, stochastic control, and stochastic optimization and simulation methods.

**ECE 6559. Advanced Linear Systems. 3 Credit Hours.**

Study of multivariable linear system theory and robust control design methodologies.

**ECE 6560. Partial Differential Equations in Image Processing and Computer Vision. 3 Credit Hours.**

Mathematical foundations and numerical aspects of partial-differential equation techniques used in computer vision. Topics include image smoothing and enhancement, edge detection, morphology, and image reconstruction.

**ECE 6562. Autonomous Control of Robotic Systems. 3 Credit Hours.**

Fundamental issues associated with autonomous robot control. Emphasizes biological perspective that forms the basis of many current developments in robotics.

**ECE 6563. Networked Control and Multiagent Systems. 3 Credit Hours.**

Covers tools and techniques for networked control systems as well as application domains and promising research directions.

**ECE 6601. Random Processes. 3 Credit Hours.**

To develop the theoretical framework for the processing of random signals and data.

**ECE 6602. Digital Communications. 3 Credit Hours.**

Basic M-ary digital communications systems, with emphasis on system design and performance analysis in the presence of additive noise.

**ECE 6603. Advanced Digital Communications. 3 Credit Hours.**

The theory and practice of efficient digital communications over linear dispersive channels, including adaptive equalization and synchronization.

**ECE 6604. Personal and Mobile Communications. 3 Credit Hours.**

To introduce various topics that are fundamental to cellular mobile telephone systems.

**ECE 6605. Information Theory. 3 Credit Hours.**

To introduce the mathematical theory of communications. Emphasis will be placed on Shannon's theorems and their use in the analysis and design of communication systems.

**ECE 6606. Coding Theory and Applications. 3 Credit Hours.**

To introduce the theory and practice of error control coding, with emphasis on linear, cyclic, convolutional, and parallel concatenated codes.

**ECE 6607. Computer Communication Networks. 3 Credit Hours.**

Fundamental concepts of computer network architecture and protocols.

**ECE 6610. Wireless Networks. 3 Credit Hours.**

Fundamental concepts of wireless networks.

**ECE 6612. Computer Network Security. 3 Credit Hours.**

Fundamental concepts of network information security, including encryption, secure access methods, and vulnerabilities in network protocols, operating systems, and network applications.

**ECE 6613. Broadband Access Networks. 3 Credit Hours.**

Study and comparison of ongoing and emerging access network technologies, including hybrid-fiber-coax, FTTP/FTTH, Gigabit Ethernet, ADSL/VDSL, and ultra wideband wireless data over fiber systems.

**ECE 6615. Sensor Networks. 3 Credit Hours.**

Basics of sensor network communications. Applications, architectures, and communication protocols for sensor networks are treated in depth.

**ECE 6710. Ethics of Biotechnology and Bioengineering Research. 3 Credit Hours.**

This course examines the ethics of biotechnological research, including issues in the realm of research ethics, bioethics, and healthcare robotics.

**ECE 6727. Cyber Security Practicum. 5 Credit Hours.**

Capstone independent study project placing each student in a commercial, academic or government setting where he or she identifies a major cyber security problem, and explores and evaluates a solution that addresses it with realistic assumptions about the organizational context. The chosen problem must be approved by course instructor. Cross-listed with PUBP and CS 6727.

**ECE 6730. Modeling and Simulation: Foundations and Implementation. 3 Credit Hours.**

Foundations and algorithms concerning the development of conceptual models for systems, and their realization in the form of computer software; discrete and continuous models. Crosslisted with CSE 6730.

**ECE 6744. Topics in Engineering Practice. 3 Credit Hours.**

Topics of current importance offered in collaboration with an approved partner of Georgia Tech's Distance Learning Program. Crosslisted with ME 6744.

**ECE 6747. Advanced Topics in Malware Analysis. 3 Credit Hours.**

This course covers advanced approaches for the analysis of malicious software and explores recent research and unsolved problems in software protection and forensics.

**ECE 6759. Plasma Processing of Electronic Materials and Devices. 3 Credit Hours.**

Fundamental physics, chemistry, chemical engineering, and electrical engineering principles inherent in plasma processes. Includes etching, deposition, diagnostic methods, and control schemes. Crosslisted with CHE 6759.

**ECE 6770. Introduction to Cyber-Physical Systems Security. 3 Credit Hours.**

This course provides an introduction to security issues relating to various cyber-physical systems including industrial control systems and those considered critical infrastructure systems.

**ECE 6771. Optoelectronics: Materials, Processes, Devices. 3 Credit Hours.**

Optoelectronic materials, physical processes, and devices. Includes compound semiconductor materials, excitation, recombination, gain, and modulation processes and devices such as emitters, detectors, and modulators. Crosslisted with PHYS 6771.

**ECE 6776. Integrated Low-Cost Microelectronics Systems Packaging. 3 Credit Hours.**

Broad overview of system-level, cross-disciplinary microelectronics packaging technologies, including design, test, thermal, reliability, optoelectronics, and RF integration. Comparison of system-on-chip and system-on-package. Crosslisted with ME and MSE 6776.

**ECE 6779. Thermal Engineering for Packaging of Micro and Nano Systems. 3 Credit Hours.**

Passive, active, and hybrid thermal management techniques, and computational modeling of micro systems. Air cooling, single phase and phase change liquid cooling, heat pipes, and thermoelectrics. Crosslisted with ME 6779.

**ECE 6780. Medical Image Processing. 3 Credit Hours.**

A study of methods for enhancing, analyzing, interpreting, and visualizing information from two- and three-dimensional data obtained from a variety of medical imaging modalities. Crosslisted with CS and BMED 6780.

**ECE 6781. Biomedical Sensing Systems. 3 Credit Hours.**

A study of physiological sensing topics from a systems viewpoint. Pertinent physiological and electro-physiological concepts will be covered. No prior knowledge of physiology or biology is needed.



**ECE 6786. Medical Imaging Systems. 3 Credit Hours.**

A study of the principles and design of medical imaging systems such as X-ray, ultrasound, nuclear medicine, and nuclear magnetic resonance. Crosslisted with BMED 6786.

**ECE 6790. Information Processing Models in Neural Systems. 3 Credit Hours.**

Examines "top-down" modeling approaches for sensorineural systems, where optimal computational principles used in engineering (e.g., information theory, Bayesian inference, control theory) explain observed information processing.

**ECE 6792. Manufacturing Seminar. 1 Credit Hour.**

Guest speakers on a broad range of manufacturing-related topics: research, applications, and technology. Required for Certificate in Manufacturing. Crosslisted with ISYE and ME 6792.

**ECE 6XXX. Electrical and Computer Engineering Elective. 1-21 Credit Hours.****ECE 7000. Master's Thesis. 1-21 Credit Hours.****ECE 7055. GT-SJTU. 12 Credit Hours.**

For GT-SJTU dual-MS students during terms when they are not taking other GT courses. Placeholder course.

**ECE 7056. GT-TU. 12 Credit Hours.**

For GT-TU double-MS students during terms when they are not taking other GT courses.

**ECE 7057. GT-Shenzhen Research. 12 Credit Hours.**

For GT-Shenzhen students during terms when they are in Atlanta on research internship with GT-Atlanta faculty.

**ECE 7103. Advanced Memory System. 3 Credit Hours.**

Covers the basic trade-offs in architecting a high performance memory hierarchy at all levels, starting from the on-chip cache to main memory and storage sub-system.

**ECE 7141. Advanced Digital Systems Test. 3 Credit Hours.**

Design and test techniques for high-speed digital systems operating at rates above 100 MHz with a practical emphasis via substantial projects.

**ECE 7142. Fault Tolerant Computing. 3 Credit Hours.**

Key concepts in fault-tolerant computing. Understanding and use of modern fault-tolerant hardware and software design practices. Case studies.

**ECE 7252. Advanced Signal Processing Theory. 3 Credit Hours.**

A lecture and seminar treatment of the latest developments in signal processing. Emphasis is placed on current literature and emerging research areas.

**ECE 7350. Topics in Analytical Electromagnetics. 3 Credit Hours.**

An in-depth treatment of several analytical techniques used in current practice for solving real-world EM wave propagation problems and their impact on wireless communications.

**ECE 7380. Topics in Computational Electromagnetics. 3 Credit Hours.**

Computational approaches for applications such as radar signature prediction, microwave antenna and device design, and modeling techniques for electronic packaging.

**ECE 7611. Advanced Communication Theory. 3 Credit Hours.**

Latest developments in communications and networking are treated in lecture and seminar. Emphasis on current literature and open research areas.

**ECE 7721. Are You Thinking of Becoming An Academic?. 1 Credit Hour.**

How to run a successful research program, advise students, apply and get a job in academia, navigate promotion and tenure, and other aspects of academia.

**ECE 7722. Future Faculty Practicum. 3 Credit Hours.**

The objective of the proposed class is to prepare students interested in applying for faculty positions for interview season and for successful start of academic career. After this class, students will have prepared material for applying for academic positions as well as developed interview talk with detailed feedback.

**ECE 7741. Robotics Professional Preparation. 1 Credit Hour.**

Preparation for a professional career in Robotics. Local & visiting speakers. Program introduction. Technical resume preparation. GT Robotics labs & resources.

**ECE 7742. Robotics Professional Preparation 2. 1 Credit Hour.**

Preparation for a professional career in Robotics. Local & visiting speakers. Selecting and applying for Internship. Developing capstone project proposal. Public speaking practice and preparation.

**ECE 7743. Robotics Professional Preparation 3. 1 Credit Hour.**

Preparation for a professional career in Robotics. Local & visiting speakers. Interview preparation & career search. Technical report writing and presentation.

**ECE 7750. Mathematical Foundations of Machine Learning. 3 Credit Hours.**

Provides the mathematical background for two of the pillars of modern data science: linear algebra and applied probability.

**ECE 7751. Probabilistic Graphical Models in Machine Learning. 3 Credit Hours.**

The course provides an introduction to theory and practice of graphical models in machine learning. It covers three main aspects; representation, probabilistic inference, and learning.

**ECE 7785. Introduction to Robotics Research. 3 Credit Hours.**

Familiarizes students with the core areas of robotics; mechanics, control, perception, AI, and autonomy. Provides an introduction to the mathematical tools required in robotics research.

**ECE 7999. Preparation for Doctoral Qualifying Examination. 1-21 Credit Hours.**

This course is reserved for students who are studying for the ECE Preliminary Exam.

**ECE 8001. ECE Seminar. 1 Credit Hour.**

Speakers with diverse backgrounds and representing many different industries, professions, and institutions describe their experiences, entrepreneurial ventures, and research challenges.

**ECE 8002. ECE Seminar. 1 Credit Hour.**

Speakers with diverse backgrounds and representing different industries, professions, and institutions describe their experiences, entrepreneurial ventures, and research challenges.

**ECE 8010. Research Seminar. 1 Credit Hour.**

Seminar presentations describing ECE-related research projects, centers, and other activities at Georgia Tech.

**ECE 8022. Professional Communication Seminar. 1 Credit Hour.**

Seminar presentations on oral and written technical communication skills needed by electrical and computer engineering professionals. Credit for this course may not be used toward the master's degree in ECE.

**ECE 8740. Robotics Internship. 1-21 Credit Hours.**

Graduate Internship at a partner company, GTRI or a GT Robotics lab.

**ECE 8741. Robotics Capstone Project. 3 Credit Hours.**

Teams or individuals apply the knowledge and skills acquired throughout the MS program to a faculty supervised robotics project.

**ECE 8750. Robotics Research Foundation I. 3 Credit Hours.**

Multidisciplinary research course supervised by two robotics faculty from different schools participating in the robotics Ph.D. program.

**ECE 8751. Robotics Research Foundation II. 3 Credit Hours.**

Continuation of AE 8751 (Robotics Research Foundation I).

**ECE 8801. Special Topics. 1 Credit Hour.**

**ECE 8802. Special Topics. 2 Credit Hours.**

**ECE 8803. Special Topics. 3 Credit Hours.**

Special Topics in ECE.

**ECE 8804. Special Topics. 4 Credit Hours.**

**ECE 8805. Special Topics. 5 Credit Hours.**

**ECE 8811. Special Topics. 1 Credit Hour.**

**ECE 8812. Special Topics. 2 Credit Hours.**

**ECE 8813. Special Topics. 3 Credit Hours.**

**ECE 8814. Special Topics. 4 Credit Hours.**

**ECE 8815. Special Topics. 5 Credit Hours.**

**ECE 8822. Special Topics. 2 Credit Hours.**

**ECE 8823. Special Topics. 3 Credit Hours.**

**ECE 8833. Special Topics. 3 Credit Hours.**

**ECE 8843. Special Topics. 3 Credit Hours.**

**ECE 8853. Special Topics. 3 Credit Hours.**

**ECE 8863. Special Topics. 3 Credit Hours.**

**ECE 8873. Special Topics. 3 Credit Hours.**

**ECE 8881. Special Topics-Laboratory. 1 Credit Hour.**

**ECE 8882. Special Topics-Laboratory. 2 Credit Hours.**

**ECE 8883. Special Topics-Laboratory. 3 Credit Hours.**

**ECE 8884. Special Topics-Laboratory. 4 Credit Hours.**

**ECE 8891. Special Topics-Laboratory. 1 Credit Hour.**

**ECE 8892. Special Topics-Laboratory. 2 Credit Hours.**

**ECE 8893. Special Topics-Laboratory. 3 Credit Hours.**

**ECE 8894. Special Topics-Laboratory. 4 Credit Hours.**

**ECE 8900. Special Problems. 1-21 Credit Hours.**

**ECE 8901. Special Problems. 1-21 Credit Hours.**

**ECE 8902. Special Problems. 1-21 Credit Hours.**

**ECE 8903. Special Problems. 1-21 Credit Hours.**

**ECE 8997. Teaching Assistantship. 1-9 Credit Hours.**

For students holding graduate teaching assistantships.

**ECE 8998. Research Assistantship. 1-9 Credit Hours.**

For students holding graduate research assistantships.

**ECE 8999. Preparation for Doctoral Dissertation. 1-21 Credit Hours.**

This course is reserved for students who are actively seeking Ph.D. advisors and /or dissertation topics.

**ECE 9000. Doctoral Thesis. 1-21 Credit Hours.**