Department of Electrical and Computer Engineering

The Department of Electrical and Computer Engineering offers the Master of Engineering, Master of Science, and Doctor of Philosophy degrees in electrical engineering. Programs of study and research opportunities are available in the areas of automatic controls, digital systems, design automation, solid state devices, communications, network analysis and synthesis, microwave systems, computer engineering, signal processing, and reliable system design and analysis. The selection of a degree program depends upon the interest and background of each individual. The Electrical Engineering Graduate Handbook, describing requirements of the graduate program, is available from the department or online at http://www.ece.virginia.edu. Financial aid is available to qualified graduate students in the form of graduate research or teaching assistantships and fellowships.

The department, in conjunction with the Computer Science Department, offers the Master of Engineering, Master of Science, and Doctor of Philosophy degrees in computer engineering. See the specific section in this catalog that describes these programs.

The department also offers a part-time program in which an employed engineer is able to work toward a masters degree in electrical engineering with a minimum of absence from work. It is designed so that over a three-year period, a minimum of two-thirds (and possibly all) of the master's degree requirements can be completed through course work taken in the late afternoon. These courses are also available to those who wish to increase their knowledge of electrical engineering but do not wish to enroll in a formal degree program.

Research within the Department of Electrical and Computer Engineering is conducted primarily in the areas of applied electrophysics (solid state and microwave systems); communications; controls; signal processing; and computer engineering.

Research in computer engineering within the department is being conducted primarily by a collection of faculty and professional staff conducting research on the design and implementation of complex electronic systems. The research activities within computer engineering are highly interdisciplinary and includes expertise in the areas of analog and digital integrated circuit design, fault tolerance, safety-critical systems, reliability engineering, embedded systems (design, applications, and security) test technology, distributed processing, computer architecture, simulation, design automation, and networks. The disciplines currently represented within the computer engineering research efforts include electrical engineering, mechanical engineering, computer science, and systems engineering.

Research in computer engineering typically includes the development of computer-based systems. Dedicated equipment available for the hardware and software development efforts includes Sun and PC-based workstations, and special purpose hardware for designing and testing full-custom integrated circuits as well as programmable logic devices and field programmable gate arrays. State-of-the-art bench equipment is also available for printed circuit board development and evaluation, including high-speed logic analysis, signal analysis, and microprocessor development. Numerous software systems are available for design description, simulation, test pattern generation, reliability analysis, and system analysis. Examples of such software include the Cadence and Mentor Graphics EDA software. Faculty includes: Professors Aylor, Blalock, Dugan, Giras, Johnson, Lach, Stan, Veeraraghavan, and Williams.

A multidisciplinary center called the Center for Safety-Critical Systems is the home for numerous research projects. The overall goal of the center is to create new knowledge that can be used by industry to create safer systems, by regulators to write regulations, for evaluators to compare the safety aspects of complex systems, and by labor to educate the workforce. Although the center grew out of the needs of the railway industry, the general area of systems where safety is a matter of life and death will be addressed. The Center currently receives generous support from the Nuclear Regulatory Commission, Federal Railroad Administration, New York City Transit System, Mag Lev, Inc., and Lockheed-Martin. In addition, the results of the work conducted for the Federal Railroad Administration was a part of the FRA report to Congress on safety. Finally, representation on the center's advisory board consists of most of the significant players in the safety field, including the National Transportation Safety Board, the Federal Railroad Administration, the Federal Transit Authority, the American Association of Railroads, the Nuclear Regulatory Commission, and the Intermodal Passenger Transportation Institute.

Communications and signal processing continues to provide exciting research opportunities. New developments in communications and signal processing science and engineering, as well as advances in device

technologies continue to take place especially in the areas of wireless and optical communications and medical imaging. The faculty brings expertise spanning the full range of communication and signal processing theory and engineering to the next generation of communications challenges. Areas of expertise include digital modulation and error control coding; wireless communication, including smart antenna technology; statistical signal processing; optical communications, including fiber and wireless infrared systems; multi-user spread spectrum system analysis; detection and estimation; resource-efficient multiuser communication; and medical imaging. Faculty includes Professors Acton, Brandt-Pearce, Guess, Silverstein, Wilson, and Zheng.

Research in control systems includes several areas in systems and control theory and their applications. The theoretical work spans the areas of adaptive control, nonlinear control, and robust control. Specific topics of interest include control design for systems with nonlinearities, such as backlash, deadzone, failures, hysteresis and saturation, stabilization of nonlinear systems, feedback linearization, sliding mode control, and multivariable adaptive control. Some of the applications of this theoretical work are artificial heart pumps, flight control systems, robotics, high speed rotors suspended on magnetic bearings, unmanned combat aerial vehicles (UCAV). Faculty includes Professors Lin and Tao.

The focus of research in the area of applied electrophysics is in novel solid-state electronic materials, devices, and circuits for microelectronic, optoelectronic, and millimeter-wave applications. Much of the research in this area includes the development of novel devices and systems and is conducted in the Semiconductor Device Laboratories. These laboratories share major fabrication, test, and computing resources, including a 3,500 square foot clean room facility for microelectronic fabrication equipped with molecular beam epitaxy systems for epitaxial growth, lithography with nanometer capability, reactive ion etching, evaporation and sputter deposition of metals, insulators, and superconducting films. Equipment available for material and device evaluation includes a field emission scanning electron microscope with one nanometer resolution, a photoluminescence system, a semiconductor parameter analyzer, a surface profiler, and a variety of optical microscopes, curve tracers, and other equipment. Microwave equipment includes network analyzers, sweep oscillators, and a variety of waveguide components, sources, and detectors for millimeter- and submillimeter-wave applications. Faculty includes: Professors Barker, Bean, Crowe, Gelmont, Globus, Harriott, Hesler, Lichtenberger, Reed, and Weikle, as well as Professor Hull from Materials Science.

The department and the University provide a wide range of computing facilities that support both research and education. The Unix Lab provides Sun Solaris workstations, X terminals, and access to Unix computer-servers, including a high performance parallel processing cluster of IBM/RS6000's. In addition, our facilities provide access to the Web, email, printers, and Engineering software packages, such as Mentor Graphics, Cadence, LabVIEW, Matlab, PSPICE, as well as advanced circuit and device simulation packages. Various software development tools and programming languages are also available.