School of Graduate Engineering and Applied Science

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The University of Virginia takes pride in its continued development of modern engineering education and research. For over one hundred fifty years, the University has offered regular study in engineering, coinciding with the industrial development of the South and paralleling the rise of the engineering profession itself. Today, a total of 9 undergraduate and 31 graduate programs are offered by 8 academic departments.

Address

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of the University. Such courses were offered starting in 1827. Notable members of the early engineering staff were Charles Bonnycastle, trained in military engineering in England, and William Barton Rogers, later co-founder of the Massachusetts Institute of Technology. Engineering instruction was not sought widely by young men in the predominantly agricultural South, however; and by 1850, it was announced that the engineering program would be discontinued.

A new and more successful beginning was made in 1865 under the direction of Professor Charles Scott Venable, and by 1869 the University awarded its first degrees in engineering. Instruction was offered in civil and mining engineering until the 1881-1882 session, when engineering became a professional department. William Mynn Thornton became the first dean of engineering in 1905. Under his leadership, three new degree programs were added: mechanical engineering in 1891, electrical engineering in 1897, and chemical engineering in 1908.

Between World War I and World War II, the engineering curricula were revised and strengthened to provide a broader program of study, including the humanities. During both wars, the school offered engineering instruction to members of the armed forces; and ROTC programs for the Navy, Army, and Air Force were introduced during and after World War II.

Reorganization following World War II led again to an extensive revision of all curricula and to the graduate studies now offered. In 1955, two new branches of engineering study were recognized by degrees: aeronautical and nuclear engineering. In the same year, the first doctoral programs were instituted in chemical engineering and engineering physics.

In 1962, the name of the School was changed to the School of Engineering and Applied Science (SEAS) in anticipation of the establishment of the Department of Materials Science (1963), the Department of Applied Mathematics and Computer Science (1964), and the Department of Biomedical Engineering (1967). The Department of Systems Engineering was established in 1975, and in 1984, Applied Mathematics and Computer Science became separate departments. Further reorganization has led to the present school academic structure with its Departments of Biomedical Engineering; Chemical Engineering; Civil Engineering; Computer Science; Electrical and Computer Engineering; Materials Science and Engineering; Mechanical and Aerospace Engineering; and Systems and Information Engineering; and the Department of Science, Technology and Society. The undergraduate program in engineering science and the graduate program in engineering physics are administered by the Department of Materials Science and Engineering. Graduate and undergraduate programs in Computer Engineering are administered jointly by the Departments of Computer Science, and Electrical and Computer Engineering.

Research Centers and Institutes

Interdisciplinary research is carried out through research centers, laboratories, and consortia in which graduate students in two or more disciplines work together on a research project.

Advanced Materials and Structures Laboratory conducts thermomechanical testing with an emphasis on multi-scale approaches that establish connections between size-scale and thermomechanical performance of materials and structures. Together with conventional macroscale materials testing, this facility has a state-of-the-art nano-indentation system that allows mechanical testing on length-scales spanning from nanometers to millimeters. This system has force resolution on the order of one billionth of a Newton, and displacement resolution on the order of one
A unique capability is an environmental temperature chamber, which enables testing in the range of -50 °C to 100 °C. Current research is directed towards establishing connections between nanoscale material features and thermomechanical stability in thin films and MEMS, with an emphasis on compliant materials such as nano-porous ceramics and polymers.

**Aerogel Research Laboratory** was established in 1996 to investigate fundamental properties as well as cutting-edge applications of aerogels. Aerogel materials have the lowest thermal conductivity, lowest dielectric constant, lowest speed of sound, and lowest density of any solid material. Applications include: thermal/acoustic/electrical insulation, microanalytical instrumentation, sensors, and sub-atomic collection media.

**Aerospace Research Lab** was established in 1986 to conduct basic and applied research in advanced aerospace technologies. Research interests have expanded to include high-speed mixing and combustion, aeroacoustics, structures and materials, optical techniques, microscale heat transfer, and computational modeling.

**Center for Applied Biomechanics** is dedicated to vehicle safety testing with a major emphasis on studying impact and injury biomechanics. The focal point of the 10,000 square foot facility is a test sled mounted on a 66-foot track which allows simulation of high speed automobile crashes. In addition to the sled system, the CAB has a number of pneumatic and gravity driven impactors as well as state-of-the-art high speed data acquisition and digital video systems. Major research efforts at the laboratory include the study of advanced occupant restraint systems including air bag and seat belt systems. In particular, the CAB is establishing guidelines and criteria for the mitigation of airbag induced injuries.

**(LASP)** is one of the world’s leading laboratories studying the interaction of energetic particles (ions, electrons) UV photons and laser beams with surfaces. It seeks to understand the mechanisms leading to electronic excitations (luminescence, emission of electrons, radiation, atoms and molecules (sputtering), and to radiation damage, chemical changes or heat. The studies use a wide array of experimental techniques such as infrared spectroscopy, microbalance, mass spectrometry, and surface analysis and also computer simulations. The research has applications in semiconductor processing, nuclear fusion, gas discharges, biology, astrophysics, and space exploration. A substantial part of the laboratory’s work consists in modeling and simulations of surface processes in icy satellites, planetary atmospheres and magnetospheres, and interstellar grains. Projects are supported by NASA, NSF, and SWRI. LASP collaborates with industrial, University, and government laboratories in the US and several countries overseas to advance research and education in this field.

**Robert M. Berne Cardiovascular Research Center** is an evolving organization based on the voluntary scientific interactions of investigative faculty with a broad interest in research in diseases of the cardiovascular system. It is a lightning rod, attracting ongoing research in cardiovascular function, as well as stimulating new initiatives. The Center is designed to be able to respond quickly to exciting new research opportunities, by providing financial and administrative assistance. Such assistance offers innovative investigators the possibility to adapt rapidly to new directions in their research programs, a capability that becomes ever more important as the pace of technology places greater importance on rapid reaction to scientific opportunity. The Center is also dedicated to working with the faculty in making the University a center of state-of-the-art technological excellence. For a mission statement, membership and more details, go to [http://www.healthsystem.virginia.edu/internet/cvrc/](http://www.healthsystem.virginia.edu/internet/cvrc/)

**Cognitive Systems Engineering Laboratory** develops decision-aiding systems, training systems and models of human performance in a wide variety of domains such as process control, medical, military and transportation. In all of these domains, teams of people typically work together and with a variety of computational systems to meet
objectives within a complex set of constraints using both well-defined strategies and ad-hoc reasoning. Typical tasks to be supported, trained, or modeled include monitoring, diagnosis, control, scheduling, planning, and problem-solving for individuals, teams, and organizations.

Communications, Control, and Signal Processing Laboratory (CCSP) conducts research and development in a variety of communications, control systems, and signal processing areas, including error control coding, data compression, network protocols, detection and estimation theory, statistical signal analysis (system identification, channel equalization, sensor arrays and image processing), optical communication, adaptive control, robust control, and nonlinear control. Research in CCSP is primarily of an analytical nature, supported by computer simulations.

Electrochemical Science and Engineering Center is a multi-disciplinary research effort that incorporates the departments of Materials Science and Engineering, and Chemical Engineering, as well as interactions with Electrical and Computer Engineering, Computer Science, and Physics. It is one of the nation’s leading research groups of its kind, and its research affects the performance and reliability of most products manufactured in the world today.

Embedded Computing Center explores means through which faculty and staff at UVa can coordinate research on embedded computing technology to produce the new intelligent devices that our society has come to expect. UVa has a unique combination of abilities that offer great potential to advance the state of the art in this field.

Far Infrared Receiver Laboratory (FIRLab) operates within the Departments of Electrical and Computer Engineering and Physics at the University of Virginia. The FIRLab is fully equipped to design, assemble and evaluate millimeter and submillimeter wavelength mixers and multipliers at frequencies from microwave to THz frequencies. Sources include two submillimeter wavelength gas laser systems (300 GHz-4.5 THz) and a variety of millimeter wavelength sources, multipliers and amplifiers. A Bruker IFS 66V Fourier Transform Infrared Spectrometer (200 GHz-225 THz) is available for materials and component evaluation, as well as a variety of power meters, microscopes and probe stations.

High-Performance Low Power Laboratory (HPLP) focuses primarily on original research in the field of low power and high performance electronics, spanning digital VLSI and analog systems, architectures, circuits, and algorithms. HPLP currently has eight active researchers, as well as a new lab facility containing PCs and workstations donated by IBM and Intel.

Hyperpolarized Gas Imaging Research is a promising option for medical imaging of air spaces and certain tissues in humans without exposing patients to radiation associated with other methods (high resolution Computed Tomography and V/Q techniques, for example.) Since spring of 1996, UVa Departmental Research Team for Hyperpolarized Gases has been exploring and conducting research in this field.

Integrated Sensing and Processing Laboratory (ISPL) merges high functional density CMOS image/signal processing mixed-signal circuits with integrated detection/transduction structures to achieve improved application performance. Its current projects are in the areas of infrared imaging, adaptive hyper-spectral imaging, biomolecular fluorourescence detection, and adaptive ultrasonic imaging. The laboratory’s work is supported by the National Science Foundation, the Defense Advanced Research Projects Agency, the Carilion Biomedical Institute, and Agilent Technologies.

Intelligent Processing of Materials Laboratory (IPML) is one of the nation’s premier centers for research on the processing of advanced materials. Affiliated with
the University’s School of Engineering and Applied Sciences, the laboratory incorporates both the synthesis and processing of materials along with their modeling, sensing, and control. Goals of IPML’s research include development of innovative process technologies, creating models for predicting materials evolution during processing, designing advanced in-situ sensors for tracking material changes during processing, and creating model-based path optimization and feedback control.

**Interdisciplinary Research in Contaminant Hydrogeology Center** is dedicated to investigation of the interplay between chemical, physical, and biological factors that control the fate and transport of contaminants in the subsurface. Its research is supported by teams of individuals from the departments of Civil Engineering, Chemical Engineering, and Environmental Sciences.

**Internet Commerce Group, InterCom**, is a coalition of university faculty and business leaders that promotes development of electronic commerce in Virginia by providing technical and business software, training, and consulting services to companies entering (or already participating in) the electronic marketplace.

**Internet Technology Innovation Center (TIC)** assists Virginia’s newest emerging industry and its growing base of Internet-related businesses. The Internet TIC is tasked to nurture an entrepreneurial environment, accelerate the creation and deployment of network-based information technology, develop the hardware/software infrastructure that Virginia needs for the coming knowledge-based economy, and expand Virginia’s high-skill workforce needed to develop, support, and market Internet-based electronic products and services. Internet TIC is funded by Virginia’s Center for Innovative Technology and is a partnership among the University of Virginia, Virginia Tech, George Mason University, and Christopher Newport University.

**Justice Information Systems, Virginia Institute**, was created to support the information technology needs of law enforcement agencies throughout the Commonwealth of Virginia and on a national level. The Institute is funded by national funding agencies including the Virginia Department of Criminal Justice Services, and the National Institute of Justice’s Crime Mapping Research Center.

**Laboratory for Architecture at Virginia (LAVA)** focuses on processor-design issues, especially multi-core and multi-threaded chip architectures, architectures for temperature-aware and power-aware computing; applications of control theory to computer architecture; graphics architecture; novel processor organizations; and associated questions of modeling technique. The LAVA Lab currently receives funding from NSF, ARO, Intel and IBM and has ongoing collaborations with Harvard and IBM TJ Watson.

**Light Metals Center** conducts a wide range of research on light materials including alloy processing, mechanical properties and microstructural characterization, deformation mechanisms and environmental effects of light metals. The center’s research advances knowledge of structural materials, which have a high strength-and/or stiffness-to-weight ratio and at the same time are able to perform satisfactorily in hostile environments.

**Magnetic Bearings Center** conducts applied research in the area of magnetic bearings used to support a variety of machines. The Center receives funding from government agencies and industry, and it places great emphasis on working with industry to develop magnetic bearing technology for a wide variety of applications, particularly in the area of turbomachinery. Many of the research results and computer programs developed by the faculty and students are widely used in industry, and in some cases are the industry standards.

**Mathematical Computational Modeling Laboratory** is dedicated to research in
mathematical modeling, computer simulation, and virtual prototyping of various industrial technologies and industrial processing operations. Recent research includes studies in high-speed gas flows, two phase flow with fibrous material, rarefied gas flow, and dynamical motion of galaxies.

**Microelectronics Institute** serves as the University’s interdisciplinary microelectronics interface to outside organizations and within the University itself. Acting as a focal point for microelectronics communications at the University, the institute consists primarily of faculty volunteers. Through organized cooperation they seek to maximize the impact of their educational and research activities.

**The University of Virginia Microfabrication Laboratories** (UVML) serves as the University’s center for research and development in solid-state materials, devices, and circuits. This laboratory, formed from the AEPL laboratories (which was founded in 1967), has a 3,500 square-foot clean room facility for device fabrication and materials growth, as well as a variety of other facilities for microwave and optical analysis, device design, testing and packaging. The UVML operates out of the Charles Brown Department of Electrical and Computer Engineering, but is open to and used by numerous other Departments in the University. More information can be found at [http://www.ece.virginia.edu/UVML/](http://www.ece.virginia.edu/UVML/) or you can contact the Director at arthurW@virginia.edu.

**Microscale Heat Transfer Laboratory** is dedicated to developing new techniques to assist in measuring, understanding, and utilizing microscale thermal phenomena. The laboratory’s research is aimed at developing a fundamental understanding of energy transport on ultra short time and length scales.

**Millimeter-Wave Research Laboratory** focuses on building communication and receiver components capable of operating at very high frequencies. The devices have a host of applications, including communications, radar, atmospheric monitoring, and radio astronomy.

**Molecular Biomechanics Laboratory**, part of the Department of Biomedical Engineering, is dedicated to understanding the molecular mechanisms by which cells move, and the application of this knowledge to the improvement of American public health.

**MRSEC Center for Nanoscopic Materials Design** explores new directions in the nanoscale design and control of self-assembled epitaxial semiconductor quantum dots by providing new algorithms for understanding and controlling the coupling of short, medium and long range order in these structures. The Center collaborates with industrial, University, and government laboratories to support and further materials research and education in this field.

**Multifunctional Materials and Structures Laboratory:** The group is focused on the study and development of materials and structural systems that displace multifunctionality. Our particular interest is in cellular materials—e.g., lattice truss structures, tensegrity structures, nanoporous thin films. Cellular metals are a class of material that has the potential to be used for many applications. These materials can be used for light/ stiff load bearing structures, energy amelioration systems, and thermal management (heat exchangers, flame arrestors, heat shields) and vibration control applications. Of particular interest is their use in high authority morphing structures. The main objectives of this study are to utilize the superior mechanical properties of these structures—such as stiffness and strength—to develop a 3D morphing foil. We are studying the feasibility of using this as the basis of a low powered, biomimetic-actuating system that can achieve the propulsive and control capabilities of a manta ray.
**Nanoscale Materials Characterization Facility** (NMCF) provides imaging, diffraction and chemical analysis of materials from atomic to microscopic levels, and offers guidance to individuals wanting to conduct their own analyses. The NMCF houses three transmission electron microscopes (TEMs), two scanning electron microscopes (SEMs), a focused Ga⁺ ion beam (FIB) microscope, extensive hardware/software for image simulation, processing and analysis, and a variety of specimen preparation equipment. The facility also has three X-ray diffractometers (XRD’s) with a variety of capabilities and software for data analysis.

**Nanoscale and Quantum Engineering Science & Technology (NanoQuEST) Institute:** A university-wide institute that spearheads cutting edge research and educational programs on nanoscale engineering and quantum manipulation within the atom, for applications including nanoelectronics, biomedical engineering, and catalysis. With seventy faculty members across multiple departments and schools at the university with nanoscience research programs, the institute seeks to develop excellence in thrust areas such as: engineering of electron charge and spin, controlling biological functions within living cells, developing multifunctional nanostructured systems, controlling nanoscale dynamics, and nanoscale control of chemical reactions. These thrusts are enabled through a research and educational infrastructure developed through the institute. An estimated 25 graduate students complete their theses each year in these projects.

**Next Generation Real-Time Computing Lab** is part of the Computer Science Department at the University of Virginia. The laboratory studies a wide range of issues in all aspects of real-time computing and wireless networks. Real-time principles are becoming important for all systems since audio and video streams are being utilized in many new contexts from control applications to the Next Generation Internet.

**Optics and Quantum Electronics Lab** conducts research in photonics and optoelectronics. Current areas of interest include photonic materials, novel optical devices, micro-opto-electro-mechanical systems (MOEMS), and organic polymers like polypropylene and poly-dimethilsiloxane.

**The Center for Risk Management of Engineering Systems** was founded by the University of Virginia in 1987 as a University-wide resource. It develops theory, methodology, and technology to assist in the management of risk for a variety of engineering systems. Working closely with faculty and students at the Center, industry and government sponsors of research contribute their unique strengths and interests.

**Rotating Machinery and Controls Laboratories (ROMAC)** conduct research in the areas of rotor dynamics, turbomachinery, structural dynamics, magnetic bearings, automatic controls, turbomachinery flows, fluid film bearings, and seals. The Laboratory’s research is supported by a consortium of industries through the ROMAC Industrial Research Program.

**Safety Critical Systems Center** explores questions of safety in industries where safety is a matter of life and death. The goal is to make current systems even safer for the public. Projects include assessing the safety of modern rail transportation systems and studying issues of safety in the nuclear industry. The center has received support for related projects from the National Science Foundation and the U.S. Air Force.

**Science and Engineering of Laser Interactions with Matter** graduate training program is designed to develop students with enhanced mastery and appreciation of the knowledge and state-of-the-art technical skills required for rapid advancements in modern science and technology.

**Semiconductor Device Lab** maintains a position of international prominence for research on solid-state devices for millimeter and submillimeter wavelength
Research is focused on development of high-sensitivity, ultra-low-noise Gallium Arsenide Schottky barrier diodes and superconducting junctions for high frequency (150 GHz and above) receiver applications. Research topics include theoretical investigations of high frequency transport in ultra-small semiconductor devices, fundamental limits to device performance, and optimization of device design for specific applications.

**Semiconductor Manufacturing Information Technology Center** is a partnership between Dominion Semiconductor Co. and Virginia's Center for Innovative Technology. The Center's goals are to improve productivity at Dominion's state-of-the-art chip fabrication facility, in Manassas, while giving students hands-on experience with actual manufacturing data. The center is located at Dominion but has a companion laboratory at UVa. Both facilities are staffed by University students and researchers.

**Semicustom Integrated Systems Center** is an internationally respected research group in the areas of computer engineering and digital systems. The Center's ultimate missions are to accelerate economic growth, to improve products and processes, and to integrate the results of academic research into Very Large-Scale Integration (VLSI) industry developments. Its research and education programs help satisfy the growing need for leading-edge design tools and methods in the VLSI industry.

**Smart Travel Laboratory** is a state-of-the-art facility of the Center for Transportation Studies that supports research and education in the area of intelligent transportation systems (ITS). Using the latest information technologies and analysis and modeling techniques, researchers in the lab are developing prototype systems and applications that promise to improve the effectiveness of ITS. The distinguishing characteristic of the lab is the direct connection established between the lab and transportation management systems operated throughout the Commonwealth of Virginia. This connection provides researchers with direct access to real ITS data and systems.

**Space Physics and Surface Physics Theory Program** studies the physics and chemistry of energetic ion, electron and UV-photon interactions with surfaces and gases. The processes of interest are desorption and sputtering, as well as the radiolysis and photolysis of surfaces and gases. The motivation for the program’s research is to understand problems in space physics and astronomy.

**Surface Science Center** provides services on surface analysis, including modifying the surface layers of materials by ion implantation, and surface characterization and depth profiling of sample compositions using a Perkin-Elmer 560 system. Available techniques are Angle-resolved X-Ray Photoelectron Spectroscopy (XPS or ESCA), Scanning Auger Electron Microscopy with sub-micron resolution, Ultraviolet Photoelectron Spectroscopy (UPS), Secondary Ion Mass Spectrometry (SIMS), Ion Scattering Spectroscopy (ISS) and Fourier Transform Infrared Spectroscopy (FTIR). Each technique can be combined with the others and with sputter etching (using a differentially pumped ion gun) to obtain composition depth profiles.

**Survivable Information Systems Center** studies the survivability of critical information systems-air traffic control, telecommunications, nationwide control of power distribution, and the financial system. Societal dependence on these systems is growing and will continue to do so for the foreseeable future. The Center's research focuses on designing software which can be tailored to information systems to ensure the intended operation of their existing components.

**Center for Transportation Studies** focuses on issues and problems related to the development, operation, and maintenance of a safe, efficient intermodal transportation system for the Commonwealth of Virginia and the nation. The Center's research program is noted for being responsive to emerging challenges from the transportation sector and for continually probing into new areas of transportation-related research.
The Center’s comprehensive research program covers areas such as intelligent transportation systems, transportation planning and logistics, traffic simulation, highway safety, transportation pavements, and freight and traffic operations.

**Traffic Operations Lab (TOL)** is part of the Center for Transportation Studies of Civil Engineering Department. TOL supports research and education related to traffic signal control, optimization, and simulation and is equipped with the state-of-the-art traffic signal controllers and microscopic simulation programs, as well as hardware in the loop simulation (HILS) system. The HILS system allows testing of advanced features of actual traffic signal controllers within a laboratory environment. TOL has access to real-time traffic data from the VDOT traffic control systems through the Smart Travel Laboratory. TOL research mainly focuses on applications of advanced statistical techniques and optimization methods for developing traffic signal control algorithms and improving calibration and validation procedure for microscopic simulation models.

**Virginia Artificial Heart Center** is a major research facility for the design, development and testing of a magnetic bearing supported artificial heart for human implantation. Several prototypes have been successfully testing in pumping both water and blood. The current work is on a ventricular assist version of the pump but future work will be on a total heart replacement.

**Wound Prevention and Repair Center** explores the principles governing mechanical and biological events in chronic skin wounds, developing the necessary monitoring and prevention techniques to eradicate chronic wounds in hospital settings. At the same time, the Center applies these principles to accelerating the repair of acute skin wounds caused by trauma, and improving therapies for skin flap procedures, intestinal ulcers, and neurological injuries.

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**Facilities and Services**

The School of Engineering and Applied Science is located in a complex of buildings, the main one being Thornton Hall, named after the first dean of engineering. Thornton Hall houses the school’s administrative offices, the Departments of Civil Engineering, and Electrical and Computer Engineering, the Department of Science, Technology and Society and assorted research laboratories. South of Thornton Hall is Olsson Hall, which houses the Departments of Computer Science, and Systems and Information Engineering. Adjacent to these buildings are three buildings housing the Departments of Mechanical and Aerospace Engineering, Materials Science and Engineering, and Chemical Engineering. Wilsdorf Hall, under construction, will link materials science and chemical engineering and will be ready for occupancy by Fall 2006. The Department of Biomedical Engineering is located in Building MR5, which is part of the Health Sciences Center. The Aerospace Research Laboratory is located on Mount Jefferson.

**Computers** The School of Engineering and Applied Science and the Department of Information Technology and Communication (ITC) provide a wide range of modern facilities to support student computing activities. Students use these computing facilities for a variety of applications including, course work, special projects, and research.

These facilities are open 24-hours a day, seven days a week, and are staffed with student consultants during the afternoons and evenings. Over 500 workstations of various models are housed in these public labs, all of which are connected to the University networks and can be used independently, or to access other computers at the University or world-wide. Some facilities house high-performance Unix workstations that can be used for specific courses or research.
To supplement the public facilities, many departments and research groups operate their own computing facilities which are used for specific courses and research projects within those departments. Computer facility equipment ranges from PCs and Macintoshes, to general purpose Unix workstations, high-performance graphics workstations and specialized processors for vision and sound research, to highly advanced parallel processing engines.

The Charles L. Brown Science and Engineering Library located in Clark Hall, includes more than 240,000 volumes, 1,500 current serial subscriptions, and 1 million technical reports. A full range of information services is available, including an online catalog with remote access, reference assistance, computerized literature searching, and inter-library loans and document delivery.

The Office of Engineering Career Development is available to help engineering students establish their career goals and develop strategies to attain those objectives. In addition to individual appointments, the office provides resource material on career fields, job search strategies, interviewing techniques, and employment opportunities. The office also coordinates on-Grounds interviews in conjunction with University Career Services.

The Center for Diversity in Engineering, established in the school in 1986, is available to help students by providing academic support, motivational activities, and financial assistance. The office provides counseling, peer counseling, and other special services for both undergraduate and graduate students. The office and student societies sponsor numerous activities to support engineering students.

Affiliated Agencies

The Virginia Transportation Research Council is sponsored by the Virginia Department of Transportation in cooperation with the University, and its offices and laboratories are located in the Shelburne Building about one-half mile west of Thornton Hall. The council has two primary objectives: providing training in the fundamentals of transportation engineering; and carrying out research programs to improve the economic design, construction, maintenance, and operation of highways. The council operates laboratories that study problems of highway aggregates, geological engineering, concrete, bituminous materials, soils, bridge structures, and traffic and safety.

The Virginia Transportation Research Council also provides financial assistance for graduate students whose thesis or dissertation research is in an area of interest to the council.

The Virginia Microelectronics Consortium (VMEC), a group of colleges and universities including George Mason University, Old Dominion University, the University of Virginia, Virginia Tech, and the College of William and Mary that offer a world-class program in microelectronics education and research. VMEC was created in 1996 to serve the microelectronics industry in the Commonwealth and to exploit our diverse industry and educational microelectronics resources to our mutual benefit.

The National Institute of Aerospace (NIA) is a research and graduate education institute initiated by NASA Langley Research Center to ensure a national capability to support NASA’s mission by expanding collaboration with academia and leveraging expertise inside and outside NASA. The institute is a non-profit corporation formed by a consortium that now includes Georgia Tech, North Carolina A&T State University, North Carolina State University, the University of Maryland, the University of Virginia, Virginia Tech, Hampton University, Old Dominion University, the College of William &
NIA conducts basic, formative, and leading edge research and develops revolutionary new technologies in all areas of interest to NASA through partnerships with the Nation's universities, industry and other government agencies. NIA performs research in a broad range of disciplines relevant to NASA Aeronautics, Space Exploration, Science and Space Operations missions. Current research focus areas include Adaptive Aircraft Technologies, Rotorcraft Aeromechanics, Aviation Safety, Air Traffic Management, Flight Systems, Cooperative Control Systems, Multifunctional Materials, Nano-materials, Sensor Technology, Systems Engineering and Analysis, Space Exploration Technologies, Planetary Science and Engineering, and Atmospheric Science.

Through NIA's graduate education program, NIA's member universities offer M.S. and Ph.D. degrees in fields of engineering and the sciences relevant to NASA. Student research is conducted on-site at Langley Research Center in Hampton, VA. NIA also conducts continuing education, public outreach, and technology transfer programs supported by NASA and other sponsoring organizations.

Degree Programs

The University of Virginia School of Engineering and Applied Science offers programs leading to the degree of Master of Science and Master of Engineering, as well as Master degrees in several areas of applied science, and the Doctor of Philosophy degree. The School's 10 curricula are: biomedical engineering; chemical engineering; civil engineering; computer engineering; computer science; electrical engineering; engineering physics; materials science and engineering; mechanical and aerospace engineering; and systems engineering.

The range of studies available within the school is designed to satisfy a variety of objectives. Specific courses leading to a degree are not prescribed; instead, each student prepares an individual program, with the help of a faculty advisor, tailored to particular needs and goals and then submits it for faculty approval.

Two types of master's degrees are available. Strong emphasis is placed on research for the Master of Science (M.S.) degree. The focal point of the M.S. is a thesis describing research accomplished in close cooperation with the student's faculty advisor. The degrees of Master of Engineering (M.E.) and Master of Applied Science are professionally oriented and do not require a thesis.

The Doctor of Philosophy degree is regarded by many as a symbol that its bearer has achieved an in-depth understanding of a segment of human knowledge and has contributed significantly to that knowledge. The Ph.D. requires a program of advanced study in courses and research, satisfactory completion of Ph.D. examinations, and submission of a dissertation based on independent, original research.

Admission Requirements

The School of Engineering and Applied Science offers an exceptional educational opportunity for qualified students who seek an environment where graduate study is characterized by integrated learning experiences with highly qualified, experienced,
and dedicated faculty. Graduate admissions committees are seeking well-rounded individuals who bring exceptional intellectual capabilities along with a passion for their chosen field. The admissions process looks for evidence of competitive academic performance, work and life experiences, and qualities of character such as motivation, maturity, tenacity, integrity, ability to work with others, self-reliance, and leadership. All applicants are considered without regard to race, color, religion, sex, national origin, political affiliation, disability, age, sexual orientation, or veteran status. The Engineering School welcomes applications from men and women from other countries whose diverse perspectives broaden the range of educational experience for all members of the academic community.

An applicant must have a baccalaureate degree from a recognized college or university. While this degree will normally be in the field of engineering or applied science, degrees in other fields may be acceptable. Undergraduate courses that may be required to remedy deficiencies must be taken without credit. An applicant should have a B average for admission into graduate studies.

Each candidate must complete the Application for Admission. The application requires completion of an essay, complete transcripts of all academic work and three letters of recommendation. A non-refundable application fee must accompany the application; an application will not be considered if the fee has not been paid. All applicants are required to take the Graduate Records Exam (GRE) general exam. International students must have an excellent command of the English language in order to enroll at the University. The TOEFL exam is required of all applicants if the language first learned and spoken in the home is not English. Most students admitted score at least 600 on the paper format of the test, 250 on the computer-based test or 100 on the Internet-based test. Scores from the International English Language Test (IELTS) may be submitted in lieu of the TOEFL. Most successful applicants score in the 7.0 band or better on the IELTS. Some students may be required to complete the Summer English for Academic Purposes Program (www.virginia.edu/provost/caelc/summer.html) prior to admission.

Applications may be completed and submitted on-line (https://applyonline.virginia.edu/engineering) or application materials may be downloaded from the same site and submitted by mail to: Graduate Studies, Office of the Dean, School of Engineering and Applied Science, Thornton Hall, Room A-108, 351 McCormick Road, P.O. Box 400242 Charlottesville, VA 22904-4242. On-line applications are strongly encouraged. Application information, including recommendations, reach the admissions committees much faster if submitted electronically.

All students who wish to be nominated for assistantships and fellowships should submit a complete application by January 15 for September admission. For U.S. citizens and permanent residents, deadlines for complete applications for admission are: December 1 for January admission, May 1 for June admission, and August 1 for September admission. International students on visas (other than permanent residents) must apply at least five months prior to the term for which admission is sought to allow time for the International Student Office to review and process necessary papers. A prospective international student must have appropriate, current, valid, and legal non-immigrant status before he/she can be offered final admission to the University. Also, all international students (other than permanent residents) must provide evidence of financial capability for the duration of their studies.

Financial Assistance

The School of Engineering and Applied Science offers financial aid to graduate students through fellowships and assistantships. Students must be nominated by their
department to be considered for a fellowship or assistantship. Most superior students can expect to receive aid of some kind throughout their graduate careers.

Students receiving financial aid from the School of Engineering and Applied Science must be registered as full-time students, defined as at least 12 credits of lecture-laboratory courses and/or research during the academic year, must maintain a grade point average of 3.0 and must also maintain satisfactory progress toward a degree. Graduate research assistants must register for a minimum of 6 credits of research during the summer term. Students receiving financial aid are not permitted to have other employment without approval of the Office of Assistant Dean for Graduate Programs. Students are awarded financial assistance to enable them to devote maximum effort to graduate studies.

**Fellowships**

Fellowships are intended to allow graduate students to devote full time to learning opportunities in the classroom and laboratory. No work duties, in a pay for service sense, are required, but good academic progress, including research for the thesis or dissertation, is essential. Some programs, during fellowship support, will include research and teaching duties as part of the usual academic requirements for the degree.

**Graduate Research Assistantships** Graduate Research Assistants are assigned to work with a faculty member on a specific research project which should culminate in a project report, thesis, or dissertation. Full-time graduate research assistants may not carry a load of more than 9 credits of lecture-laboratory courses but must register each semester for enough additional credits of teaching/research to maintain full-time student status.

**Graduate Teaching Assistantships** Graduate Teaching Assistants are assigned to assist a faculty member teaching a specific lecture/laboratory course. The assigned duties will depend on the course and instructor. Graduate teaching assistants may not carry a load of more than 9 credits of lecture-laboratory courses but must register each semester for enough teaching/research credit to maintain full-time student status.

**Special Fellowships**

**The ARCS Fellowship** was established in 1984 as an annual gift from the Metropolitan Washington, D.C. Chapter of the Achievement Rewards for College Scientists Foundation. The recipients are chosen from enrolled students nominated by the departments.

**L. William Ballard, Jr., Fellowship** is offered to a graduate student who has demonstrated academic excellence, leadership qualities, and financial need.

**Carlos and Esther Farrar Fellowship** provides fellowships to deserving students at the University of Virginia studying in disciplines and programs pertaining to scientific investigation of the universe (i.e., aerospace engineering, astrophysics, mathematics). This fellowship is awarded on the basis of scholastic merit and financial need.

**John H. and Dorothy W. Sidebottom Fellowship** is offered to graduate students majoring in aerospace engineering.

**GEM Fellowships** The University of Virginia is a member of the National Consortium for Graduate Degrees for Minorities in Engineering, Inc. While attending one of the member universities for graduate study leading to a master’s degree in engineering, a
minority student accepted into the GEM program receives a stipend plus an allowance for tuition and fees. The School of Engineering and Applied Science supplements the stipend to equal, at a minimum, the total of the fellowships normally awarded to entering students. Application material can be obtained by contacting Executive Director, GEM, Box 537, Notre Dame, IN 46556, (219) 239-7183.

**The Dean’s Fellows Award** was established in 1984 to recognize outstanding entering graduate students. This award provides a stipend of $2,000 per year for up to three years, in addition to the financial aid offered by the departments.

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**General Requirements**

**Grades** The letter grade symbols used for grading graduate students in the School of Engineering and Applied Science are: A+, A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F. To obtain a graduate degree in the School of Engineering and Applied Science, an individual must have a minimum cumulative grade point average of 3.0 on all graded graduate course work taken at the University of Virginia while a graduate student, and graduate courses taken as an undergraduate at the University of Virginia if the courses are listed on a program of studies and are used to satisfy requirements for a graduate degree. No grade lower than a C is acceptable toward meeting the requirements for a graduate degree. If a course is repeated, both grades are used in computing the overall grade average. Undergraduate courses and courses taken on a Credit/No Credit basis may not be used to meet requirements for a graduate degree and are not used in computing the grade average. A 10-day period past the end of the semester (end of the examination period) is automatically allowed to remove an incomplete. A maximum extension to the end of the subsequent semester (the following fall for a spring class and spring for a fall class) may be granted upon special request to the dean’s office.

**Quality of Work** Graduate degrees are not conferred merely upon the basis of the number of courses passed, nor the length of time spent in residence or in research, but primarily on the basis of the quality and scope of the candidate’s knowledge and power of investigation in a chosen field of study. Unsatisfactory work during any semester or an overall grade average of less than B may be considered sufficient reason for withdrawal of financial assistance, or for enforced withdrawal from the graduate program. Graduate students are considered to be on probation if their cumulative grade point average for graduate work is less than 3.0 and they are notified of this by the dean’s office. Graduate students are subject to dismissal if their cumulative grade point average is not raised to 3.0 within one semester.

**Research** All graduate students conducting research must register for the appropriate research course. Credits are assigned to this course in such a way that the total number of credits for which the student is registered reflects the fraction of time devoted to progress toward a degree. Students must register for a minimum of six credits of research for the Master of Science (thesis) degree and 24 credits of research for the Ph.D. degree. In many cases, research in excess of these minimum requirements, particularly for the Ph.D. degree, is desirable. Project research for the Master of Engineering or Master of Applied Science (non-thesis) degrees is encouraged and, in some curricula, required.

**Time Limit For Graduate Degrees** The student must complete all the requirements for a Master of Science degree within five years after admission to the graduate program, and he or she must complete all requirements for a Master of Engineering degree within seven years after admission to the graduate program. All requirements for the Doctor of Philosophy degree must be completed within seven years after admission to the doctoral program. Expired credits may be revalidated with approval from the advisor, the appropriate department graduate committee or department...
chair, graduate studies committee, and the Office of the Dean.

**Residency** M.S. and Ph.D. degree programs require a period of residency. A full-time graduate student in residence at the University, whether taking courses or doing research, is expected to be fully engaged in the academic community, to participate in planned and impromptu discussions with faculty, graduate students and undergraduate students, and to actively contribute to intellectual discourse within the School. During the period of residency, a student should have no major conflicts of commitment. Substantial employment obligations, for example, would generally be in conflict with the residency requirement.

**Right to Petition** In certain cases there may be extenuating circumstances that cause a deviation from the requirements for the master’s or doctoral degrees. A student has the right to petition the Graduate Studies Committee requesting such a deviation from the normal requirements. This petition should be in writing and endorsed by both the student’s advisor and department chair.

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**Transfer Credit**

The Graduate School of Engineering and Applied Science grants transfer credit based on an analysis of the content, level and comparability of the course taken, the applicability of the courses to the student’s intended degree program, the quality of the student’s performance in the course, and the institution at which the work was completed. Transfer credit, as described below, will be considered for acceptance toward a degree in the Graduate School of Engineering and Applied Science.

**Master of Science Candidates** may include a maximum of six credits of graduate course transfer credit on their program of study at the University of Virginia. They cannot have been used to satisfy requirements for another degree, and only courses with a grade of B or better may be transferred. All requests for the inclusion of transfer credit in the University of Virginia program of study are subject to the approval of the candidate’s academic department and the Office of the Dean for Graduate Programs.

**Master of Engineering Candidates** may include a maximum of 12 credits of graduate course transfer credit in their program of study at the University of Virginia. They cannot have been used to satisfy requirements for another degree, and only courses with a grade of B or better may be transferred. All requests for the inclusion of transfer credit in the University of Virginia program of study are subject to the approval of the candidate’s academic department and the Office of the Dean.

**Doctor of Philosophy Candidates** transfer of courses must be submitted for approval in the program of study.

**Air Force and Army ROTC**

Graduate students in the School of Engineering and Applied Science are eligible to participate in the Air Force and Army ROTC programs. Inquiries concerning enrollment in the Air Force ROTC should be addressed to the Unit Admissions Officer in the Astronomy Building (434-924-6833). Inquiries concerning enrollment in the Army ROTC should be addressed to the Professor of Military Science, Room B-030, New Cabell Hall. Air and Military Science courses are described in the *Undergraduate Record*.
Master of Science

The Master of Science degree is a graduate research degree that introduces students to research at the graduate level. A full-time student may be able to complete the program in one and one-half calendar years. The School of Engineering and Applied Science offers instruction leading to degrees in biomedical engineering, chemical engineering, civil engineering, computer engineering, computer science, electrical engineering, engineering physics, materials science and engineering, mechanical and aerospace engineering, and systems engineering.

The department chair appoints an advisor to each graduate student for consultation in preparing a program of study. This program should be approved by the advisor and the department chair, and submitted for approval to the Office of the Dean by the end of the first semester of graduate study. Graduate credit is not automatically granted for courses completed before the program of study is approved. Any later change in the program of study must be submitted for approval. Approval of a program of study does not obligate the University to offer the courses listed, as all graduate courses are offered subject to sufficient enrollment. Candidates who complete the degree requirements and are approved by the faculty are presented for degrees at the University’s first scheduled graduation exercise following completion of the requirements.

Degree Requirements A candidate for the Master of Science degree must:

1. complete an approved program of study that includes a minimum of 24 graduate-level credits, with at least 12 credits taken in the area of major study. This program may contain no more than a total of nine credits of 500-level courses, and no more than six of those credits may be taken within the department conferring the degree. Classes at the 400-level or below do not count toward the Masters degree. Departmental requirements may be more restrictive. The program may include a maximum of six transfer credits for graduate courses completed at another school of recognized standing; however, those courses must be part of the approved program of study at the University. Only courses with a grade of B or better may be transferred;
2. complete acceptable research, accomplished under the close direction of a faculty advisor. The research is documented in a written thesis. Written instructions for thesis preparation are available in the Office of the Dean;
3. perform satisfactorily in a final examination of the thesis conducted by an examining committee appointed by the Office of the Dean. Depending on the policy of the individual department, at least one examiner may be from outside the applicant's major department. A candidate who does not perform satisfactorily on the examination may, with the recommendation of two-thirds of the examining committee, be granted a further examination after being given adequate time to prepare;
4. submit the approved thesis. Three copies of the final thesis, as approved by the examining committee, must be submitted for binding by the date specified on the academic calendar;
5. apply for the degree, using a standard form, by the date specified on the academic calendar;
6. complete at least one semester in residence at the University of Virginia as a full-time student; and
7. complete a comprehensive examination (if required by the student’s department).

Master of Engineering

The Master of Engineering degree is a graduate professional degree. It enhances the professional instruction of the bachelor’s program in engineering or applied science, providing greater knowledge and deeper understanding in a specific field. A full-time
student should be able to complete the degree program in one calendar year. The School of Engineering and Applied Science offers instruction leading to the degree of Master of Engineering in biomedical engineering; chemical engineering; civil engineering; computer engineering, electrical engineering; mechanical and aerospace engineering; and systems engineering.

The degrees of Master of Computer Science, Master of Engineering Physics, and Master of Materials Science and Engineering are also offered.

The department chair appoints an advisor to each graduate student for consultation in preparing a program of study. This program must be approved by the advisor and the department chair and submitted to the Office of the Dean for approval by the end of the first semester of graduate study.

**Degree Requirements:** A candidate for the Master of Engineering, Computer Science, Engineering Physics, or Materials Science and Engineering must:

1. complete an approved program that includes a minimum of 30 graduate-level credits, with at least 18 credits taken in the area of major study. This program may contain no more than nine credits of 500-level courses; no more than six of those credits may be taken within the department conferring the degree. Classes at the 400-level or below do not count toward the Masters degree. Departmental requirements may be more restrictive. The program may include a maximum of 12 transfer credits for graduate courses completed at another school of recognized standing; however, those courses must be part of the approved program of study at the University. Only courses with a grade of B or better may be transferred;
2. apply for the degree, using a standard form, by the date specified in the academic calendar; and
3. complete a comprehensive exam (if required by the student’s department).

**Part-time Graduate Students**

Those students who wish to pursue a graduate degree in the School of Engineering and Applied Science on a part-time basis must be approved for admission to the degree program by the department or program offering the degree, and they must meet all admission requirements for full-time degree students. Part-time students taking on-Grounds courses for degree credit, except those taking courses through the Commonwealth Graduate Engineering Program (CGEP), must register through the School of Engineering and Applied Science, not through the School of Continuing and Professional Studies. A maximum of six credits of graduate course work taken on-Grounds through continuing and professional studies prior to admission to a graduate degree program may be accepted as credit toward degree requirements.

**Accelerated Master’s Degree in Systems Engineering**

The Accelerated Master’s Degree in Systems Engineering is designed to enable working professionals to become systems thinkers and problem solvers through a unique blend of formal education integrated with personal work experience. Responding to the needs of industry and individuals alike, this one-year Accelerated Master’s Program enables professionals to earn their degrees without career interruption.

The program’s focus is on information proficiency, systems thinking and decision analytics. The curriculum introduces and explores systems methodologies through real-world case studies firmly focused on problem-solving using both analytical and theoretical modeling approaches throughout.

Taught by full-time faculty of the Department of Systems and Information Engineering
and the Darden Graduate School of Business Administration, the program format includes one full week in residence in late May, twenty weekends (Fridays and Saturdays) throughout the year, and a final week in residence during the following April. Tuition covers courses, books, software, lodging and meals.

The program has four core courses: Introduction to Systems Engineering (SYS 601), Systems Integration (SYS 602), Enterprise Analysis and Modeling (SYS 603) and Probabilistic Modeling (SYS 605). Additional elective courses include data analysis and forecasting, risk analysis and modeling, information systems architecture and decision analysis among others. Prerequisites include a bachelor’s degree from an college or university of recognized standing, calculus (2 semesters), probability and statistics (calculus-based), linear algebra (or equivalent) and computer programming. Applicants must take the GRE general exam.

Commonwealth Graduate Engineering Program (CGEP)

In addition to the resident Master of Engineering degree program conducted on the Grounds of the University of Virginia, the School of Engineering and Applied Science offers the following six degrees through the Commonwealth Graduate Engineering Program: Master of Engineering in Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical and Aerospace Engineering, and Systems Engineering; Master of Engineering Physics, and Master of Materials Science and Engineering.

Regular graduate courses are taught via videoconferencing throughout the Commonwealth and to selected out-of-state locations. This two-way video/two-way audio capability provides professors and students on-Grounds the ability to communicate with off-Grounds students at remote classroom sites. Serving as off-Grounds receive sites are Virginia Polytechnic Institute and State University, George Mason University, Virginia Commonwealth University, Old Dominion University, Mary Washington College, and Shenandoah University, as well as the Centers for Higher Education in Roanoke, Lynchburg, Northern Virginia, Hampton Roads, Abingdon, and Halifax/South Boston. Additionally, certain companies and government agencies have established classrooms at their locations and participate in this graduate engineering program.

Each of the six departments in this program has an appointed advisor who consults with students on curriculum and any special circumstances that might arise with participating working professionals. Students’ programs of study must be approved by their advisors and the associated department chairs and be submitted to the Office of the Dean.

Degree requirements are the same as mentioned in the previous Master of Engineering section, except that an additional three transfer credits from Virginia Commonwealth University, George Mason University, Old Dominion University, or Virginia Polytechnic Institute and State University may be included in the candidate’s program of study.

Graduate courses with grades of C or better taken for graduate credit at participating institutions may be transferred toward meeting the requirement of the Master of Engineering degree.

All graduate courses taken for degree credit through the Commonwealth Graduate Engineering Program, including transfer courses from the participating institutions, are included in the student’s grade point average.

M.E. – M.B.A. Joint Degree Program
The objective of the joint M.E.-M.B.A. degree program is the development of leaders with business administration skills and solid technical expertise. The M.E. degree provides a foundation in engineering or applied science well above the normal undergraduate level. The M.B.A. develops the functional areas of business by teaching the essential behavioral and quantitative sciences that apply to management, as well as the techniques of management decision making. The combined degrees provide the knowledge required for a wide range of business applications.

A student must be admitted to both degree programs and satisfy nearly all of the requirements for both degrees. Typically, the overall program length is reduced by one semester compared to the total time for attaining both degrees separately.

In order to obtain this reduction in the number of credits, the student cannot stop after one degree but must finish both degrees. If the student decides to drop out of the joint degree program, the full requirements of one of the degree programs must be met.

Students in the M.E.-M.B.A. Joint Degree Program are required to complete 24 credits for the Master of Engineering degree in SEAS and 69 credits for the Master of Business Administration degree in the Darden Graduate School of Business Administration. Of the 24 credits in SEAS, 21 credits will be normal course work and 3 credits will be a project course taken in an appropriately numbered course. A minimum of 12 credits of course work must be taken in the major department, with a maximum of 6 credits at the 500 level. None of the 24 credits may include a course taken in the Darden School. The project must have one advisor from SEAS and another from the Darden School.

**Doctor of Philosophy**

The School of Engineering and Applied Science offers instruction leading to the degree of Doctor of Philosophy in Biomedical Engineering; Chemical Engineering; Civil Engineering; Computer Engineering; Computer Science; Electrical Engineering; Engineering Physics; Materials Science and Engineering; Mechanical and Aerospace Engineering; and Systems Engineering.

An advisory committee for each doctoral student is appointed by the Office of the Dean upon recommendation of the chair of the student’s department or curriculum area. At least one member of the advisory committee is from outside the student’s department and major curriculum study area. The committee meets with the student as soon as possible to assist in planning a detailed program of study and research. The committee recommends a program of formal courses, discusses research objectives and research plans with the student, and advises the student on the areas in which he or she must take Ph.D. examinations. The committee meets with the student as needed to review progress and, if necessary, to assist the student in revising the program of study.

**Degree Requirements** The degree of Doctor of Philosophy is conferred by the School of Engineering and Applied Science primarily in recognition of breadth of scholarship, depth of research, and ability to investigate problems independently. A candidate for the Doctor of Philosophy degree must:

1. complete at least three sessions (or the equivalent) of graduate study after the baccalaureate degree, or two sessions (or the equivalent) after the master’s degree. At least one session beyond the master’s degree must be in full residence at the University of Virginia in Charlottesville. For students who enter a Ph.D. program without a master’s degree, at least 1.5 sessions (3 semesters, not including summer sessions) must be spent in full residence at the University
of Virginia in Charlottesville. For the purpose of satisfying these requirements, two regular semesters (not including summer sessions) will be considered as one session;

2. satisfactorily complete an approved program of study. Each program is tailored to the individual student in accordance with the departmental requirements approved by SEAS faculty. The program must include a combined minimum of 72 credits of research and graduate level course work beyond the baccalaureate. The program must also include a minimum of 24 credits of formal course work, with no more than nine of those credits from 500-level courses. No more than six credits at the 500-level may be earned within the department granting the degree. Classes at the 400-level or below do not count toward the Ph.D. degree. Departmental requirements may be more restrictive. Transfer of course credit from other schools of recognized standing may be included in the program of study; however, only courses with a grade of B or better may be transferred. The student must submit the program for approval first to the department faculty and then to the Office of the Dean within one semester after the Ph.D. exam;

3. perform satisfactorily on the departmental Ph.D. examination. The objective of the examination is to determine whether the student has assimilated and is able to integrate a body of advanced knowledge;

4. submit a dissertation based on independent, original research that makes a significant contribution to the student’s field of study. In preparation for conducting research and writing the dissertation, students must prepare a written dissertation proposal. This proposal describes the current state of the art with bibliography, outlines the proposed method of investigation, and discusses the anticipated results. The student then makes a public, oral presentation of the proposal to the advisory committee, with all members of the faculty invited to attend. After the presentation, the student submits the written dissertation proposal for approval to the department faculty (or its designated committee) and the Office of the Dean;

5. be admitted to candidacy for the degree: a student must have satisfactorily completed the Ph.D. examination and have received approval for the dissertation proposal before being admitted to candidacy. Admission to candidacy must be completed at least one semester before the degree is awarded;

6. satisfactorily present and defend the dissertation in a public forum. The dissertation defense is conducted orally and publicly by a committee appointed by the Office of the Dean; this committee must include the candidate’s advisory committee. The defense is held after the candidate has submitted the dissertation to the committee, and it is designed to test the student’s knowledge of a field of research. Candidates who are accepted by the examining committee and approved by the faculty are presented for degrees at the first scheduled graduation exercises of the University following completion of the requirements;

7. apply for a degree on the standard form by the date specified in the academic calendar;

8. submit three copies of the approved final dissertation to the Office of the Dean by the date specified in the academic calendar.

National Institute of Aerospace

The University of Maryland, Virginia Tech, North Carolina State University, North Carolina A&T State University, Georgia Tech, and the University of Virginia are participating in a cooperative program of graduate engineering and applied science education and research centered in the Tidewater area of Virginia. This effort focuses upon research and education opportunities found at the NASA Langley Research Center. It is intended to allow students to pursue M.S. and Ph.D. degrees based upon research conducted at the NASA Langley facility. Students in the NIA program must be U.S. citizens, enroll in the graduate program of one of the six participating schools.
(their "home institution"), reside in the Hampton Roads area, and work on a research
project at NASA Langley under the guidance of a faculty member at their home
institution. Using distance learning technology, students in the NIA program are able
to take graduate classes from the six participating schools (the "NIA universities"). A
student's program of study may include 50 percent transfer courses provided that
those courses are taught by faculty of the NIA universities. Upon successful completion
of the program, a student receives a degree from her or his home institution. Other
M.S. and Ph.D. degree requirements are the same as mentioned in the Master of
Science and Doctor of Philosophy sections, with the exception that residency in
Charlottesville is not required.

Faculty

Office of the Dean of the School of Engineering and Applied Science

James H. Aylor, Ph.D., Dean
Barry W. Johnson, Ph.D., Senior Associate Dean, Associate Dean for Research,
Professor
Mary P. Beck, M.S., Applied Math Instruction, Lecturer
Nancy J. Cable, Ph.D., Vice President for Development of Virginia Engineering
Foundation, Associate Dean
M. Elzey, D.Sc., Director of Rodman Program, Associate Professor
James F. Groves, Ph.D., Assistant Dean for Research, Director of Distance Learning
Program, Assistant Professor
Frances Hersey, Associate Director of Center for Engineering Career Development, 
Lecturer
Clarence J. Livesay, B.S., Director of Center for Engineering Career Development, 
Lecturer
P. Paxton Marshall, Ph.D., Associate Dean for Undergraduate Programs, Professor
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Mitchel C. Rosen, Ph.D., Chief Technology Officer, Associate Professor
Mary D. Smith, M.S., Assistant Dean for Finance and Budget, Lecturer
Kathryn C. Thornton, Ph.D., Associate Dean for Graduate Programs
William J. Thurneck, Jr., Ph.D., Associate Dean for Administrative and Academic 
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Carolyn A. Vallas, M.S., Director of Center for Diversity in Engineering, Lecturer

Department of Biomedical Engineering

Professors

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Brian R. Duling, A.B., Ph.D.
Sanjiv Kaul, M.D., Francis M. Ball Professor of Cardiology
Yong I. Kim, B.S., M.S., Ph.D.
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Distinguished Professor, Chair of Orthopaedic Surgery
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Richard J. Price, B.S., M.S., Ph.D., Associate Professor
David M. Smalley, B.S., Ph.D., Assistant Professor

Department of Chemical Engineering

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Visiting Associate Professor

Susan E. Burns, B.C.E., M.S., Ph.D., P.E.

Visiting Assistant Professor

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M. Shabbir Hossain, B.S.C.E., M.S.C.E., Ph.D.
Roseaana M. Neupauer, B.S., S.M., M.S., Ph.D., P.E.

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