ENGINEERING ACADEMIC PROGRAMS
THE UNIVERSITY OF GEORGIA

UGA provides a fundamental engineering education in a liberal arts environment

Information Handbook

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Description of UGA Engineering

The University of Georgia engineering program provides a small-college experience within a major university setting. This small-college environment allows faculty and students to "get to know each other on both the professional and the personal level". Through the university's Faculty of Engineering, the engineering student also has opportunities to participate in innovative interdisciplinary research programs. Unlike conventional engineering schools where faculty members are appointed to an engineering department, members of UGA's Faculty of Engineering are housed in academic units throughout the campus.

The University of Georgia is a major land-grant university that offers a learning environment that goes beyond the classroom. The UGA engineering student is able to develop a network of friends who are majoring in the arts, education, communication, law and business. After graduation, the student will work closely with professionals who have these backgrounds. UGA's comprehensive education, environment and extracurricular activities provide the engineering student with the life-long learning skills needed in today's global market. Alumni from the UGA engineering program indicate that such an environment and education philosophy lead to a wide range of avenues for career advancement.

Several years ago, the UGA faculty designed the engineering degrees to focus on the fundamentals of engineering. Overall, our program provides an education that qualifies graduating students to take advantage of employment opportunities related to civil, mechanical, electrical, agricultural, biochemical, biomedical and environmental engineering. This design allows the UGA student to choose from the following

Engineering Areas of Emphasis

Biochemical **Biomedical** **Environmental**
Electrical/Electronic Systems **Natural Resource Management** **Mechanical Systems**
Process Operations **Structural Systems**

These areas of emphasis are offered under the B.S. Biological Engineering and B.S. Agricultural Engineering programs, both of which are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 [telephone: (410) 347-7700].

The Program Educational Objectives of these engineering programs are to provide graduates with:

- *Educational experiences using mathematical, physical, chemical, biological and engineering sciences and engineering design that motivate and prepare graduates to recognize and solve complex engineering problems.*
- *Superb technical skills in the areas of computers, information transfer and communication; innovative and imaginative attitudes; and an appreciation for the management function*
- *Learning experiences necessary for the synthesis of knowledge across disciplines in the social sciences, humanities, and natural sciences in order to understand the ethical, environmental and social impacts of decisions.*
- *An appreciation for continued professional development through life-long learning.*

The University of Georgia's motto is "to teach, to serve, and to inquire into the nature of things". Through its programs and practices, the University seeks to foster the understanding of and respect for cultural differences necessary for an enlightened and educated citizenry. The UGA main campus, located in downtown Athens, covers

605 acres, houses 14 different schools or colleges and offers 164 undergraduate majors. The University and the Athens area offer the student activities in the fine arts, community volunteer organizations, internships, professional society involvement and chances to make life long friendships.

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Biomedical Area of Emphasis

Description

This area of emphasis combines biology and engineering in order to develop medical instruments and prosthetic devices. Engineers with this expertise develop, design, and manufacture products for the medical healthcare industry.

Goal

The educational goal of this area of emphasis program is to prepare graduates who can function effectively at the complex interface between engineering and medicine or biology.

Faculty/Student Activities

- Cellular Engineering: This activity is centered on investigating cellular signaling with emphasis on establishing quantitative information about how the components (e.g., receptors, enzymes, signaling molecules) fit together in space and time to produce mechanical, chemical, and biological outputs that constitute cell, tissue, or organ function. Applications range from cell-based sensing to biological effects of magnetic fields.
- Biomechanics: Faculty are developing an understanding of the tissue healing mechanism. Results are intended to ensure the health of the general public and of companion and food animals. The specific goals of this program are: to utilize an avian model to examine human medicine issues such as tendon rupture, wound healing, and bone loss/gain; to study the effects of vascularization and the hormonal/endocrine systems on tendon mechanics.
- Environmental Physiology: This activity is investigating the effects of temperature, relative humidity and other environmental factors on bone and soft tissue mechanics. Past studies have focused on animal respiratory problems due to air born particulates and pollutants.
- Nanoscale Structures: This activity seeks to integrate biotechnology and nanotechnology for advancing fundamental knowledge in the development of new products such as a biosensor. Researchers in the Nano-fabrication Center are developing new structures for growing cells with the long term objective of developing biomedical devices such as glucose sensors.

Career Opportunities

As engineers, graduates with this specialization are qualified to

- Develop new biomedical products such as surgical glues
- Design medical implants and orthopedic devices
- Develop software to monitor the physiological function of patients and workers
- Assist in the fabrication of biomaterials needed in implants
- Analysis of patient health using imaging equipment.

These graduates are pursuing careers such as

- Researchers developing new medicines and medical devices
- Safety engineers evaluating medical and health care products
- Designers improving the quality of life for humans and animals, and
- Support engineers working with physicians to solve health care problems.

Student Project-Functional Prosthetic Hand Providing Independent Movement of All Fingers
The objective of this project was to design a prosthetic hand which is both cosmetic and functional. The hand had to have the ability to perform everyday tasks such as picking up and holding a glass of liquid. Overall, the final design had to be superior to current designs that use mechanical system powered by shoulder or arm or electrically powered using electrical impulses from the residual limb to trigger sensors. The final solution to this problem included a prosthetic hand with all five fingers moving independently and was capable of grasping irregularly shaped objects. A prototype of the design was made in order to exam and to evaluate the functionality of the prosthetic. A final prototype for human use was not made.

Typical course load for the Biomedical Area of Emphasis

Year one	Course	Credit Hour
Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	BIOL 1107 & L - Biology	4
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		
Fall	ENGR 2120 - Statics*	3
	BIOL 1108 & L - Biology	4
	MATH 2500 - Calculus	3
	ENGL 1102 - English Comp.	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2110 - Engr. Dec. Making	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	CHEM 2211 & L - Organic Chem	4
	MATH 2700 - Diff. Equations	3
Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 3520 - Mass Tr./Rate Phen.	3
	ENGR 3720 - Engr. Physiology	3
	BCMB 3100 (4010) - Biochemistry 3	3
Spring	ENGR 2140 - Str. Of Mat'ls	3
	ENGR 3760 - Biomech. or Elective	3
	English Literature	3
	MIBO - Microbiology	4
	Free Elective	2
Fourth Year		

Fall	ENGR 4230 - Sensors and Transducers	3
	ENGR 4740 - Biomaterials	3
	ENGR 4210 - Linear Sys. or Elective	3
	Social Science****	3
	Major Sci. Elec.*****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR - Area Elective	3
	Social Science****	3
	Social Science****	3
	Social Science****	3

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Biochemical Area of Emphasis

Description

This area of emphasis involves the application of the engineering and biological sciences for the development of new bio-based products and processes. Graduates with this specialization understand and use techniques to modify and control biological systems needed in the chemical and biochemical industries including food production, pharmaceuticals and environmental protection.

Goal

The educational goal of this area of emphasis is to prepare engineers who can function effectively at the complex interface of engineering, biochemistry and microbiology.

Faculty/Student Activities

- **By-Product Recovery.** This activity seeks to separate useful byproducts from waste streams occurring as a result of business activities or industrial processes to increase the efficiency in the use of resources, create of new products and processes, increase productivity and profitability, create new jobs, and prevent pollution. It is intended to support state efforts in converting and utilizing industrial, municipal, and agricultural byproducts as value-added products

- **Molecular BioEngineering** focuses on research for the improvement of biological processes through metabolic engineering. Metabolic Engineering involves targeted alteration of biochemical pathways toward the goals of increased yield and productivity of biological products, or for enhanced biodegradation capabilities.

- **Bioconversion** Efforts are focused on converting and utilizing industrial, municipal, and agricultural by-products and to foster new industries associated with these materials. Key programs are developing technology and providing technology-transfer to reduce solid wastes going to landfills, thereby protecting groundwater resources in Georgia; are enhancing the economic viability of rural Georgia by facilitating economic alternatives for waste handling, thereby facilitating retention of existing industries and development of new industry; and are enhancing agronomic and horticultural industries by enabling economic nutrient and soil building sources

Career Opportunities

As engineers, graduates with this specialization are qualified to

- Design equipment for fermentation processes needed by the food and pharmaceutical industries,
- Design monitoring and control systems for biochemical processes,
- Develop new techniques to handle waste material,
- Assist customers in solving problems; providing technical services to the biochemical industry,
- Provide technical support to maintain and troubleshoot processes at a production facility,
- Conduct inspections to ensure product quality and worker safety, and
- Conduct research to identify new products and processes for the benefit of society.

Student Project-Catheter Impregnation Process Automation

Horizon Medical Products (HMP) enlisted three engineering students to design a mechanism to automate a part of HMP's production of antimicrobial impregnated catherters. Tehse short-term central venous catheters (CVCs) are expected to

provide antimicrobial protection against bloodstream infection for a period significantly longer than existing competitive products. HMP has an established process involving mixing of components to form an antimicrobial solution, dipping of the catheter tubing within the antimicrobial solution and cleaning of the catheters following immersion in the solution. Through thorough definition of the problem and conceptual development, the design team developed a final solution that focused on both the mixing and dipping processes named above. The design includes physically separated mixing and dipping processes, integrated UV spectrophotometric probes for sampling purposes, a telescopic pole mechanism and automated parallel grippers for catheter restraint, among other elements.

Typical course load for the Biochemical Area of Emphasis

Year one	Course	Credit Hour
Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	BIOL 1107 & L - Biology	4
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		
Fall	ENGR 2120 - Statics*	3
	BIOL 1108 & L - Biology	4
	MATH 2500 - Calculus	3
	ENGL 1102 - English Comp.	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2110 - Engr. Dec. Making	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	CHEM 2211 & L - Organic Chem	4
	MATH 2700 - Diff. Equations	3
Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 3520 - Mass Tr./Rate Phen.	3
	MIBO 3500 Microbiology	3
	BCMB 3100 (4010) - Biochemistry 3	3
Spring	ENGR 2140 - Str. Of Mat'ls	3
	ENGR 4450 Structural Environments	3
	ENGR 4510 Biochemical Engineering	3
	ENGR area elective	4
	Free Elective	2

Fourth Year		
Fall	ENGR 4230 - Sensors and Transducers	3
	ENGR 4520 Design of Biochem Sep.	3
	English Literature elective	3
	Social Science****	3
	Major Sci. Elec.*****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR - Area Elective	3
	Social Science****	3
	Social Science****	3
	Social Science****	3

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Environmental Area of Emphasis

Description

This area of emphasis combines the natural and biological sciences with engineering in order to develop sustainable environmentally friendly processes and products. Taking advantage of UGA's Institute of Ecology (internationally known

for its multidisciplinary approach to science of ecology), students learn how to use natural systems to cleanse water and reduce society's impact on ecosystems.

Goal
The goal of this area of emphasis is to couple the students' skills in microbiology, biochemistry and engineering so that they can design processes and products that prevent pollution formation or remediate polluted environments.

This research program allows the student to participate in a dual degree program with **Environmental Health Science**. This program fully integrates the two accredited degree programs, Environmental Health Science and Biological Engineering, into a 5-year course of study which culminates in the awarding of both degrees.

Faculty/Student

- **Watershed Assessment.** Watershed Assessment is the use of chemical, physical, and biological properties to determine the current health of a watershed. Also included in a watershed assessment are predicting future watershed conditions and suggesting management practices that will maintain and improve the health of a watershed.
- **Modeling of Groundwater Flow:** This program examines the interaction of groundwater with the environment. Researchers are developing mathematical models and implementing these models to understand the effects of wells on rivers and lakes, of sea water intrusion on coastal aquifers and the flow of leaky aquifer systems.
- **Systems and Engineering Ecology.** This program is seeking to identify the fundamental principles that govern ecosystems, to model the organizing nature of ecosystems and their ability to adapt and to develop engineering science that can be used to design ecosystems for the benefit of the environment.
- **Pollution Prevention Program.** This program is focused on identifying technologies that can prevent pollutants from entering the environment.

Career Opportunities
Graduates with this specialization are qualified to

- Design water treatment systems
- Develop, operate and monitor solid waste facilities
- Design systems to handle and dispose of hazardous waste
- Maintain, restore and protect ecosystems and sustainable systems
- Analyze, predict and correct movement of contaminants in air, water, and soil
- Design contaminated site remediation and restoration

Student Project-Design of a Living Machine
A "living machine" is used to treat water using naturally occurring processes. "Living machines" accelerate nature's own water purification processes. This system incorporates bacteria, plants and animals that thrive by breaking down and digesting organic pollutants. Since the use of these natural processes reduces energy requirements and avoids the addition of chemicals, it is a more environmentally friendly wastewater treatment option. The objective of this project was to design a "Living Machine" that can be used at an eco-tourism lodge in the cloud forests of Northwestern Ecuador. Initial considerations for design were the lodge's remote location, the amount of rainfall in the region, topography of the site and the treatment standards that the wastewater must meet. The "living machine" will dispose of food waste and treat the on-site waste-water stream. This will be accomplished using a two-step septic tank system which will be used primarily to settle out solids. . The main treatment of the wastewater will be done using a subsurface wetland. The wetlands were designed based on the removal of nitrogen because it has the slowest removal rate. The treated effluent will be used to raise tilapia, water an organic vegetable garden and to flush toilets. Aesthetics, education qualities and renewable energy resources were major concerns.

Typical course load for the Environmental Area of Emphasis

Year one	Course	Credit Hour

Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	BIOL 1107 & L - Biology	4
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		
Fall	ENGR 2120 - Statics*	3
	BIOL 1108 & L - Biology	4
	MATH 2500 - Calculus	3
	ENGL 1102 - English Comp.	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2110 - Engr. Dec. Making	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	CHEM 2211 & L - Organic Chem	4
	MATH 2700 - Diff. Equations	3
Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 3520 - Mass Tr./Rate Phen.	3
	ENGR 3410 Intro. To Natural Resource Engr.	3
	BCMB 3100 (4010) - Biochemistry	3
Spring	ENGR 2140 - Str. Of Mat'ls	3
	ENGR 3440 Water Management	3
	MIBO 3500 Microbiology	3
	ENGR area elective	4
	Free Elective	2
Fourth Year		
Fall	ENGR 4480 Instru. For Envr. Quality	3
	ENGR 4440 Envr. Engr. Units Op.	3
	English Literature elective	3
	Social Science****	3
	Major Sci. Elec.*****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR 4450 Envir. Engr. Bioremediation	3
	Social Science****	3
	Social Science****	3
	Social Science****	3

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Natural Resource Management Area of Emphasis

Description

This area of emphasis integrates the physical and natural sciences into the engineering sciences for the purpose of solving problems related to food, wastes and our natural environment. Graduates are prepared to design hydraulic structures and specify approaches for controlling runoff and erosion for rural and urban landscapes as well as designing systems to control odors associated with animal production in rural areas and bioconversion operations in urban locations.

Goal

A goal of this area of emphasis is to prepare graduates who can apply technology for economic development while maintaining environmental sustainability.

Faculty/Student Activities

- **Atmospheric Sciences**. The Atmospheric Sciences Group emphasizes research in applied meteorology and climatology with a special interest in understanding the interactions between the atmosphere and other environmental systems.
- **Watershed Assessment** is the use of chemical, physical, and biological properties to determine the current health of a watershed. Also included in a watershed assessment are predicting future watershed conditions and suggesting management practices that will maintain and improve the health of a watershed.
- **Bioprocessing** Program is focused on providing technical assistance research, enhancing technology transfer and deployment to industry for the purpose of reducing pollution.
- **Decision Support System.** This program includes crop simulation models, data base management programs, crop model application programs for tactical and strategic decision making, as well as yield forecasts.
- **Sustainable Systems**: This program involves development of sensors, sustainable practices, and management assistance aids for precision and sustainable farming. It has been recently discovered that plants play produce volatile chemicals in response to some insect feeding. Researchers are also developing new technologies for agricultural water use and for interfacing of water quality models for agricultural and riparian areas.

Career Opportunities

As engineers, graduates with this specialization pursue careers in land and water resource management, wildlife resource management, environmental management and park management, just to name a few. Work conducted by these graduates include

- Development of solutions for environmental restoration
- Management of storm water and water transfers
- Solving problems in natural resources conservation and utilization
- Monitoring and control of solid waste, waste water, aquifers and storage waters (lakes)
- Design of recreational sites for national, state and county parks.

Student Project-Water Management System for a local watershed
Storm water runoff within a watershed located on the UGA campus has resulted in excessive flooding and compromised ecological integrity. With a significant percentage of the watershed comprised of impervious surface material, alternatives to storm water routing are needed for rehabilitating the hydrologic regime and minimizing the volume of water lost from the watershed resulting from storm water routing. The objective of this project is to design a water management system for a specified area of the watershed (to be determined by UGA Facilities personnel) that will eliminate the contribution of that area's runoff into stream. One student team developed a runoff filtering system to be built beneath a major university street. Water from the street drains would enter this filtering system and disperse slowly underground to stream. Second student teams developed a rain fall capturing system to store and slowly disperse runoff from university buildings. A third student team developed containment ponds that would provide water for gardens and wetland areas for student recreation and relaxation.

Typical course load for the Natural Resource Management Area of Emphasis

Year one	Course	Credit Hour
Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	ENGL 1102 English Comp II	3
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		

Fall	ENGR 2120 - Statics*	3
	BIOL 1107 & L - Biology	4
	MATH 2500 - Calculus	3
	ENGR 2110 Engr. Dec. Making	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2130 Dynamics	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	ENGR 2140 Strgth of Materials	3
	MATH 2700 - Diff. Equations	3
Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 4230 Sensors & Transducers	3
	ENGR 3410 Intro. To Natural Resource Engr.	3
	ENGR Option Course	3
Spring	ENGR 4240 MicroControllers	3
	ENGR 3440 Water Management	3
	ENGR 3120 Spatial Data Analysis	3
	ENGR 4650 Envir. Structures I	3
	English Literature	3
	Free Elective	2
Fourth Year		
Fall	ENGR Option/Elective	3
	ENGR Option/Elective Course	3
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
	Engineering Option Courses	
	ENGR 3270 Electronics	
	ENGR 3300 Mechanism Design	
	ENGR 3540 Physical Units Operat	
	ENGR 3610 Structural Design	

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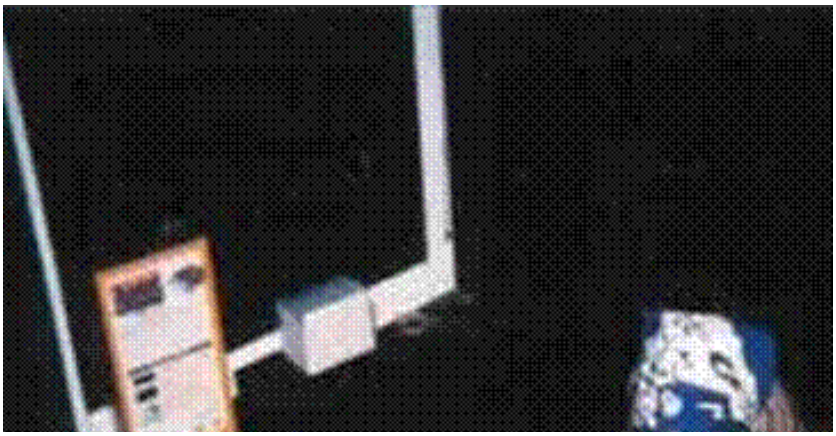

Electrical/Electronic Systems area of emphasis

Description

This area of emphasis involves the study of electrical and electronic circuits and control systems. Electrical and electronic

systems range from high voltage applications in power distribution and machinery to applications of microelectronics. Devices in the form of electronic systems appear in everything from high-end computer systems to the watch on your wrist. Household appliances such as the washer and dryer have electronic systems to improve user control.

Goal

The educational goal of this area of emphasis is to prepare graduates to design and develop electrical, electronic and control systems for industrial applications.

Faculty/Student Activities

- **Applied Electrostatics**: Electrostatic phenomena and technology are studied here and developed for direct solution of practical problems in agricultural, biological, and industrial systems. Electrostatic forces and processes are being beneficially applied to a number of significant operations to enhance energy efficiency, reduce resource input and environmental-pollutant output, and improve overall product quality and economic competitiveness.
- **Non-destructive Sensing**: The non-destructive sensing laboratory specializes in measuring internal defects as opposed to surface defects. The program's objective is to relate internal defects to surface features using sensor fusion approaches, and is available for cooperative studies.
- **Machine Vision**: This program is focused on the development of optical sensing systems based on visible/near-infrared spectroscopy and spectral imaging for stress and disease detection in peanut and cotton, and for evaluation of quality and composition of foods and composting agricultural products.

Career Opportunities

As engineers, graduates with this specialization are qualified to

- Design circuits for computers and control systems
- Quality Control of electronic and electrical equipment
- Develop specifications for semiconductor components used in manufactured products
- Design digital signal processing systems
- Automated systems for materials processing
- Design electrical, power supply, and monitoring systems
- Investigate, develop and evaluate new motor and control technologies.

Student Project- Design and Development of a Machine System for Testing Dynamic and Visco-elastic Properties of Biological Materials and Other Non-Linear Visco-elastic Materials and Structures

Presently, a general mathematical expression is not available to describe nonlinear visco-elastic behavior. A testing procedure to formulate such a description for visco-elastic materials would greatly benefit the biomedical industry in material production and usage optimization. The objectives of this project were to design and develop a machine for non-destructive testing of dynamic and visco-elastic properties of biological materials and other non-linear visco-elastic materials and structures. A test machine (VET) was developed which is capable of high speed linear actuation and data acquisition. The VET is capable of dynamic and static loading including ramp loading and increasing peak to peak loading. The VET uses a BEI VoiceCoil electromagnetic motor for high speed linear actuation. Coarse and linear motions are accomplished through the use of a rotary step motor. An electronic control box housed electrical components including power supplies, motor drivers and I/O interface. Test specimens are gripped using waterproof sandpaper that is compressed in custom Delrin grips. A saline bath and AC resistive heating element allows for a warm, hydrated specimen environment. A system control system utilizing LabVIEW was developed. All components of the system are controlled and automated using AI/O, DI/O and motion control subVI’s. Feedback from the system to the program is provided using a LVDT, an S-type load cell, a thermostat, a pulse counter and a limit switch. High speed data acquisition is performed using buffered AI. Data analysis is achieved using high speed linear based transformations.

Typical Course Load for the Electrical/Electronic Systems Area of Emphasis

Year one	Course	Credit Hour
Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	ENGL 1102 English Comp II	3
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		
Fall	ENGR 2120 - Statics*	3
	BIOL 1107 & L - Biology	4
	MATH 2500 - Calculus	3
	ENGR 2110 Engr. Dec. Making	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2130 Dynamics	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	ENGR 2140 Strgth of Materials	3
	MATH 2700 - Diff. Equations	3
Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 4230 Sensors & Transducers	3
	ENGR 4210 Linear Systems	3
	ENGR Option/Elective Course	3
Spring	ENGR 4240 MicroControllers	3
	ENGR 3270 Electronics	3
	ENGR 4220 Feedback Controls	3
	ENGR Option/Elective Course	3
	English Literature	3
	Free Elective	2
Fourth Year		
Fall	ENGR 4250 Advanced MicroControllers	3
	ENGR Option/Elective Course	3
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
	Engineering Option Courses	
	ENGR 3120 Spatial Data Analysis	
	ENGR 3300 Mechanism Design	
	ENGR 3540 Physical Units Operat	
	ENGR 3610 Structural Design	
	ENGR 3410 Intro. To Natural Resource Management	
	ENGR 4650 Struc. Environ. I	

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Mechanical Systems Area of Emphasis

Description

This area of emphasis provides the opportunity to study the design of mechanical and hydraulic systems. Course work prepares the graduate to analyze the dynamics of machinery motion, stress and deformation in parts, the effect of fatigue on parts, the design and/or selection of machinery parts such as bolted and welded connections, bearings, chain, gear, and V-belt drives and shafts. Students may also elect to combine this field with the electrical/electronic systems area of emphasis.

Goal

The educational goal of this area of emphasis is to prepare graduates to design mechanical parts, machines, machinery systems, and machine hydraulic systems.

Faculty/Student Activities

- **Alternative Fuels and Solvents.** This group is focuses primarily on the development of alternative fuel and solvent replacements that are more environmentally friendly than their traditional counterparts.

- **Handling of Biological Tissues**: A systems approach was developed for reducing post-harvest losses and for improving the quality of fresh fruits and vegetables available to consumers.

- **Machine Vision**: This program is focused on the development of optical sensing systems based on visible/near-infrared spectroscopy and spectral imaging for stress and disease detection in peanut and cotton, and for evaluation of quality and composition of foods and composting agricultural products.

Career Opportunities

Graduates with this specialization are qualified to

- Design mechanisms used in manufacturing of products
- Develop detailed layouts and assembly of machine components
- Design digital controller systems
- Determine and evaluate the flow of fluids, heat and energy
- Design and develop engines
- Design mechanisms used in power generation
- Develop, install and maintain climate control systems
- Test and evaluate products for quality control

Student Project: Small scale avian hatchery incubator for rural communities in Burkina Faso, West Africa.

One of ASUDEC's activities is to provide livestock to farmers who return the same number of offsprings after reproduction for distribution to new farmers. For the chicken and guinea fowl program, ASUDEC is providing incubators at the community level for egg hatching, which is more efficient in comparison to naturally hatched eggs. Because of lack of grid electricity, kerosene lamps power these incubators. The incubator temperature must not exceed 38 ^{o}C (chicken) or 39 ^{o}C (guinea fowl). The main problem is maintaining a constant temperature. The kerosene lamp flame is not uniform. Excess heat often results in loss of embryos or cause malformations of the offspring. The smoke from the flame often pollutes the internal environment, asphyxiating the embryos. The customer is interested in a solution to this problem.Customer: ASUDEC (Dr. Some Salibo, Executive Director (asudec@cenatrin.bf), a nonprofit sustainable development organization.

Typical Course Load for the Mechanical Systems area of emphasis

Year one	Course	Credit Hour
Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	ENGL 1102 English Comp II	3
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		
Fall	ENGR 2120 - Statics*	3
	BIOL 1107 & L - Biology	4
	MATH 2500 - Calculus	3
	ENGR 2110 Engr. Dec. Making	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2130 Dynamics	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	ENGR 2140 Strgth of Materials	3
	MATH 2700 - Diff. Equations	3
Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 4230 Sensors & Transducers	3
	ENGR 3300 Mechanism Design	3
	ENGR 4350 Finite Element Analysis	3
Spring	ENGR 4240 MicroControllers	3
	ENGR 3270 Electronics	3
	ENGR 4330 Mechanical Systems	3
	ENGR Option/Elective Course	3
	English Literature	3
	Free Elective	2
Fourth Year		
Fall	ENGR Option/Elective Course	3
	ENGR Option/Elective Course	3
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
	Social Science****	3
	Engineering Option Courses	
	ENGR 3120 Spatial Data Analysis	
	ENGR 3410 Intro. To Natural Resource Management	
	ENGR 3540 Physical Units Operat	
	ENGR 3610 Structural Design	

ENGR 4650 Struc. Environ. I

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Process Operations area of Emphasis

Description

This area of emphasis involves the application of the physical, natural and engineering sciences in the operation and design

of manufacturing plants. Graduates fill jobs that are responsible for a wide range of production processes ranging from production control to materials handling.

Goal
The educational goal of this area of emphasis is to prepare engineers for designing improved processes and for applying improved industrial process control systems for manufacturing applications.

Career Opportunities
As engineers, graduates with this specialization are pursuing careers in manufacturing and production. Typical work done by graduates from Process Operations include

- Assembly line layout and design of workstations
- Analysis of material flow and development of just-in-time processes
- Scheduling of workload and resource needs
- Quality management of production processes
- Planning and implementation of a complete manufacturing process

Student Project: Flooring Mill Upgrade
A small company that produces hardwood flooring wanted to double their daily production rate. UGA engineering students worked with the company's plant manager and analyzed work procedures used at the planer, gang ripsaw, molder and packing stations. The company's raw material inventory and material flow were also characterized. To meet the company's request, a new plant layout was developed, the assembly-line conveying system was redesigned and personnel were trained on new waste reduction procedures. The final design won third place in an international competition sponsored by the James F. Lincoln Arc Welding Foundation.

Typical Course Load for the Process Operations Area of Emphasis

Year one	Course	Credit Hour
Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	ENGL 1102 English Comp II	3
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		
Fall	ENGR 2120 - Statics*	3
	BIOL 1107 & L - Biology	4
	MATH 2500 - Calculus	3
	ENGR 2110 Engr. Dec. Making	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2130 Dynamics	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	ENGR 2140 Strgth of Materials	3
	MATH 2700 - Diff. Equations	3

Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 4230 Sensors & Transducers	3
	ENGR 4210 Linear Systems	3
	ENGR 4940 Systems Modeling	3
Spring	ENGR 4240 MicroControllers	3
	ENGR 3270 Electronics	3
	ENGR 3540 Physical Units Ops.	3
	ENGR 4220 Feed-back controls	3
	English Literature	3
	Free Elective	2
Fourth Year		
Fall	ENGR Option/Elective Course	3
	ENGR Option/Elective Course	3
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
	Social Science****	3

Engineering Option Courses

ENGR 3120 Spatial Data Analysis
ENGR 3410 Intro. To Natural Resource Management
ENGR 3300 Mechanism Design
ENGR 3610 Structural Design
ENGR 4650 Structural Envr. I

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Structural Systems area of emphasis

Description

This area of emphasis involves designing a structure and conditioning the environment within it. The types of structures are residential, light-framed industrial buildings, larger industrial buildings and greenhouses. While this research program focuses primarily on the integrity of structures, students also use state-of-the-art software to evaluate the form, function and appearance of a new structural design.

Goal

The goal of this area of emphasis is to prepare engineers to design properly buildings and create a safe and productive environment within them.

Research

Environmental Physiology. Control of the environment around study animals is conducted here, as well as research with food animals.

Nanoscale Structures: This program seeks to integrate biotechnology and nanotechnology for advancing fundamental knowledge in the development of new products such as a biosensor. Researchers in the Nano-fabrication Center are developing new structures for growing cells with the long term objective of developing biomedical devices such as glucose sensors.

Design of Light Steel Structure. This program focuses on the stress analysis of structures that carry loads from granular materials and models the effects of loading and unloading of that material.

Design of sustainable buildings and processes. A sustainable building or process can be defined as one that provides for the needs of the present without detracting from the ability to fulfill the needs of the future.

Career Opportunities

As engineers, graduates with this specialization are qualified to

- Design heating, ventilation and air-conditioning systems for many different buildings
- Analyze and design an array of different framing and engineered beams for construction of residential and commercial buildings
- Oversee the construction of buildings to ensure safety and quality
- Design foundations and retaining walls
- Model loading behavior of wooden, steel and composite structures
- Monitor and correct building air flow and quality

Student Project- Design of a Demand Controlled Ventilation (DCV) system for UGA classrooms

This project investigated the potential for energy savings and indoor air quality improvements using DCV for two large classrooms on the UGA campus. The project required the development of a model that would predict the CO_2 levels based on number of people in each room and the outdoor air ventilation rate. CO_2 levels are used as a surrogate for indicating sufficient ventilation. The current HVAC systems bring in a fixed amount of outdoor air that does not provide adequate ventilation when the rooms are fully occupied, but also consumes energy to condition outdoor air when the rooms are unoccupied. A study was run comparing the energy consumed to condition outdoor air and the resulting CO_2 levels for the existing HVAC systems, a control concept that adjusted outdoor air based on the time of day, and the systems modified to include DCV. The project also considered the mechanical and electrical control changes that would be necessary to implement DCV in each room; one room was not well suited to a retrofit since it still has an older, pneumatic control system. The analysis indicated that approximately $600 per year in energy cost savings are possible with DCV in one room, and that overall indoor air quality would be improved in both rooms. Changing to a DCV system would result in a three year or less economic payback for the room where DCV would be feasible

Typical Course Load for the Structural Systems Area of Emphasis

Year one	Course	Credit Hour
Fall	ENGR 1120 Engr. Graphics & Design	3
	ENGR 1140 - Comput. Engr. Methods	2
	MATH 2200& L - Anal. Geo. & Calc.	4
	CHEM 1211 & L - Frsh. Chem. I	4
	ENGL 1101 - English Comp.	3
Spring	ENGL 1102 English Comp II	3
	CHEM 1212 & L - Frsh Chem II	4
	MATH 2210 & L - Calculus	4
	PHYS 1211 & L - Physics	4
Year two		
Fall	ENGR 2120 - Statics*	3
	BIOL 1107 & L - Biology	4

	MATH 2500 - Calculus	3
	ENGR 2110 Engr. Dec. Making	3
	PHYS 1212 & L - Physics	4
Spring	ENGR 2130 Dynamics	3
	ENGR 3160 - Fluid Mech.	3
	ENGR 2170 - Elec. Circuits	3
	ENGR 2920 - Engr. Design Meth*	2
	ENGR 2140 Strgth of Materials	3
	MATH 2700 - Diff. Equations	3
Year three		
Fall	ENGR 3140 Thermodyn.	3
	ENGR 3150 - Heat Transf.	3
	ENGR 4230 Sensors & Transducers	3
	ENGR 3610 Structural Design	3
	ENGR 4630 Design of Residential Structures	3
Spring	ENGR 4240 MicroControllers	3
	ENGR 4610 Design of Steel Structures	3
	ENGR 4650 Structural Envir. I	3
	ENGR Option/Elective Course	3
	English Literature	3
	Free Elective	2
Fourth Year		
Fall	ENGR 4660 Structural Envir. II	3
	ENGR Option/Elective Course	3
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
Spring	ENGR 4920 - Engr. Design	4
	ENGR Option/Elective Course	3
	Social Science****	3
	Social Science****	3
	Social Science****	3

Engineering Option Courses
ENGR 3120 Spatial Data Analysis
ENGR 3410 Intro. To Natural Resource Management
ENGR 3540 Physical Units Operat
ENGR 3270 Electronics

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Engineering Certificates

Engineering Physics

The undergraduate certificate program in Engineering Physics is designed to enhance an undergraduate degree program and give undergraduates the opportunity to document their educational achievement at the interface of engineering and physics. As an interdisciplinary approach to education, undergraduates will be prepared to understand both the theoretical and practical aspects of the physical sciences and engineering systems. Design is the heart of the practice of engineering and the engineering design component unites engineering and physics into engineering physics. With a large number of electives available, the student may tailor the program to meet his or her needs. Thus, the program appeals to students from a variety of backgrounds. The educational goal of the program is to develop undergraduate scholars with a theoretical and practical understanding of physics and engineering systems.

Students successfully completing the requirements for this certificate are expected to have:

- *a fundamental understanding of physics and engineering systems,*
- *the necessary knowledge and skills to pursue graduate work or employment in engineering physics,*
- *the necessary background to continue lifelong learning in engineering and physics.*

Career Opportunities

An engineering physicist designs, develops and supervises the construction of new equipment, applying the knowledge of engineering and physics to develop new engineering methods and principles. The engineering physicist completes the link between the pure scientist and the engineer by being able to understand the theory of science and to relate it to the practical problems of engineering.

The certificate program graduates should be competitive in the job market because of their broad background. In particular, these graduates should be very attractive in the rapidly growing high-tech industries in Georgia. They will have both the theoretical and practical background for these dynamic industries.

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Computer Systems Engineering

The undergraduate certificate program in Computer Systems Engineering (CSE) is designed to enhance the learning experience achieved with an undergraduate degree program and is an interdisciplinary approach to a technical education. Computer systems engineering involves the design and implementation of computer hardware and software systems to solve problems. Courses have been selected so that the student will have a broader understanding of both software and hardware design of computers and can capitalize on the rapid advances in semiconductor technology. The growth in computer-related technologies has led to a need in industry for professionals who have knowledge of basic electrical engineering concepts of circuits, electronics and digital systems and a foundation in computer science. The goal of the program is to develop undergraduate scholars with a theoretical and practical understanding of computer science and engineering systems.

Students successfully completing the requirements for this certificate are expected to have:

- *a fundamental understanding of computer science and engineering systems,*
- *the necessary knowledge and skills to pursue graduate work or employment in computer systems engineering,*
- *the background to use microelectronics, microprocessors, and software to solve problems in engineering systems,*
- *the knowledge and motivation to continue lifelong learning in engineering and computer science.*

Career Opportunities

Graduates with this specialization are qualified to deal with all aspects of computer systems including the design, construction and operation of computers and software. Work conducted by these graduates would include

- *Design and developing of computer operating systems for businesses and organizations*
- *Improving interfacing components of network systems*
- *Optimization of software and hardware*
- *Designing more efficient computer systems*

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Coastal and Oceanographic Engineering Certificate

The undergraduate certificate program in Coastal and Oceanographic Engineering is designed to enhance the learning experience of an undergraduate degree program and to give undergraduates the opportunity to document their educational achievement at the interface of engineering and marine science. The program will be open to all UGA undergraduate students but will be of special interest to students who wish to combine both a theoretical and practical understanding of marine science and engineering systems. The Coastal and Oceanographic Engineering certificate program is interdisciplinary and is focused on the use of engineering principles in the marine environment rather than by the topic of study (e.g., physical oceanography, marine biology, chemical oceanography or marine geology). This UGA program has two tracks: (1) marine instrumentation and (2) coastal and near-shore modeling. The marine instrumentation track emphasizes the design of operational and research instruments for use in the marine environment. The coastal and near-shore modeling track seeks to

understand and thus predict coastal and near-shore processes that impact both natural and artificial coastal systems.

The goal of the program is to develop undergraduate scholars with a theoretical and practical understanding of marine and engineering systems. Students successfully completing the requirements for this certificate are expected to have:

- *a fundamental understanding of marine and engineering systems,*
- *the necessary knowledge and skills to pursue graduate work or employment in marine sciences, marine instrumentation or marine engineering depending on their undergraduate major*
- *the knowledge and motivation to continue lifelong learning in marine engineering .*

Career Opportunities

Georgia's marine industries that depend on employees trained in both instrumentation engineering and marine sciences. The coastal and nearshore modeling students will be sought by coastal engineering firms, governmental agencies, and environmental consulting firms. With a coastal and oceanographic engineering certificate, UGA graduates should be very competitive in the marine and environmental job market.

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Engineering Science Certificate

The undergraduate certificate program in Engineering Science is designed to enhance the learning experience provided by an undergraduate degree program. Courses for this certificate have been selected for undergraduates who wish to have an exposure to an engineering education and gain a fundamental understanding of the engineering sciences, and for undergraduates planning to pursue graduate study in engineering. This certificate program is open to all UGA majors and is especially attractive to students majoring in chemistry, mathematics, management information science, environmental health science, biology, cell biology, ecology, biochemistry, etc. The certificate program serves these students as documentation of their educational achievement in engineering science.

The goal of the program is to develop undergraduate scholars with a theoretical and practical understanding of the engineering systems.

Students successfully completing the requirements for this certificate are expected to have:

- *a fundamental understanding of the applications of the conservation of momentum, the conservation of energy and the conservation of mass to engineering programs*
- *a fundamental understanding of engineering systems*
- *the necessary knowledge and skills to pursue graduate study in the engineering sciences*
- *the necessary background to continue lifelong learning in marine engineering .*

Career Opportunities

Upon completion of this certificate program graduates should be qualified for many engineering graduate programs across the country and for many jobs in the high tech industries that depend on employees trained in both engineering and the natural sciences.

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What do engineers do?

An engineer is a professional who combines knowledge of science, mathematics, economics, arts and politics to solve technical problems for the benefit of society. Engineering, while challenging, offers exceptional rewards and satisfaction as a career choice. As an engineer, you can have a positive influence on a person's life and well-being. UGA engineering students and faculty are making a difference by using knowledge from ecology to reduce the adverse impacts on the environment, knowledge from microbiology and biochemistry to help develop new

drugs, knowledge from biology to design new medical devices, knowledge from physics to design machine vision systems, and knowledge from the computational sciences to better integrate software and hardware in computers. Like a scientist, an engineer needs an education that investigates *what makes something work*; but an engineer also has the ability to use scientific knowledge and create *what is to be*.

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What is engineering at UGA?

The University of Georgia has offered Bachelor of Science degrees in engineering for over 130 years, making it the first public institution in the state to educate Georgians in the engineering sciences. In keeping with this legacy of leadership and innovation, UGA continues to offer engineering programs that focus on the comprehensive education needed in today's technological world. Existing within a major land-grant university, this learning environment goes beyond the classroom. The UGA engineering student is able to develop a network of peers who are majoring in the arts, education, communication, law and business. After graduation, the student will work closely with professionals who have these backgrounds. Alumni from the UGA engineering program indicate that such an environment and education philosophy lead to a wide range of avenues for career advancement.

One of the biggest challenges facing engineering educators comes from the rapid advancement of science and technology. In order to provide undergraduates with the skills needed to understand these advancements and their impact on the world, Engineering at UGA focuses on the underlying theories and principles of science, math and engineering, thereby providing the student with the ability to adopt new information, new approaches and new technologies into their problem solving skills. Coordinated with a broad education in philosophy and arts, students in UGA Engineering can understand the impact of their actions on humankind. This fundamental approach provides a solid foundation for academic growth and lifelong learning, skills necessary for keeping pace with changes in the engineering profession.

The design of Engineering at UGA allows the students to experience several areas of engineering prior to selecting a specific engineering area of emphasis. Therefore, students gain an appreciation for several career paths before having to select their upper division course work in the junior year. Depending on the area of emphasis selected, graduates are qualified to take advantage of employment opportunities related to civil, mechanical, electrical, biomedical, environmental, biochemical, agricultural and process engineering. By focusing on the fundamentals of engineering as well as the natural sciences and humanities, the UGA graduate is well prepared for the engineering profession, a global job market and a wide range of careers.

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The Driftmier Engineering Center

All engineering instructional facilities are housed in the Driftmier Engineering Center which provides over 100,000 ft^2 of office, classroom and laboratory space. Nine classrooms ranging in size from 624 ft^2 to 1360 ft^2 are available for lectures and other academic activities. Five of these classrooms are equipped with video and/or computer based projection systems. One classroom has a dedicated computer network for in-class as well as remote content delivery using interactive and collaborative instructional techniques. The General Computing Undergraduate Study Hall occupies approximately 1228 ft^2

and is designed to provide general-purpose computing for undergraduates. This Study Hall is accessible to students for 90 hours per week. A Design Studio provides dedicated computer facilities for rapid prototyping and CNC machining. Undergraduates enrolled in the sophomore-level Design Methodology course and the senior-level Engineering Project course are required to design, prototype and analyze a new product that meets a real-world need. Projects in these courses are typically sponsored by industry and are used by the companies to solve current problems.

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The Engineering Faculty

Forty-five faculty members belong to the UGA engineering program and 23 of these faculty members have instruction responsibilities. This faculty has expertise in over 12 engineering disciplines including aeronautical engineering, biomedical engineering, chemical engineering, computer systems engineering, civil engineering, electrical engineering, and mechanical engineering. Research activities include, but not limited to, the development of

- New bio-based products, biomaterials and bioprocesses,
- Nano-scale 3-D structures powerful enough to grow cells in packs,
- Biological techniques for the treatment of waste water,
- Optical sensing systems based on visible/near-infrared spectroscopy and spectral imaging for stress and disease detection in plants,
- Systems for the environmental control of structures,
- New techniques for improving water quality, and
- Decision support systems incorporating computational intelligence and operations research, and
- Novel methods to enhance biobased air pollution controls.

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Faculty Members who provide undergraduate instruction

Mark Bakker, Associate Research Scientist and Lecturer
Ph.D.-Civil Engineering University of Minnesota
BS/MS-Civil Engineering Delft University of Technology
Area of Specialty
- Modeling of groundwater flow and its interaction with the environment
- Transient interaction between pumping wells and rivers and lakes.
- Intrusion of sea water in coastal aquifers.
- Modeling of flow in leaky aquifer systems.

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K.C. Das, Assistant Professor
Ph.D.-Agricultural Engineering Ohio State University
MS-Agricultural Engineering University of Georgia
BS-Mechanical Engineering Anna University
Area of Specialty
- Development and analysis of biological techniques for the treatment of municipal, industrial, and agricultural wastes.
- Process design, process control, optimization and modeling.
- Image analysis, spectrometric applications and artificial intelligence applications such as neural networks to agricultural and environmental problems.

Mark Eiteman, Professor
Ph.D.- Chemical Engineering University of Virginia
M.S. – Chemical Engineering University of Virginia
B.S.- Chemical Engineering Virginia Tech
Area of Specialty

Metabolic engineering for the enhancement of product formation in both aerobic and anaerobic fermentation processes, downstream processing of biological compounds, recovery of useful compounds from food and agricultural waste

Tim Foutz, Professor and Coordinator of Undergraduate Engineering Programs
Ph.D. – Biological and Agricultural Engineering N.C. State University
M.S. – Biological and Agricultural Engineering N.C. State University
B.S. – Agricultural Engineering N.C. State University
Area of Specialty
Biological systems and biomechanical response of tissue; soft tissue healing and repair animal locomotion; analyzing and improving medical techniques in veterinary medicine; materials used for tissue grafting

David Gattie, Assistant Professor
Ph.D. - Ecology The University of Georgia
B.S. - Agricultural Engineering The University of Georgia
Area of Specialty
Simulation and modeling of biodegradation of chemicals in aquatic systems; Mathematical modeling of ecosystems and environmental quality

Takoi Hamrita, Associate Professor
Ph.D. Electrical Engineering Georgia Inst. Of Technology
M.S. Electrical Engineering Georgia Inst. Of Technology
B.S. Electrical Engineering Georgia Inst. Of Technology
Area of Specialty
Microprocessor-based-control; Intelligent control; Monitoring and control of biological and agricultural systems; Digital signal processing

James Kastner, Assistant Professor
Ph.D. – Applied Biology Georgia Institute of Technology
M.S. - Chemical Engineering Mississippi State University
B.S. - Chemical Engineering Mississippi State University
B.S. - Biochemistry Mississippi State University
Area of Specialty
The design and scale-up of bioreactors; The use of microorganisms to produce or develop environmentally benign products/processes, such as biodegradable polymers or the degradation of wastes; The production of specialty chemicals using enzymes and/or microorganisms

William Kisaalita, Professor
Ph.D. – Chemical Engineering U. of British Columbia
M.S. - Bioresource Engineering U. of British Columbia
B.S. - Mechanical Engineering Makerere University
Area of Specialty
Quantitative information about how receptors, enzymes, signals fit together in space; mechanical, chemical and biological outputs of cells, tissues and organs; cell-based screening system for drug discovery; nano-technology application to understanding cell structure

Tom Larwance, Assistant Professor
Ph.D. - Mechanical Engineering Purdue University
M.S. - Mechanical Engineering Purdue University
B.S. - Mechanical Engineering Purdue University
Area of Specialty
Design of sustainable buildings and processes Building energy usage and indoor air quality**;** Residential, commercial and industrial building heating, ventilation and air conditioning systems**;** Impact of buildings on the local site and overall environment

Ed Law, Brooks Distinguished Professor
Ph.D. –Agricultural Engineering N.C. State University
M.S. –Agricultural Engineering N.C. State University
B.S. – Agricultural Engineering N.C. State University
Area of Specialty

Electrostatics technology for biotechnological including: application of agricultural pesticide sprays and biological/chemical agents; electric force-field management of biomaterials; airborne particulate technology; sensors and instrumentation systems

Ron McClendon, Professor
BS-Aerospace Engineering Mississippi State University
MS-Aerospace Engineering Mississippi State University
Ph.D.- General Engineering Mississippi State University
Area of Specialty
Decision support systems; Computational intelligence; Operations research techniques.

Glenn Rains, Assistant Professor
Ph.D. - Agricultural Engineering Virginia Tech.
M.S. - Agricultural Engineering Virginia Tech.
B.S. - Agricultural Engineering University of Georgia
Area of Specialty
Mechanical Sensing and remote operations

Bill Tollner, Professor and Coordinator of Graduate Engineering Programs
Ph.D. Agricultural Engineering Auburn University
M.S. Agricultural Engineering University of Kentucky
B.S. Agricultural Engineering University of Kentucky
Area of Specialty
X-Ray tomography for visualizing and quantifying soils and biological materials and nuclear magnetic resonance spectrometry for quantifying soil-water-plant systems and properties of food products ; Developing bioconversion approaches enabling use of waste streams and byproducts in resource conservation; Ecological process engineering

Chi Thai, Associate Professor
BS- Mechanical Engineering Northrop University
MS- Aerospace Engineering Northrop University
Ph.D.- Agricultural Engineering U. California-Davis
Area of Specialty
The development of optical sensing systems based on visible/near-infrared spectroscopy and spectral imaging for stress and disease detection in peanut and cotton, and for evaluation of quality and composition of foods and composting agricultural products.

Sid Thompson, U.H. Davenport Chair Professor
Ph.D. – Agricultural Engineering University of Kentucky
M.S. – Civil Engineering Purdue University
B.S. - Civil Engineering Kansas State University
Area of Specialty
Storage of granular materials; Physical properties of granular materials; Design of agricultural structures; Studies in stress and strain; Computer modeling and graphics

E. Dale Threadgill, Professor and Department Head
Ph.D.- Agricultural Engineering Auburn University
B.S. – Agricultural Engineering Auburn University
Area of Specialty
Leadership for all University of Georgia engineering teaching, research, and extension programs statewide; Irrigation systems and management: soil and water conservation; soil-plant-water relations; chemical application systems including chemigation; crop production systems; soil tillage systems.

Brahm Verma, Professor and Research Coordinator
B.S.- Agricultural Engineering University of Allahabad
M.S.- Agricultural Engineering University of Kentucky

Ph.D.- Agricultural Engineering Auburn University
Area of Specialty
My research assignments and projects have been in diverse application areas of agricultural, food and biological systems. They focused on the theory of models and the principles of similitude, systems analysis, and machine concepts and development.

Guigen Zhang, Assistant Professor
Ph.D. – Bioengineering Clemson University
M.S. - Mechanical Engineering Tongji University
B.S. - Mechanical Engineering Tongji University
Area of Specialty
Non-linear viscoelasticity of biological materials; Modeling of micromechanics of bones and other hard tissues; Composite applications in medicine; Nano-fabrication for medical applications
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The Institute of the Faculty of Engineering

The Faculty of Engineering at the University of Georgia is a new kind of engineering school organized to capture the convergence of scientific and engineering disciplines. Unlike conventional engineering schools where faculty members are appointed to an engineering department, UGA engineering faculty in the Faculty of Engineering are housed in academic units throughout campus. In addition, engineering faculty at other universities and engineers in the private sector are encouraged to participate in the Faculty of Engineering.

This innovative interdisciplinary approach to engineering increases opportunity for learning, research and outreach at the confluence of disciplines, giving rise to new but pervasive fields like pharmaceutical engineering, metabolic engineering, marine engineering, ecological engineering, information engineering and biological engineering. Academic programs emerging in this environment adopt an educational approach that gives engineering students broader learning experiences and prepares them for careers devoted to the integration of discoveries from multiple disciplines. The programs graduate engineers with liberal arts backgrounds. The use-inspired research paradigm that emerges out of the collaboration between science and engineering leads to the development of products and services that are relevant to the needs of society. The engineering outreach programs enhance economic development and quality of life for Georgians, and prepare them to be global leaders in science, technology, education and sustainable development.
The Faculty of Engineering is a new and daring experiment. The unconventional approach to organizing a major discipline is unique and may be the first of its kind at a research university in the United States. It employs principles of entrepreneurship, boundarylessness, networking and life-long learning to create a learning organization that is responsive to unpredictability and adoptive of opportunity.
The development of high quality, relevant programs in engineering at UGA will not only serve the University and its students, but the state of Georgia and a changing world.

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Some Job Titles and Functions of an Engineer

- A **Design Engineer** is responsible for transforming an idea to a useful product. Design is the

essence of engineering and is what many people think of when they think of engineering. This type of position requires the engineer to use knowledge from scientific, mathematical and engineering laws, coupled with experience, to generate a product to meet a specific need.

- A **Test Engineer** is responsible for verifying the integrity, reliability and quality of products. This type of position requires the engineer to monitor the quality of a product and to support production by identifying and resolving problems, to train personnel in the proper procedures for applying a technology and to preparing reports on quality control issues.
- A **Research Engineer** is responsible for using knowledge from basic research to generate a product that might be useful to the public. Typically associated with a Research and Development Department, this type of position requires the engineer to understand the basic science behind a research experiment, transform the idea behind the research from the laboratory bench-top setting to a production line setting and eventually transform the idea into a marketable "product".
- A **Production Engineer** is responsible for the manufacturing of a product. This type of position provides a challenging role for the engineer who wishes to have a hands-on experience within manufacturing environment.
- A **Project Engineer** is responsible for responsible for assigned projects and proposals, including program design, cost, schedule, and testing. This type of position requires the engineer to provide instruction to other disciplines such as drafting, production, business, associated with a project and to coordinate all activities ranging from technical to clerical assignments.
- An **Operations Engineer** is responsible for ongoing operation of a facility. This position coordinates the physical work place used to produce a product and requires basic knowledge of business administration, architecture and engineering sciences.
- A **Sales Engineer** is responsible serving as a link between the customer and the manufacturer of a product. These types of position requires the engineer to use basic skills in engineering science and design in order to help customers determine which products or services best suit their needs.

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Some Job Titles and Functions of UGA Engineer Alumni

Project Engineer for Carter and Sloope Inc., a civil engineering consulting firm in Macon Georgia

Job responsibilities include

§ Designing water treatment systems

§ Developing and monitoring of solid waste facilities

§ Management of storm water and water transfers

§ Solving problems in natural resources

Process Engineer for Merial-Animal Pharmaceuticals Manufacturer

Job responsibilities include

§ Monitoring control systems for biochemical processes

§ Conducting inspections to insure product quality

Manufacturing Engineer for Reliance Electric Co., manufacturer of industrial motors

Job responsibilities include

§ Supervising the manufacturing process of small electrical motors

§ Redesign of manufacturing processes

§ Scheduling and supervision of assembly line operations

§ Quality control of production processes

Engineer for McNaughton-McKay Electric Company, distributor of electrical products

Job responsibilities include

§ Design of automated systems

§ Field installation of manufactured products

§ Oversight of customized products

Research Engineer for the Orthopedic Surgery Department, Washington University Hospital School of Medicine

Job responsibilities include

§ Testing of orthopedic devices

§ Research and development of new medical products

§ Provide technical assistance to surgical researchers

Structural Engineer for Winfrey Architectural Concrete Inc., firm that specializes in concrete products

Job responsibilities include

§ Designing customized concrete products including architectural cladding and wall panels

§ Supervising drafting and engineering department

§ Quality control of production processes

Director of Donor Center Operations for Serologicals Inc., a global provider of biological products

Job responsibilities include

- Oversight of global regulatory compliance and quality programs
- Maintaining all aspects of daily center functions and storage equipment and facilities
- Operation and maintenance of donor tissue

Civil Engineer for Federal Aviation Administration

Job responsibilities include

- Designing FAA facilities such as air traffic control towers
- Supervision of construction
- Installation of radar/surveillance systems

Mechanical Design Engineer for Amscomatic Inc., manufacturer of folding and packaging equipment

Job responsibilities include

- Designing mechanisms used in the manufacturing process
- Developing layouts and assembly of components
- Testing and evaluating products for quality

Environmental Engineer for J.W. Salm Engineering ,a firm that specializes in constructed wetlands for wastewater treatment

Job responsibilities include

- Solving problems in natural resources conservation and production
- Designing storm water management systems
- Ground water monitoring and soil borings
- Constructing vegetated wetland for municipal wastewater treatment

Systems Engineer for Georgia Power Energy Services

Job responsibilities include

- Monitor and control of transmission and distribution system
- Development and operational evaluation of power system
- Management of human, physical, and energy resources

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What alumni say about UGA engineering

Trey Gavin- Project Engineering for Carter Carter and Sloope Inc.

"UGA provides a diverse engineering curriculum with a population of gifted, well-rounded students. This department has avoided the stigma that is often associated with engineering by recruiting students from different backgrounds to participate in this program".

Jessica Peterson- Environmental Engineer for J.W. Salm engineering

"There's more to life than just engineering and that really helped me in my future. I feel like I learned how to talk to people well and interact well with people"

James B. Beasley, Jr. President-Chief Executive Officer Southern Nuclear Operating Co.

"The general engineering approach, the real diverse and variety of courses that we were able to take really prepared me to be a very good practical practicing engineer when I got out of college."

Melissa Houseal RF Engineer Cingular Wireless

"While I took the normal core courses that all engineering students are required to take, I had the freedom to explore other areas of engineering other than my chosen concentration, Electronics and Electrical Systems. I also enjoyed the smaller class sizes at UGA, which allowed students and professors to get to know each other and share common experiences."

Doug Brouillard Manufacturing Engineer Eaton Corporation

"UGA's Engineering school provided me with an education that allowed me to migrate to almost any type of engineering that I wanted (or was available at the time) directly after graduation."

Amanda McMahan- Currently a Co-Op Student CertainTeed Insulation Group

"You get more of a diverse experience than you would get at certain schools where the main focus is engineering, and therefore the opportunity to explore other areas with electives rather than just getting engineering courses. Plus, the friends that you make will all have hugely different majors, different interests, and different knowledge, and being in the minority helps make you aware of others".

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ENGINEERING and the HONORS PROGRAM

At the University of Georgia, the Honors Program and the Engineering Academic Office are working together to provide the best of both worlds in engineering education. Through the engineering degrees, students can obtain top level instruction in a variety of engineering specializations, and still take advantage of the resources of a major Research University. Both the classroom and extra-curricular opportunities at UGA provide a breadth and depth rarely found at a single institution. For students with wide-ranging interests, this opportunity may be the best of both worlds -- top notch science and engineering with the best in a wide variety of liberal arts disciplines. UGA students have access to state-of-the-art labs, Pulitzer Prize winning authors, internationally recognized scholars

and diplomats, as well as outstanding concerts and performing arts presentations. The University of Georgia, and especially the Honors Program, provides a challenging and eclectic peer group of college students. For students who are looking for a broad undergraduate education before embarking on a career or on graduate study in engineering, UGA can provide the wide range of educational opportunities they seek.

Many of the core classes have Honors sections which provide superior preparation for upper division engineering courses. In addition, the Honors Program provides core courses in the humanities and social sciences to round out the students' core curriculum. When students begin taking upper division engineering courses they may contract with the professor to do an extra project or paper that will allow them to pursue their course work in greater depth than the rest of the class. The required Senior Design Project is a natural for Honors Research and Thesis credit.

Engineering Core Curriculum courses may be taken as either regular core classes or as Honors classes. The science core obviously takes priority for engineering students, and most of these courses are completed in the first two years. The humanities and social science core classes may be taken at any time during a student's four years, except for English composition, which should be completed in the first two years.
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Frequently Asked Questions

Who do I contact for information?
You can contact Dr. Tim Foutz (current undergraduate Coordinator) for information. His e-mail address is tfoutz@engr.uga.edu . You can also send an e-mail message to the following address ugrad.prog@engr.uga.edu. The Academic Programs Office in our department will process requests made to this address. You can also find more information in the undergraduate advice section of this website. You may call the undergraduate office at our department toll-free at 866-775-1220

How do I apply to your department?
You should first apply to the University of Georgia (freshman and transfer students. More information on enrollment requirements are listed at: http://www.admissions.uga.edu

Does UGA offer accredited engineering degrees?
Absolutely. The BSAE and BSBE degrees are accredited by the Accreditation Board for Engineering and Technology (ABET), the agency which accredits all engineering degrees in the U.S. Our department also offers two engineering degrees at the Masters level and a Ph.D.

I am interested in the Honors Program. Can I participate in it and pursue an engineering degree?
Absolutely.

Do the UGA engineering degrees allow me to pursue a Professional Engineering license?
Yes. Preparation for the PE license requires graduating from an ABET accredited degree program. Both of our degrees are ABET accredited. We also require that all of our graduating seniors to take the Fundamentals of Engineering (FE) exam. Passing the FE allows you to be an Engineer in Training (EIT) which is also required in the PE licensing process.

Which courses should I choose for Area C Humanities core courses?
Our department requires SPCM 1100 for speech communication skills and an English literature course (see list of

possible courses on front of degree requirement sheets) for reading and writing skills.

Which courses should I choose for Area E Social Sciences?
The University requires 12 hours (or 4 courses) from the list. As far as the University is concerned, this requirement could be met, for example, with four of the Sociology courses shown. However, the vast majority of students take HIST 2111 or 2112 because it satisfies the Regents Exam on U.S. and Georgia History. In addition, students usually take POLS 1101 because it satisfies the Regents Exam on the U.S. and State Constitution. If a student takes Political Science out of state, it only satisfies the U.S. Constitution portion of the exam and they are still responsible for the state exam. A more complete discussion of these requirements is shown on page 33 of the UGA Bulletin. This page also contains information on the Regents Reading and Writing exam. The upper-right hand corner of the first page of the DARS sheet gives the students status in regard to these exams. Again, the majority of our students take HIST 2111 (or 2112) and POLS 1101. If they don't wish to take these courses then they must pass the exams. In terms of the other six hours in Area E, our last ABET review reinforced the requirement of depth in Humanities/Social Sciences. In our degree programs, "depth" is accomplished with two of the four Area E courses having the same prefix. This could be a second HIST, a second POLS, or two social science courses with a single prefix from the list.

I have taken SPCM 1500; do I need to take SPCM 1100?
Yes. SPCM 1100 is the only course in the core in which the student must prepare a speech and present it to a group. This course is a pre- or co-requisite for senior design.

I have taken DRAM 2130 (drama) and RELI 1001 (religion) and the DARS sheet says they satisfy Area C. Why do I need to take an English Lit course and SPCM 1100?
Our graduates, employers of graduates, and engineering education publications constantly stress the importance of written and oral communication skills. Moreover we use these courses to satisfy communication requirements for ABET accreditation.

I have taken HIST 2111, POLS 1101, AFAM 2000, and PSYC 1101. My DARS sheet indicates that I have completed Area E. Why do I need to take another HIST, POLS, AFAM, or PSYC course?
Our ABET accreditation requires that we demonstrate depth in Humanities and Social Sciences. We require that our students show this depth in Social Science by taking two of the four acceptable Area E courses with the same prefix.

I took the equivalent of PHYS 1111/L and 1112/L. My advisor at the previous institution said it was all the same material and these courses satisfy the core. Do I have to take PHYS 1211/L and 1212/L?
PHYS 1111/L and 1112/L satisfy the core requirements, however, PHYS 1211/L is a prerequisite for Statics and PHYS 1212/L is a prerequisite for Circuits. You must take the Calculus-based Physics to satisfy prerequisites.

I took Statics and Differential Equations and made a D in each. Can I take Strength of Materials and Fluid Mechanics next semester?
UGA does not allow a grade requirement on a prerequisite. Our faculty has placed a grade requirement for graduation of C or better in all math and physics courses as well as ENGR 1120, 2110, 2120, 2130, 2140, 2150, 2170, and 3150. The intent is for a student to retake a course to receive a C or better before taking the subsequent course.

How should I prepare for the advising sessions held during the Fall and Spring semesters?

Prior to the advising sessions a student must prepare a written tentative schedule for the next term as well as the subsequent three terms (or to graduation). A copy must also be provided for the advisor. Advising will then consist of revisions to this schedule. The revised advisor copy will remain in the folder.

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