Department of Computer Science and Electrical Engineering

Dr. Mircea Agapie, Department Head
Department of Computer Science and Electrical Engineering
Box T-0390
Stephenville, Texas 76402
254-968-9863
254-968-9503
agapie@tarleton.edu
www.tarleton.edu/encs (http://www.tarleton.edu/encs/)

The department of Computer Science and Electrical Engineering (CSEE) offers bachelor's degrees in Electrical Engineering, Computer Science, and a master's degree in Computer Engineering. CSEE majors engage in hands-on applications of discipline-related concepts and tools, taught in an engaging, student-centered, academic success focused environment. Our department houses state of the art instructional and research equipment including industry standard software, 3D printing, HPLC analysis, automation and robotics, hydraulic flume, 145 mph wind tunnel and a 100 kN universal testing machine. Students gain practical experience with these tools throughout the curriculum and also have the opportunity to conduct undergraduate research with our faculty. A degree from the CSEE department opens doors to challenging and rewarding, high-salaried, high tech engineering and computing careers.

Math Readiness

All ENCS bachelor's degrees start with MATH 2413 Calculus I as the first mathematics course. Placement into Calculus 1 is by the CLMPE placement exam, or by college credit for MATH 1316 Plane Trigonometry or MATH 2412 Precalculus. Contact Tarleton's Center for Access and Academic Testing (http://www.tarleton.edu/caat/) for test information and locations. Incoming students are strongly encouraged to **take the CLMPE math placement exam prior to orientation** so they may enroll in the proper math course. If the student is college-ready in mathematics but is not prepared to take Calculus I as the first course, then he or she will be required to take MATH 2412 Precalculus. Engineering majors who are not college-ready in mathematics are designated as "Pre-engineering" (PREN) until they are eligible to enroll in Precalculus; at that time they will declare an engineering major and begin engineering coursework.

Departmental Course Prerequisite Policy

It is important for students to stay academically prepared as they progress through their curriculum. Prerequisite (taken previously) and corequisite (taken previously or concurrently) courses are in place to establish the foundational knowledge and skills needed to be successful in any given course. For all programs in the ENCS department, students must earn a grade of “C” or better in all required Engineering, Computer Science, Mathematics and Science coursework to graduate, as well as to proceed to follow-up courses. The following summarizes the policy for allowing/disallowing forward progress when prerequisite (prereq) and/or corequisite (coreq) conditions are not fully met:

- If a student earns an F in a prereq course or has not taken that prereq, the student may NOT enroll in the follow-up course.
- If a student earns a D in a prereq for a course, the student IS allowed a prereq waiver to enroll in the follow-up course only if ALL THREE of the following conditions are met:
  - The student has an overall GPA of 2.2 or higher, AND
  - If by not enrolling in the follow-up course, the student’s graduation date is adversely impacted (advisor must check the cascading effect of not enrolling in a course), AND
  - The student has not exceeded the max of FOUR prereq waivers.

If a student qualifies for a prereq waiver, the student must re-enroll in the prereq course concurrently; if the prereq course is not offered concurrently, the student must re-enroll on its immediate next offering. A student may utilize a maximum of FOUR prerequisite waivers over the duration of their pursuit of a degree within the ENCS Department. Changing majors within the department does not reset the waiver count.

The department also allows a maximum of TWO engineering courses in a curriculum that can be taken as a transient (temporary) student at another university. Consult the department website, office or an advisor for additional information on these policies.

Electrical Engineering

The Electrical Engineering program at Tarleton State University was launched in Fall 2014 and is accredited by the Engineering Accreditation Commission of ABET, www.abet.org. The mission of the Electrical Engineering program is to prepare graduates for employment in Electrical Engineering related industries, for engineering licensure, and for graduate studies in Electrical, Computer and related Engineering and Science disciplines. This is accomplished through an application-oriented curriculum and experiences in which students develop their ability to synthesize concepts into solutions, use modern analytical tools and techniques, communicate professionally and work in a team environment. The program provides both breadth and depth in topics including digital systems, electronics, signal processing and control systems. Additional studies in ethics assure that the graduate understands engineers' special obligations to society. This results in engineering graduates who strive to advance the engineering profession through technical competence, innovative problems solving and design, professional conduct, and lifelong learning. Additional details can be found on the department website: www.tarleton.edu/encs (http://www.tarleton.edu/encs/).

Students must earn a grade of “C” or better in all Engineering, Computer Science, Mathematics, and Science coursework in order to graduate. Students are strongly encouraged to take the Fundamentals of Engineering (FE) licensure exam, and resources for FE preparation are provided.

Bachelor of Science in Electrical Engineering

Required Courses

Placement for Calculus 1 is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.		
General Education Requirements (http://catalog.tarleton.edu/undergrad/academicaffairs/)		43
ENGR 1100 [shared]	Transitioning to University Studies in Engineering	
ENGR 1211	Engineering Fundamentals I	2
ELEN 1212	Introduction to Electrical Engineering	2
ENGR 2322	Engineering Thermodynamics	3
ENGR 3311	Engineering Mathematical Methods	3
ENGR 4259	Engineering Capstone I	2
ENGR 4360 [WI (http://catalog.tarleton.edu/undergrad/academicaffairs/)]	Engineering Capstone II	3
ELEN 2425	Electrical Circuit Theory	4
ELEN 2448	Introduction to Digital System Design	4
ELEN 3314 [WI (http://catalog.tarleton.edu/undergrad/academicaffairs/)]	Signals and Systems	3

ELEN 3320	Engineering Analysis Techniques	3
ELEN 3443	Computer Architecture	4
ELEN 3310	Power Systems Engineering	3
ELEN 3445	Electronics I	4
ELEN 4340	Digital VLSI Design	3
ELEN 4336	Solid State Physics	3
ELEN 4441	Microprocessor System Design	4
ELEN 4443	Linear Control System Design	4
ELEN 4446	Electronics II	4
ELEN 4350	Communication Systems Theory	3
ELEN 4355	Digital Signal Processing	3
Advanced COSC, MATH, or ELEN elective - Choose from the following:		3
COSC 3360	Python Programming for Data Science	
COSC 3365	NoSQL Databases	
COSC 4401	Database Theory and Practice	
COSC 4478 [WI (http://catalog.tarleton.edu/undergrad/academicaffairs/)]	Computer Networks	
MATH 3310	Discrete Mathematics	
MATH 3320	Foundations of Mathematics	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
ELEN 4088	Undergraduate Research Project	
COSC 1310	Procedural Programming	3
CHEM 1409	College Chemistry for Engineers	4
PHYS 2425 [shared]	University Physics I	
PHYS 2426 [shared]	University Physics II	
MATH 2413 [shared]	Calculus I	
MATH 2414	Calculus II	4
MATH 3433	Calculus III	4
MATH 3306	Differential Equations	3
Total Hours		128

Computer Science

The Bachelor of Science degree in Computer Science prepares graduates to enter the high-tech workforce or to continue their studies at the graduate level. We offer concentrations in **software engineering, artificial intelligence and data science, computer engineering, cybersecurity** and **game design**. The program provides a strong foundation in hardware and software, mathematics and general science, that is aligned with curriculum standards as set forth within the computer science discipline. Students are encouraged to also specialize in a complementary technical area through technical electives. Additional details can be found on the department website: www.tarleton.edu/encs.

Student must earn a grade of “C” or better in all Computer Science, mathematics, physics and technical elective coursework in order to graduate.

The Bachelor of Science Degree in Computer Science

Required Courses		
Placement for Calculus 1 is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.		
General Education Requirements (http://catalog.tarleton.edu/undergrad/academicaffairs/)		42
COSC 1100 [shared]	Transitioning to University Studies in Computer Science	
MATH 2413	Calculus I	4
MATH 1342 [shared]	Elementary Statistical Methods	
MATH 2414	Calculus II	4
MATH 3310	Discrete Mathematics	3
PHYS 2425 [shared]	University Physics I	
COSC 1302	Introduction to Computer Science	3
COSC 1310	Procedural Programming	3
COSC 2321	C++ Programming	3
COSC 2331	Java Programming	3
COSC 2341	Data Structures	3
COSC 2448	Introduction to Digital Systems Design	4
COSC 3443	Computer Architecture	4
COSC 3380	Operating Systems	3
COSC 3489 [WI (http://catalog.tarleton.edu/undergrad/academicaffairs/)]	Software Engineering I	4
COSC 4478 [WI (http://catalog.tarleton.edu/undergrad/academicaffairs/)]	Computer Networks	4
Technical Electives (at least 8 hours advanced) [1]		9
Total Hours		96

Additional Required Courses for Concentrations

Computer Engineering

PHYS 2426 [shared]	University Physics II	
MATH 3306	Differential Equations	3
ELEN 2425	Electrical Circuit Theory	4
ELEN 3314 [WI (http://catalog.tarleton.edu/undergrad/academicaffairs/)]	Signals and Systems	3
Select 10 hours from the following:		10
ELEN 4350	Communication Systems Theory	
ELEN 4355	Digital Signal Processing	
ELEN 3445	Electronics I	
ELEN 4443	Linear Control System Design	
COSC 4441	Microprocessor System Design	4
Total Hours		24

Artificial Intelligence and Data Science

COSC 3360	Python Programming for Data Science	3
COSC 4360	Machine Learning	3
COSC 4401	Database Theory and Practice	4
Select one of the following:		3
COSC 3366	Computer Vision	
COSC 3365	NoSQL Databases	
COSC or approved MATH, BCIS, or Digital Media Studies electives (at least 6 hours advanced)		11
Total Hours		24

Game Development

COSC 3330	Games, Graphics and GUIs	3
ARTS 2344	Game Design	3
ARTS 3366	3D Video Game Environment I	3
ARTS 4367	3D Rendering and Lighting	3
COSC or approved MATH, BCIS, or Digital Media Studies electives (at least 10 hours advanced)		12
Total Hours		24

Software Engineering

COSC 3390	Software Engineering II	3
COSC 4389	Programming Languages Fundamentals	3
COSC 4401	Database Theory and Practice	4
COSC 4451	Distributed Applications	4
COSC or MATH electives (at least 6 hours advanced)		10
Total Hours		24

General Computer Science

COSC 4401	Database Theory and Practice	4
COSC or approved MATH, BCIS, or Digital Media Studies electives (at least 15 hours advanced)		20
Total Hours		24

Cybersecurity

COSC 3360	Python Programming for Data Science	3
COSC 4360	Machine Learning	3
COSC 4364	Principles of Cybersecurity	3
MATH 3301	Number Theory	3
COSC or approved MATH, BCIS, or Digital Media Studies electives (at least 7 hours advanced)		12
Total Hours		24

[1] Technical electives include courses from all College of Science and Technology (COST) subject prefixes, Digital Media Studies ARTS, and BCIS.

Computer Engineering Courses

Computer Science Courses

COSC 1100. Transitioning to University Studies in Computer Science. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).
Practical study designed to prepare the student for university life, aid in the development of skills for academic success, promote personal growth and responsibility, and encourage active involvement in the learning process from an individual college perspective. These skill sets are presented in the context of engineering and computer science disciplines.

COSC 1302. Introduction to Computer Science. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
History of computers and of their applications in a variety of fields, both as PCs and as embedded systems. Overview of programming paradigms. Overview of today's most dynamic computer-related technologies, including communication networks and the Internet. A modern programming language is used to present types of problems that can be solved with computers, the underlying algorithms, and the fundamental limitations. We adopt early in this course the information-centric viewpoint, exploring the role of computers in all stages of the information life-cycle. Students apply their newly-acquired programming skills to performing basic information-processing tasks. Lab fee $15.

COSC 1310. Procedural Programming. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Introduces the fundamental concepts of structured programming. Topics include software development and methodology, data types, control structures, functions, arrays, pointers and the mechanics of running, testing, and debugging. Prerequisite: One of the following: MATH 1314, MATH 1316, MATH 2412, or MATH 2413. Lab fee: $2.

COSC 2321. C++ Programming. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Applies the object-oriented programming paradigm using the C++ programming language. The focus is on the definition and use of classes, interfaces, data encapsulation, inheritance, and polymorphism, templates and exceptions. Presents an introduction to object-oriented design. Prerequisite: COSC 1310. Lab fee: $2.

COSC 2331. Java Programming. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
The main parts of the Java programming language are covered, including classes, methods, interfaces, inheritance, polymorphism, generics, lambda expressions, annotations, exceptions, threads and synchronization, collections, Java IO and NIO API. Prerequisite: COSC 1310 Lab fee: $2.

COSC 2341. Data Structures. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Application of programming techniques, introducing the fundamental concepts of data structures and algorithms. Topics include recursion, fundamental data structures (including stacks, queues, linked lists, hash tables, trees, and graphs), and algorithmic analysis. Prerequisite: COSC 1310 or BCIS 3332 or BCIS 3333 Lab fee: $2.

COSC 2448. Introduction to Digital Systems Design. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Combinational and sequential digital system design techniques; programmable logic devices; computer components (ALU, memory, IO circuits); hardware description language (VHDL); introduction to machine and assembly languages. Credit for both COSC 2448 and ELEN 2448 will not be awarded. Prerequisite: COSC 1310 (coreq) or ELEN 1212 (prereq) Lab fee: $2.

COSC 3330. Games, Graphics and GUIs. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
2D and 3D graphics; the main building-blocks of game design, from a programmer's perspective, such as character animation, scene navigation, shading, modeling, game rules, and GUI. Prerequisites: COSC 2321 and COSC 2341 Lab fee: $2.

COSC 3344. Computer Applications in Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Binary representations of integers, floating-point numbers and characters; solutions to specific and general polynomial equations; regression and iteration techniques; approximate derivation and integration; error analysis; linear systems and matrix algorithms; other selected numerical algorithms. Prerequisites: MATH 2414 and one of the following: COSC 1310 or BCIS 3332 or BCIS 3333 Lab fee: $2.

COSC 3360. Python Programming for Data Science. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Programming tools are used to illustrate the components of the data pipeline: data collection, cleaning, exploration, dimensionality reduction, modeling, visualization, and applications. The course includes an introduction to machine learning. Prerequisite: COSC 1310, or COSC 2321, or COSC 2331, or BCIS 3332, or BCIS 3333 Lab fee: $2.

COSC 3365. NoSQL Databases. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
This course provides an introduction to NoSQL database management systems, with emphasis on the document-centric model. Topics include Create, Read, Update, Delete (CRUD) operations, data processing pipelines, replication, sharding, and the MapReduce paradigm. Prerequisite: COSC 1310, or COSC 2321, or COSC 2331, or BCIS 3332, or BCIS 3333 Lab fee: $2.

COSC 3366. Introduction to Computer Vision. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
This course provides an introduction to the field of computer vision. It covers a broad range of topics, from simple to complex, such as: image formation, camera calibration, image processing, edge detection, filtering, feature extraction, image segmentation, multiple-view geometry, optical flow. The course also provides an introduction to deep learning and robotics applications. Prerequisite: COSC 1310 or COSC 2321 or COSC 2331 or BCIS 3332 or BCIS 3333 Lab fee: $2.

COSC 3380. Operating Systems. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Introduction to the design and development of operating systems. Analysis of current system software technology, including process management, memory organization, security, and file systems. Prerequisite: COSC 1310; COSC 2341 Lab fee: $2.

COSC 3390. Software Engineering II. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
The course is a follow-up to Software Engineering I. The main topics are: tools used in software development, coding practices, design patterns, code smells and refactoring, and testing. Prerequisite: COSC 3489 Lab fee: $2.

COSC 3443. Computer Architecture. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Hardware and software structures found in modern digital computers. Instruction set architecture, hardwired design of the processor, assembly language programming, microprogramming, I/O and memory units, analysis of instruction usage, hardware complexity, and parallel computer architectures and programming. Credit for both COSC 3443 and ELEN 3443 will not be awarded. Prerequisite: COSC 2448 or ELEN 2448. Lab fee: $2.

COSC 3489. Software Engineering I. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
The course is an introduction to software engineering. The main topics are software development process, software requirements, Unified Modeling Language, conceptual and behavioral modeling, software architecture, software design, and design principles. Prerequisite: COSC 2331 Lab fee: $2.

COSC 4086. Special Problems. 1-4 Credit Hours (Lecture: 1-4 Hours, Lab: 1-4 Hours).
Directed study of selected topics in Computer Science. May be repeated with approval of department head.

COSC 4088. Undergraduate Research Project. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 0-0 Hours).
Methods of research in computer science through a research project directed by a departmental faculty member. The student is required to prepare a final report and presentation. No credit is earned until the final report and presentation are certified as completed by the faculty member directing the project. Prerequisites: Junior standing.

COSC 4360. Machine Learning. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
This course is a broad introduction to machine learning algorithms, with emphasis on their application in data science and cybersecurity. Topics include dimensionality reduction, regression, clustering, support vector machines, decision trees, naïve Bayes, and neural networks. The course includes a significant project component, with real-world data. Prerequisites: COSC 2341, COSC 3360, and either MATH 1342 or MATH 3311 Lab fee: $2.

COSC 4364. Principles of Cybersecurity. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Introduces students to the fundamental concepts, tools, and industry standards of the cybersecurity field. Students will learn how to protect computer systems, networks, and programs from possible digital attacks. Practical and research-specific knowledge to match today's industry standards. Prerequisite: MATH 1342; MATH 3310; COSC 3360 or proficiency in Python; Lab fee: $2.

COSC 4389. Programming Languages Fundamentals. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
The course is about the principles of programming languages, concepts of language processing, program representation, and language translation and execution. The main topics are formal description of programming languages, syntax analysis, semantic analysis, code generation, and runtime systems. Prerequisite: COSC 2331, COSC 2341 Lab fee: $2.

COSC 4401. Database Theory and Practice. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Fundamental types of database models, with emphasis on relational databases. SQL, conceptual modeling, relational algebra, functional dependency theory, normalization and normal forms. File and data management principles underlying database construction. Optimization algorithms and indexing. Prerequisites: Either COSC 2341 by itself, or (MATH 3310 and one of the following: COSC 1310 or BCIS 3332 or BCIS 3333) Lab fee: $2.

COSC 4441. Microprocessor System Design. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Introduction to microprocessors; 8/16 bit single board computer hardware and software designs; chip select equations for memory board design, serial and parallel I/O interfacing; ROM, static and dynamic RAM circuits for no wait-state design; assembly language programming, stack models, subroutines and I/O processing. Credit for both COSC 4441 and ELEN 4441 will not be awarded. Prerequisite: COSC 1310; ELEN 2448 or COSC 2448. Lab fee $2.

COSC 4451. Distributed Applications. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
A study of the architecture and design of distributed applications. N-tier application and supporting technologies are investigated including client/server architecture, supporting languages, transaction processing, and distribution of processes. Prerequisites: COSC 2331 and COSC 2341. Lab fee $2.

COSC 4478. Computer Networks. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
Bottom-up presentation of computer network hardware and protocols, going through the five main layers: physical, data link, network, transport, and application. Special emphasis is placed on the medium access control sub-layer for local area networks, IP routing, security and modern wireless access technologies. Prerequisites: Either COSC 2341 by itself, or (MATH 3310 and one of the following: COSC 1310 or BCIS 3332 or BCIS 3333) Lab fee: $2.

Electrical Engineering Courses

ELEN 1212. Introduction to Electrical Engineering. 2 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).
The course elaborates on the question “What is Electrical Engineering?”, and also aims to cover background and basics on various topics in electrical engineering, such as analog and digital circuitry, microelectronics, signal processing, control systems, communication systems, and power systems. After learning some fundamental theories and concepts, the students will apply them to standard electrical system designs and analysis. The students will also utilize a variety of systems testing and circuit prototyping tools, such as digital multimeters, oscilloscopes, function generators, electronic workstations, along with industry-standard software. Prerequisite: ENGR 1211 Lab fee: $2.

ELEN 2425. Electrical Circuit Theory. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Theory of electrical circuits, including voltage, current, power, and energy as circuit variables and sources, resistors, capacitors, and inductors as circuit elements. Coverage of disciplined circuit analysis techniques, equivalent circuit models, maximum power transfer, ideal operational amplifiers, first- and second-order circuits, sinusoidal steady state operation, phasor analysis, and computer-aided circuit simulation. This course concludes with an introduction to system-level concepts, the Bode response, and system transfer functions. Prerequisite: PHYS 2426 or concurrent registration; MATH 2414 or concurrent registration. Lab fee: $2.

ELEN 2448. Introduction to Digital System Design. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Combinational and sequential digital system design techniques; design of practical digital systems. Credit for both COSC 2448 and ELEN 2448 will not be awarded. Prerequisite: COSC 1310 (coreq) or ELEN 1212 (prereq) Lab fee: $2.

ELEN 3310. Power Systems Engineering. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to the generation, transmission, distribution and utilization of electric power, along with the electrical devices connected to such systems including generators, motors and transformers. Topics include: fundamentals of electromagnetic field theory, fundamentals of electric power, basic components of power systems, three-phase systems, transformers, electric machines, AC and DC motors, generators, power generation and distribution, power plants, transmission lines, and renewable energy systems. Prerequisite: ELEN 2425; MATH 3306 or concurrent registration.

ELEN 3314. Signals and Systems. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
Modeling and analysis of electrical and mechanical systems using Laplace transformation methods; transient and steady-state analysis; Fourier series; Fourier transform; elementary feedback. Prerequisites: ELEN 2425, MATH 3306 or concurrent registration.

ELEN 3320. Engineering Analysis Techniques. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
This course covers the applications and implementation of numerical algorithms commonly encountered in engineering and scientific analyses. Topics may include statistical analysis, analysis of linear and non-linear systems, optimization and linear programming, numerical differentiation and integration, and analysis of differential equations. Use of MATLAB (or other similar computational tools) for performing computational analysis and generating graphical interpretations of the results is also included. Prerequisite: ENGR 1211; MATH 3306 or concurrent enrollment; Lab fee: $2.

ELEN 3332. Electromagnetic Field Theory. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course provides the background necessary to formulate and solve electromagnetic problems relevant to many fields of electrical engineering such as RF and microwave circuits, photonics, wireless networks, computers, bioengineering, and nanoelectronics. Topics include: static electric and magnetic fields; Maxwell’s equations in integral and differential forms; wave propagation; reflection and refraction of plane waves; transient and steady-state behavior of waves on transmission lines. Prerequisites: PHYS 2426; MATH 3306 and MATH 3433 or concurrent registrations.

ELEN 3360. Microwave Theory. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course covers the key concepts related to the analysis and design of microwave systems at the subsystem and component level. Topics include: waveguides and wave propagation on transmission lines, including stripline and microstrip structures; microwave network analysis; impedance matching techniques; analysis and design of microwave resonators; power dividers, couplers, and hybrids; microwave filters; noise and distortion in microwave circuits; an introduction to microwave system implementation. Prerequisites: ELEN 3314, 3445, and either ELEN 3332 or PHYS 3332.

ELEN 3443. Computer Architecture. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Hardware and software structures found in modern digital computers. Instruction set architecture, hardwired design of the processor, assembly language programming, microprogramming, I/O and memory units, analysis of instruction usage, and hardware complexity. Credit for both COSC 3443 and ELEN 3443 will not be awarded. Prerequisite: COSC 2448 or ELEN 2448. Lab fee $2.

ELEN 3445. Electronics I. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
A first course in microelectronics intended to give students an introduction to the analysis and design of analog and digital integrated circuits. Topics include: semiconductor physics theory and operating principles of the p-n junction, MOS field effect transistor (MOSFET), and bipolar junction transistor (BJT); operational amplifiers; large- and small-signal equivalent circuit models of diodes, MOSFETs, and BJTs; single-transistor amplifier configurations; digital logic circuits. Prerequisite: ELEN 2425; ELEN 3314 or concurrent registration Lab fee: $2.

ELEN 4086. Special Problems. 1-4 Credit Hours (Lecture: 1-4 Hours, Lab: 1-4 Hours).
Directed study of selected topics in Electrical Engineering. May be repeated with approval of department head.

ELEN 4088. Undergraduate Research Project. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 0 Hours).
Methods of research in electrical engineering through a research project directed by a departmental faculty member. The student is required to prepare a final report and presentation. No credit is earned until the final report and presentation are certified as completed by the faculty member directing the project. Prerequisites: Junior standing.

ELEN 4336. Solid State Physics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course covers the basic principles required to understand the operation of solid-state devices with an emphasis on device physics. Semiconductor fundamentals including crystals and energy bands, charge carriers (electrons and holes), doping, and transport (drift and diffusion); basic concepts of generation-recombination and the P-N junction as capacitors and current rectifier; semiconductor device equations developed from fundamental concepts; P-N junction theory developed and applied to the analysis of devices such as varactors, bipolar transistors, and field-effect transistors. Prerequisites: ELEN 3445 and MATH 3306.

ELEN 4340. Digital VLSI Design. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduces the key concepts to design CMOS VLSI digital integrated circuits. Topics include the basic physical operation and terminal characteristics of CMOS devices, CMOS fabrication highlights, the design of logic gates, static and dynamic digital circuits, timing, memory, and low-power techniques. A project will give students the opportunity to design a digital integrated circuit block from specifications by the use of computer-aided design tools. Prerequisite: ELEN 1212; ELEN 2425; ELEN 2448.

ELEN 4350. Communication Systems Theory. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to the frequency and time domain; modulation; random signal theory; network analysis using nondeterministic signals; basic information theory; noise. Prerequisites: ELEN 3314 and ELEN 2425.

ELEN 4355. Digital Signal Processing. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to discrete-time signal processing and discrete-time systems. Topics include: discrete-time linear systems, difference equations, z-transforms, discrete convolution, stability, discrete-time Fourier transforms, analog-to-digital and digital-to-analog conversion, digital filter design, discrete Fourier transforms and fast Fourier transforms, spectral analysis, and applications of digital signal processing. Prerequisite: ELEN 3314.

ELEN 4441. Microprocessor System Design. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Introduction to microprocessors; 8/16 bit single board computer hardware and software designs; chip select equations for memory board design, serial and parallel I/O interfacing; ROM, static and dynamic RAM circuits for no wait-state design; assembly language programming, stack models, subroutines and I/O processing. Credit for both COSC 4441 and ELEN 4441 will not be awarded. Prerequisite: COSC 1310; ELEN 2448 or COSC 2448. Lab fee: $2.

ELEN 4443. Linear Control System Design. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Application of state variable and frequency domain techniques to modeling and analysis of single input, single output linear control systems; physical implementation of control systems by integrating sensors, actuators and other control system components; use of software design tools. Prerequisite: ELEN 2425, MATH 3306, and either ELEN 3320 or COSC 3344. Lab fee $2.

ELEN 4446. Electronics II. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
A second course in microelectronics emphasizing the analysis and design of analog integrated circuits. Topics include: MOSFET and BJT fabrication technologies; current mirrors and biasing techniques; amplifier topologies; frequency response of analog integrated circuits; feedback, stability, and amplifier compensation techniques; output stages; noise in integrated circuits; linear integrated circuit applications. Prerequisites: ELEN 3445 and ELEN 3314 Lab fee: $2.