COMPUTER ENGINEERING (CENG), BACHELOR OF SCIENCE

OVERVIEW

At Dunwoody College of Technology, the Computer Engineering bachelor's degree prepares students for careers that focus on the design, integration, and optimization of internet-connected devices (smart technologies). The degree prepares students for careers that focus on the intersection of electrical engineering, software engineering, and computer engineering. Job titles can range from computer engineer and electrical engineer to computer scientist and data scientist.

Students learn to how to use computer and embedded systems that monitor, collect, send, control, and store vast amounts of data in order to solve a variety of problems. The emphasis is not on designing the microprocessor chips themselves, but rather on how they're used in industry and other applications, such as in enterprise development, data-driven systems, and the integration of IT (information technology) and OT (operational technology).

Coursework includes study in electrical circuits, programming, digital and microprocessors systems, connected devices, embedded systems, and data science. Curriculum is project-integrated so that theoretical engineering principles are reinforced and experienced through hands-on creation and problem-solving.

Arts & Sciences courses help students understand the core mathematical and scientific principles that all engineering projects grow out of as well as provide students with the communication and critical thinking skills required to succeed in the profession.

All students complete a senior project.

Credential Earned: BS
Length of Program: 4 years (8 semesters)
Classes Offered: Day
Available Starts: Fall Semester

PROGRAM OUTCOMES

- EAC 1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- EAC 2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- EAC 3: An ability to communicate effectively with a range of audiences
- EAC 4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- EAC 5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- EAC 6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- EAC 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

DEGREE REQUIREMENTS

Code	Title	Credits
General Education		
MATH1811	Calculus I	4
MATH1821	Calculus II	4
MATH2260	Probability & Statistics	4
MATH2810	Multi-Variable Calculus	4
MATH2820	Linear Algebra & Differential Equations	4
MATH2830	Discrete Math	3
PHYS1800	Physics I with Lab	4
PHYS1820	Physics II with Lab	4
SPCH1000	Speech	3
SSCI1100	Introduction to Macro & Micro Economics	3
WRIT2010	Technical Writing	3
Humanities Elective		3
Social Sciences Elective		3
Technical Credits		
ENGR1210	Introduction to Programming	3
ENGR1110	Introduction to Engineering	3
ENGR1115	Intro to Automation,Robotics, & Sensors	2
EENG1240	Circuit Fundamentals I	3
EENG1241	Circuit Fundamentals I Lab	1
SENG1210	Application Development I	4
EENG1210	Logic & Digital Design	2
EENG1220	Logic & Digital Design Lab	1
ENGR1230	Networking, Data Security for Engr	4
EENG2111	Circuit Fundamentals	3
EENG2120	Circuit Fundamentals Lab	1
SENG2240	Connected Devices Development I	3
EENG2132	Digital Systems	3
EENG2210	Analog Circuits	3
EENG2220	Analog Circuits Lab	1
SENG3400	Operating Systems	3
EENG3131	Signals & Systems	3
SENG4400	Data Science & Machine Learning	3
ENGR3120	Engineering Economics	2
EENG3211	Digital & Microprocessors Systems	3
EENG3220	Digital & Microprocessors Systems lab	1
EENG3150	Topics in Applied Instrumentation	3
EENG3260	Motors & Controls	4
SENG3240	Connected Device Development II	3
CENG4200	Embedded Systems	3
CENG4100	Computer Architecture	4
CENG4300	Computational Optimization in HW	3
ENGR4110	Engineering Ethics	2
EENG4231	DSP & Filters	3

CENG4150	Senior Design Project	2
Total Credits		**125**

COURSES

ENGR1210 | Introduction to Programming | Lecture/Laboratory (3 Credits)
Examine and implement computational problem-solving strategies using computer languages to solve engineering problems. Develop algorithms and translate solutions into computer programs. Distinguish differences in programming languages and software tools with applicability to different types of problem solutions. Apply modular design and clear documentation for efficient problem solving.

ENGR1110 | Introduction to Engineering | Lecture (3 Credits)
Explore major topics in Engineering. Provides a pathway to success in the School of Engineering programs, including time management, industry software, study skills, teamwork skills, internship availability and career opportunities.

ENGR1115 | Intro to Automation,Robotics, & Sensors | Lecture/Laboratory (2 Credits)
Explore major topics in Automation, Robotics and Sensors as well as learning software tools and practical design and construction techniques to support studies in Electrical and Computer Engineering.

EENG1240 | Circuit Fundamentals I | Lecture (3 Credits)
Analyze fundamental circuits. Investigate the relationship between voltage, current, power and energy. Identify and predict responses of RC and RL circuits. Must be taken with EENG1241.
Corequisite(s): EENG1241

EENG1241 | Circuit Fundamentals I Lab | Laboratory (1 Credit)
Analyze fundamental circuits in a lab environment. Investigate the relationship between voltage, current, power and energy. Identify and predict responses of RC and RL circuits. Must be taken with EENG1240.
Corequisite(s): EENG1240

SENG1210 | Application Development I | Lecture/Laboratory (4 Credits)
Develop a base level of proficiency in Python and Java programming languages employing simple and moderately complex data structures and algorithms. A range of programming concepts will be covered, including classes, objects, primitives, inheritance, encapsulation, abstraction, polymorphism, and interfaces.
Prerequisite(s): ENGR1210

EENG1210 | Logic & Digital Design | Lecture (2 Credits)
Introduction to logic gates and state machines. The foundations of number systems and binary logic are implemented using logic gates. Karnaugh maps are used to realize Boolean algebra, leading to combinational logic circuits. State machines such as flip-flops, counters, and registers are analyzed.
Corequisite(s): EENG1220

EENG1220 | Logic & Digital Design Lab | Laboratory (1 Credit)
Build logic circuits and state machines in a laboratory environment from scratch using components such as IC chips and breadboards. Measure inputs and outputs using oscilloscopes and logic analyzers. Explore potential uses and implementations for real world solutions. Model design with Hardware Description Language coding.
Corequisite(s): EENG1210

ENGR1230 | Networking, Data Security for Engr | Lecture/Laboratory (4 Credits)
Explore data communications, cybersecurity, and Internet of Things (IoT) in a connected world. Explain computer networking concepts with data security in mind. Identify security concepts and security audit processes as well as career opportunities in connectivity/networking/security disciplines.

EENG2111 | Circuit Fundamentals | Lecture (3 Credits)
Examine transient and steady state conditions in complex circuits. Investigate power, power factor, and power transfer. Explore frequency using Fourier analysis, Bode plots, passive filters and transfer functions.
Prerequisite(s): ENGR1221

EENG2120 | Circuit Fundamentals Lab | Laboratory (1 Credit)
Prototype various circuits and determine values using electrical metrology tools and techniques. Compare expected behavior against measured responses.
Prerequisite(s): ENGR1221

SENG2240 | Connected Devices Development I | Lecture/Laboratory (3 Credits)
Explore and implement Internet connected devices. Internet of Things (IoT) device design and implementation. Use the Raspberry Pi and a variety of sensors, actuators, networking, and programming techniques to create IoT devices. A knowledge of Python is required and prior programming experience.
Prerequisite(s): SENG1210

EENG2132 | Digital Systems | Lecture/Laboratory (3 Credits)
Examine various systems through abstraction from the basic concepts of digital blocks. Use hardware description languages such as Verilog to design the digital systems. Work with memory and programmable logic devices and FPGAs to design and program reconfigurable systems.
Prerequisite(s): EENG1210

EENG2210 | Analog Circuits | Lecture (3 Credits)
Analysis of continuous variable systems. Discuss non-linear components such as diodes and transistors. Explore more advanced concepts and components including multi-transistor amplifiers and op-amps.
Prerequisite(s): EENG2110
Corequisite(s): EENG2220

EENG2220 | Analog Circuits Lab | Laboratory (1 Credit)
Design and construct circuits, focusing on prototyping and debugging, using common electrical engineering equipment and tools.
Prerequisite(s): EENG2120
Corequisite(s): EENG2210

SENG3400 | Operating Systems | Lecture/Laboratory (3 Credits)
Analyze the purpose of operating systems. Topics include: elements of operating systems, memory and process management, interactions among major components of a computer system, the effects of computer architecture on operating systems, and an examination of how different operating systems (desktop, server, mobile, real-time) impact Software Design.
Prerequisite(s): SENG2220

EENG3131 | Signals & Systems | Lecture (3 Credits)
Introduction to the foundation of communications, signal processing and control theory. Analyze linear time invariant continuous and discrete systems and signal transformations, convolution, frequency spectra, Laplace transforms, Z transforms, and fast Fourier transforms.
Prerequisite(s): MATH2820

SENG4400 | Data Science & Machine Learning | Lecture/Laboratory (3 Credits)
Advanced topics in Data Analysis, Data Science, and Machine Learning. Analyze large datasets. Implement supervised and unsupervised learning.
Prerequisite(s): SENG2230

ENGR3120 | Engineering Economics | Lecture (2 Credits)
Economic analysis of engineering decisions under uncertainty. Concepts include time value of money, cash flow estimation, rate of return analysis, net present value estimation, and asset evaluation. Applications include comparing different project alternatives accounting for heterogeneity in cost, revenue, taxation, depreciation, inflation, and risk.

EENG3211 | Digital & Microprocessors Systems | Lecture (3 Credits)
Investigate microprocessor and microcontroller operations. Explain registers, memory and I/O interfacing principles. Describe embedded systems and their applications in real world systems. Utilize microprocessor/microcontroller for embedded system Hardware/Software development.
Prerequisite(s): EENG2132
Corequisite(s): EENG3220

EENG3220 | Digital & Microprocessors Systems lab | Laboratory (1 Credit)
Implement embedded systems using different hardware platforms and different programming languages. Demonstrate the design considerations for systems ranging from basic to complex applications.
Prerequisite(s): EENG2132
Corequisite(s): EENG3211

EENG3150 | Topics in Applied Instrumentation | Lecture/Laboratory (3 Credits)
Introduction to various types of instrumentation and control schemas. Topics include pressure, temperature, level and flow detection and calculations. Lab activities include calibration, tuning and installation of various analog and smart equipment used in industry.
Prerequisite(s): EENG3110

EENG3260 | Motors & Controls | Lecture/Laboratory (4 Credits)
Examine the fundamentals of electrical motor control components, circuits and systems. Topics include electrical control symbols, power distribution, control transformers, solenoids and relays, motor starters, pilot devices, timers and sequencers, DC and AC motor principles, proximity sensors and troubleshooting.
Prerequisite(s): EENG3110

SENG3240 | Connected Device Development II | Lecture/Laboratory (3 Credits)
Advanced study of Internet connected devices. Design and implement applications and services for mobile and smart devices such as smartphones, smart displays, smart speakers. The Android architecture and operating system will be primarily used. Design challenges and opportunities in the mobile/smart device market. Students must have a strong background in application development, the software lifecyle/tooling, and Operating Systems.
Prerequisite(s): SENG3400

CENG4200 | Embedded Systems | Lecture/Laboratory (3 Credits)
This course will cover the basics of designing, interfacing, configuring, and programming embedded systems. The course will utilize inexpensive, popular embedded systems, like Arduino, which are used by hobbyists, researchers, and in industry, to implement the techniques learned in class.
Prerequisite(s): EENG3211

CENG4100 | Computer Architecture | Lecture/Laboratory (4 Credits)
This course will cover the basics of computer architecture and organization. A variety of computer processor architectures will be analyzed and experimented with to evaluate each in terms of performance, power consumption, etc.
Prerequisite(s): EENG3211

CENG4300 | Computational Optimization in HW | Lecture/Laboratory (3 Credits)
This course will cover topics such as (but not limited to) techniques for speeding up hardware implementations, including system restructuring, algorithms, and hardware innovations. Students will learn the importance of code optimization trade offs for available hardware resources.
Prerequisite(s): SENG2220

ENGR4110 | Engineering Ethics | Lecture (2 Credits)
Interpret the connection between personal morality, the role of engineers and engineering in society, and relationship to one's employer. Case studies involving conflicts within these roles are reviewed and evaluated.

EENG4231 | DSP & Filters | Lecture (3 Credits)
Analyze Discrete-time signals and systems. Design and implement Digital Filters. Compute Signal Spectrum using FFT algorithms. Implement DSP solutions using industry standard solutions and design tools offered by companies such as Texas Instruments, and ON Semiconductor. Contrast DSP and Microprocessor solutions in meeting performance standards.
Prerequisite(s): EENG4110

CENG4150 | Senior Design Project | Capstone (2 Credits)
Senior Design Project to implement the learning gained from previous years of study. This course will vary based on the instructor and students' areas of interest.

SSCI1100 | Introduction to Macro & Micro Economics | Lecture (3 Credits)
Fundamental economic issues and theories are explored through discussion and research. Current events, policy perspectives, and case studies are used to process and apply economics to everyday life.
General Education: Social Sciences

MATH1811 | Calculus I | Lecture (4 Credits)
The fundamental tool used by engineers and scientists to determine critical measurements, such as maximums, minimums and allowable rates of change. Utilize multiple methods in the calculation and application of limits, derivatives, transcendental functions, implicit differentiation and related rates.
General Education: Mathematics

MATH1821 | Calculus II | Lecture (4 Credits)
The fundamental tool used by engineers and scientists to determine critical measurements such as the area under curves, the volumes within complex geometries, and for describing functions as an infinite series. Computer software enables the application of the definite integral, the fundamental theorem of calculus, applications of integration, and numerical methods of integration.
Prerequisite(s): MATH1811 Or MATH1812
General Education: Mathematics

PHYS1800 | Physics I with Lab | Lecture/Laboratory (4 Credits)
Introduction to mechanics using differential calculus as a foundation. Topics include kinematics and dynamics of linear motion, static equilibrium, the conservation of energy and momentum, mechanics of solids and fluids, and thermodynamics. The laboratory portion incorporates experimentation, instrumentation, and graphical tools to verify calculations in motion, mechanics and thermodynamics.
Prerequisite(s): MATH1810 Or MATH1811
General Education: Physical Sciences with Lab

PHYS1820 | Physics II with Lab | Lecture/Laboratory (4 Credits)
An introductory calculus-based course in electromagnetic fields and their applications. Topics include: Coulomb's and Gauss' Law, electric fields and potentials, electrical and magnetic properties of matter, Ampere's and Faraday's laws, elementary DC and AC circuits, Maxwell's equations, and electromagnetic waves.
Prerequisite(s): MATH1821, Or MATH1820, And PHYS1800
General Education: Physical Sciences with Lab

MATH2810 | Multi-Variable Calculus | Lecture (4 Credits)
Differentiate and integrate functions of two and three variables. Apply differentiation and integration techniques to physical sciences and engineering. Explore the theorems of Green and Stokes.
Prerequisite(s): MATH1820 Or MATH1821
General Education: Mathematics

MATH2820 | Linear Algebra & Differential Equations | Lecture (4 Credits)
Introduction to Linear Algebra, including vector spaces and linear mappings between such spaces. Explore solution methods for ordinary differential equations, qualitative techniques; includes matrix methods approach to systems of linear equations and series solutions.
Prerequisite(s): MATH1821 Or MATH1820
General Education: Mathematics

MATH2830 | Discrete Math | Lecture (3 Credits)
Examine a set of branches of math that all have in common the feature that they are “discrete” rather than “continuous”.
General Education: Mathematics

MATH2260 | Probability & Statistics | Lecture (4 Credits)
Introduction to probability and statistics with applications. Topics include: basic combinatorics, random variables, probability distributions, hypothesis testing, confidence intervals, and linear regression.
Prerequisite(s): MATH1810, Or MATH1811, Or MATH1812
General Education: Mathematics

SPCH1000 | Speech | Lecture (3 Credits)
Introduction to public speech making; purpose and organization, audience analysis and response, verbal and non-verbal clues.
General Education: Communications

WRIT2010 | Technical Writing | Lecture (3 Credits)
Technical writing applications are studied for format, style, voice, and point of view; considered for purpose, audience, and subject. Critical thinking and developed expertise are employed to analyze, interpret, evaluate, summarize and generate various technical documents, individually and within teams.
General Education: Communications