Electrical Engineering and Computer Science (EECS)

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The newly merged Department of Electrical Engineering and Computer Science will offer the same degrees as the former Department of Electrical Engineering and the Department of Computer Science and Computer Engineering. Review any of their undergraduate programs at the following links:

Majors

- Computer Engineering (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/computerscienceandcomputerengineeringcsce/#bscmpeincomputerengineeringtext) B.S.Cmp.E.
- Computer Engineering (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/computerscienceandcomputerengineeringcsce/#bscmpewithcybersecurityconcentrationtext) B.S.Cmp.E. with Cybersecurity Concentration
- Computer Science (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/computerscienceandcomputerengineeringcsce/#bsincomputersciencetext) B.S.C.S.
- Computer Science (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/computerscienceandcomputerengineeringcsce/#bscswithcybersecurityconcentrationtext) B.S.C.S. with Cybersecurity Concentration
- Computer Science (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/computerscienceandcomputerengineeringcsce/#baincomputersciencetext) B.A.
- Electrical Engineering (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/electricalengineeringeleg/#requirementsforbsinelectricalengineeringtext) B.S.E.E.

Minors

- Computer Science (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/computerscienceandcomputerengineeringcsce/#minorincomputersciencetext)

Requirements for Computer Engineering B.S.Cmp.E.

The computer engineering degree has required sequences of courses in both hardware and software aspects of computer applications and design. Since almost all of today's complex systems encompass hardware and software elements, computer engineering graduates must acquire the skills required to design, build, and test complex digital systems. At the advanced level, students are exposed to hands-on experience with open-ended problems with opportunities for research and design.

The Bachelor of Science in Computer Engineering program culminates in a capstone project completed in two consecutive semesters. In the first semester, students form teams and develop a project proposal. In the second semester, students develop, implement, and present the final project.

Computer Engineering B.S.Cmp.E. Eight-Semester Degree Program

The following sections contain the list of courses required for the Bachelor of Science in Computer Engineering (B.S.Cmp.E.) with a suggested sequence below.

Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites. Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program.

First Year	Units	
	Fall	Spring
GNEG 11101 Introduction to Engineering I	1	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405)[1]	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3	
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
U.S. History Elective (Satisfies General Education Outcomes 3.2 and 4.2) Choose from one of the following courses:	3	
HIST 20003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)		
HIST 20103 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)		
GNEG 11201 Introduction to Engineering II		1
MATH 25004 Calculus II		4
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)		4
Freshman Science Elective (Satisfies General Education Outcome 3.4) Choose one of the following science and corresponding lab options:		4
BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)		
BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)		
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture)		
CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture)		

GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
ENGL 10303 Technical Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.2)		3
Year Total:	14	16

Second Year		**Units**
	Fall	**Spring**
CSCE 20004 Programming Foundations I	4	
CSCE 21104 Digital Design	4	
MATH 26004 Calculus III	4	
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)	4	
CSCE 20104 Programming Foundations II		4
CSCE 22104 Computer Organization		4
MATH 25804 Elementary Differential Equations		4
MATH 26103 Discrete Mathematics		3
Social Sciences Elective (Satisfies General Education Outcomes 3.3 and 4.1)[2]		3
Year Total:	16	18

Third Year		**Units**
	Fall	**Spring**
CSCE 31903 Programming Paradigms	3	
CSCE 36103 Operating Systems	3	
CSCE 39503 System Synthesis and Modeling	3	
Social Sciences Elective (Satisfies General Education Outcome 3.3)[3]	3	
INEG 33103 Engineering Probability and Statistics[4]	3	
CSCE 35103 Software Engineering (Satisfies General Education Outcome 6.1)		3
CSCE Elective (4000 level)		3
ELEG 39903 Circuits & Electronics		3
PHIL 31003 Ethics and the Professions (Satisfies General Education Outcome 5.1)		3
SPCH 10003 Public Speaking (ACTS Equivalency = SPCH 1003)		3
Year Total:	15	15

Fourth Year		**Units**
	Fall	**Spring**
CSCE 45601 Capstone I	1	
CSCE 41104 Embedded Systems	4	
CSCE Elective (4000 level)	3	
CSCE Elective (4000 level)	3	
Fine Arts Elective (Satisfies General Education Outcome 3.1)[5]	3	
General Elective	3	
CSCE 42103 Computer Architecture		3
CSCE 49603 Capstone II		3
CSCE Elective (4000 level)		3
Social Sciences Elective (Satisfies General Education Outcome 3.3)[3]		3
General elective		3
Year Total:	17	15

Total Units in Sequence:	**126**

1 Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

2 The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 20103, SOCI 201H3, or SOCI 20103.

3 The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 2013, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 201H3, SOCI 20103. Note, courses cannot be counted twice in degree requirements.

4 Student may petition to take the two-course sequence, STAT 30133 and STAT 31133, instead of INEG 33103.

5 The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

Program Educational Objectives

For the B.S. degree program in computer engineering, the following set of program educational objectives describe what graduates are expected to attain within a few years after graduation.
Computer Engineering graduates will:

1. Be able to practice their profession in a competitive market. The competitive market includes being recruited by industrial firms, government agencies and graduate schools.
2. Make a significant contribution to society, including improving the standard of living particularly for the taxpayers of the state of Arkansas.
3. Understand the need for life-long learning and continued professional development for a successful and rewarding career.
4. Accept responsibility for leadership roles, in their profession, communities, and society.

Student Learning Outcomes

- CE1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- CE2. 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.

- CE3. An ability to communicate effectively with a range of audiences.
- CE4. 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.
- CE5. 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.
- CE6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- CE7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for Computer Engineering B.S.Cmp.E. with Cybersecurity Concentration

The computer engineering degree has required sequences of courses in both hardware and software aspects of computer applications and design. Since almost all of today's complex systems encompass hardware and software elements, computer engineering graduates must acquire the skills required to design, build, and test complex digital systems. At the advanced level, students are exposed to hands-on experience with open-ended problems with opportunities for research and design.

The Bachelor of Science in Computer Engineering program culminates in a capstone project completed in two consecutive semesters. In the first semester, students form teams and develop a project proposal. In the second semester, students develop, implement, and present the final project.

Additional Requirements for the Cybersecurity Concentration

The requirements for the Computer Engineering degree with Cybersecurity Concentration include completing the B.S. in Computer Engineering requirements and 9 semester credit hours in the area of cybersecurity. Courses satisfying the cybersecurity topics are listed below.

Choose three courses from the following list of CSCE Cybersecurity Electives:		9
CSCE 44303	Cryptography	
CSCE 47503	Computer Networks	
CSCE 47803	Cloud Computing and Security	
CSCE 48103	Computer Graphics	

Computer Engineering with Cybersecurity Concentration Eight-Semester Degree Program

The following sections contain the list of courses required for the Bachelor of Science in Computer Engineering: Cybersecurity Concentration with a suggested sequence below.

Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites. Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program.

First Year	Fall	Spring
GNEG 11101 Introduction to Engineering I	1	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3	
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013)	3	
U.S. History Elective (Satisfies General Education Outcomes 3.2 and 4.2) Choose from one of the following courses:	3	
HIST 20003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)		
HIST 20103 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)		
GNEG 11201 Introduction to Engineering II		1
MATH 25004 Calculus II		4
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)		4
Freshman Science Elective (Satisfies General Education Outcome 3.4) Choose one of the following science and corresponding lab options:		4
BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)		
BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)		
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture)		
CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture)		
GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
ENGL 10303 Technical Composition II (ACTS Equivalency = ENGL 1023)		3
Year Total:	14	16

Second Year	Fall	Spring
CSCE 20004 Programming Foundations I	4	
CSCE 21104 Digital Design	4	
MATH 26004 Calculus III	4	
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)	4	
CSCE 20104 Programming Foundations II		4
CSCE 22104 Computer Organization		4
MATH 25804 Elementary Differential Equations		4

MATH 26103 Discrete Mathematics		3
Social Sciences Elective (Satisfies General Education Outcomes 3.3 and 4.1)[2]		3
Year Total:	16	18

Third Year	Units	
	Fall	Spring
CSCE 31903 Programming Paradigms	3	
CSCE 36103 Operating Systems	3	
CSCE 39503 System Synthesis and Modeling	3	
Social Sciences Elective (Satisfies General Education Outcome 3.3)[3]	3	
INEG 33103 Engineering Probability and Statistics[4]	3	
CSCE 35103 Software Engineering (Satisfies General Education Outcome 6.1)		3
CSCE Cybersecurity Elective (4000 level)		3
ELEG 39903 Circuits & Electronics		3
PHIL 31003 Ethics and the Professions (Satisfies General Education Outcome 5.1)		3
SPCH 10003 Public Speaking (ACTS Equivalency = SPCH 1003)		3
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
CSCE 45601 Capstone I	1	
CSCE 41104 Embedded Systems	4	
CSCE Cybersecurity Elective (4000 level)	3	
CSCE Elective (4000 level)	3	
Fine Arts Elective (Satisfies General Education Outcome 3.1)[5]	3	
General Elective	3	
CSCE 42103 Computer Architecture		3
CSCE 49603 Capstone II		3
CSCE Cybersecurity Elective (4000 level)		3
Social Sciences Elective (Satisfies General Education Outcome 3.3)[3]		3
General elective		3
Year Total:	17	15

Total Units in Sequence:	**126**

1. Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.
2. The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 20903, HUMN 111H4, HUMN 211H4, INST 2013, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 20103, SOCI 201H3, or SOCI 20103.
3. The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11013, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 2013, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 201H3, SOCI 20103. Note, courses cannot be counted twice in degree requirements.
4. Student may petition to take the two-course sequence, STAT 30133 and STAT 31133, instead of INEG 33103.
5. The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

Requirements for Computer Science B.S.C.S.

Computer science core courses include the fundamentals of programming concepts, operating systems, algorithms, formal languages, and database management systems.

The Bachelor of Science in Computer Science program culminates in a capstone project completed in two consecutive semesters. In the first semester, students form teams and develop a project proposal. In the second semester, students develop, implement, and present the final project.

Computer Science B.S.C.S. Eight-Semester Degree Program

The following sections contain the list of courses required for the Bachelor of Science in Computer Science (B.S.C.S.) degree with a suggested sequence below.

Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites. Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program.

First Year	Units	
	Fall	Spring
GNEG 11101 Introduction to Engineering I	1	
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
History Elective (Satisfies General Education Outcomes 3.2 and 4.2). Choose from one of the following courses: HIST 20003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) HIST 20103 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)	3	
GNEG 11201 Introduction to Engineering II		1

MATH 25004 Calculus II		4
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034)		4
Freshman Science Elective (Satisfies General Education Outcome 3.4) Choose one of the following science and corresponding lab options:		4
BIOL 10103 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)		
BIOL 10101 Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)		
CHEM 14203 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture)		
CHEM 14201 University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		
GEOL 11103 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture)		
GEOL 11101 Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab)		
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (For students who already have credit for PHYS 2054, they may wish to select PHYS 2074 for their Freshman Science Elective.)		
ENGL 10303 Technical Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.2)		3
Year Total:	14	16

Second Year	**Fall**	**Spring**
CSCE 20004 Programming Foundations I	4	
CSCE 21104 Digital Design	4	
MATH 26103 Discrete Mathematics	3	
Fine Arts Elective (Satisfies General Education Outcome 3.1)[2]	3	
Social Sciences Elective (Satisfies General Education Outcomes 3.3 and 4.1)[3]	3	
CSCE 20104 Programming Foundations II		4
CSCE 22104 Computer Organization		4
MATH 30803 Linear Algebra		3
Social Sciences Elective (Satisfies General Education Outcome 3.3)[4]		3
Year Total:	17	14

Third Year	**Fall**	**Spring**
CSCE 31903 Programming Paradigms	3	
CSCE 36103 Operating Systems	3	
INEG 33103 Engineering Probability and Statistics[5]	3	
PHIL 31003 Ethics and the Professions (Satisfies General Education Outcome 5.1)	3	
General Elective	3	
CSCE 35103 Software Engineering (Satisfies General Education Outcome 6.1)		3
CSCE 45203 Database Management Systems		3
CSCE Elective (4000 level)		3
MATH 31003 Combinatorics		3
SPCH 10003 Public Speaking (ACTS Equivalency = SPCH 1003) (Satisfies General Education Outcome 1.2)		3
Year Total:	15	15

Fourth Year	**Fall**	**Spring**
CSCE 45601 Capstone I	1	
CSCE 41303 Algorithms	3	
CSCE 47503 Computer Networks	3	
CSCE Elective (4000 level)	3	
General Elective	3	
General Elective	3	
CSCE 49603 Capstone II		3
CSCE 43203 Formal Languages and Computability		3
CSCE Elective (4000 level)		3
General Elective		3
Social Sciences Elective (Satisfies General Education Outcome 3.3)[4]		3
Year Total:	16	15

Total Units in Sequence:	**122**

1 Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

2 The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 1003, THTR 10103, or THTR 101H3.

3 The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 1123, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 2013, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 20103, SOCI 201H3, or SOCI 20103.

4 The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 201H3, SOCI 20103. Note, courses cannot be counted twice in degree requirements.

5 Student may petition to take the two-course sequence, STAT 30133 and STAT 31133, instead of INEG 33103.

Program Educational Objectives

For the B.S. degree program in computer science, the following set of program educational objectives describe what graduates are expected to attain within a few years after graduation.

Computer Science graduates will:

1. Enhance Arkansas' and the nation's information technology industry.
2. Engage in advanced study of Computer Science and other fields, including engineering, law, medicine, and business.
3. Possess a sufficiently broad education to be inquisitive, well-informed reasoning members of their profession and society.
4. Understand human, social and ethical issues so that they will be good employees or employers, citizens and neighbors.

Student Learning Outcomes

- CS1. An ability to analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
- CS2. An ability to design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
- CS3. An ability to communicate effectively in a variety of professional contexts.
- CS4. An ability to recognize professional responsibilities and make informed judgements in computing practice based on legal and ethical principles.
- CS5. An ability to function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
- CS6. An ability to apply computer science theory and software development fundamentals to produce computing-based solutions.

Requirements for Computer Science B.A.

The Bachelor of Arts in Computer Science degree has the same educational objectives as the Bachelor of Science degree. However, the course requirements differ greatly to allow students to double major or pursue other interests.

Humanities and social science electives are selected from the State Minimum Core Requirements listed in the Catalog of Studies. To satisfy the State Minimum Core, all CSCE students are required to take the following 18 hours of humanities/social science courses:

PHIL 31003	Ethics and the Professions	3
Fine Arts from Category "A"		3
U.S. History		3
Social Science		9

The Undergraduate Handbook has a list of approved basic science, mathematics, and technical electives. Any course not included in these lists requires faculty approval.

Degree Program Changes

Students must meet all requirements of their degree programs and are expected to keep informed concerning current regulations, policies, and program requirements in their fields of study. Changes made in the curriculum at a level beyond that at which a student is enrolled might become graduation requirements for that student. Changes made in the curriculum at a level lower than the one at which a student is enrolled are not required of that student. Students should consult their departmental adviser for additional information.

Computer Science B.A. Eight-Semester Degree Program

The following sections contain the list of courses required for the Bachelor of Arts in Computer Science (B.A.) degrees with a suggested sequence below.

Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites. Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program.

Scholarship students may need to take General Elective hours in First Year, Fall and Spring Semesters, as well as the Third Year, Spring Semester for 15 semester hours.

First Year	Units	
	Fall	Spring
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
Social Sciences Elective Satisfies General Education Outcomes (3.3 and 4.1) [2]	3	
Select one of the following Satisfies General Education Outcomes (3.2 and 4.2)	3	
HIST 20003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)		
HIST 20103 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)		
CSCE 20004 Programming Foundations I		4
CSCE 21104 Digital Design		4
ENGL 10203 Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.1) or ENGL 10303 Technical Composition II (ACTS Equivalency = ENGL 1023)		3
MATH 26103 Discrete Mathematics		3
Year Total:	13	14

Second Year	Units	
	Fall	Spring
CSCE 20104 Programming Foundations II	4	
CSCE 22104 Computer Organization	4	
Fine Arts Elective (Satisfies General Education Outcome 3.1)[3]	3	
Social Sciences Elective (Satisfies General Education Outcome 3.3)[4]	3	
General Elective	3	
CSCE 31903 Programming Paradigms		3

SPCH 10003 Public Speaking (ACTS Equivalency = SPCH 1003) (Satisfies General Education Outcomes 1.2 and 5.1)		3
MATH 21003 Principles of Statistics (ACTS Equivalency = MATH 2103)		3
Two General Electives		6
Year Total:	17	15

Third Year	Units	
	Fall	Spring
CSCE 35103 Software Engineering (Satisfies General Education Outcome 6.1)	3	
ENGL 30503 Technical and Professional Writing (ACTS Equivalency = ENGL 2023)	3	
Science Elective (Meets State Minimum Core and Satisfies General Education Outcome 3.4)	4	
Two General Electives	6	
PHIL 31003 Ethics and the Professions[5]		3
CSCE 36103 Operating Systems		3
Social Science Elective (Satisfies General Education Outcome 3.3)[3]		3
Two General Electives		5
Year Total:	16	14

Fourth Year	Units	
	Fall	Spring
Two CSCE electives (3000 level or higher)	6	
Science Elective (Meets State Minimum Core and Satisfies General Education Outcome 3.4)	4	
Two General Electives (3000 level or higher)	6	
Two CSCE electives (3000 level or higher)		6
Three General Electives (3000 level or Higher)		9
Year Total:	16	15

Total Units in Sequence:	**120**

1 Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

2 The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 11293, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 201H3, or SOCI 20103.

3 The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

4 The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 2813H, PSYC 20003, RESM 28503, SOCI 20103, SOCI 201h3, SOCI 20103. Note, courses cannot be counted twice in degree requirements.

5 PHIL 31003 also meets Humanities Elective for State Minimum Core and Satisfies General Education Outcomes 3.2 and 5.1.

Requirements for Electrical Engineering B.S.E.E.

Undergraduate Program in Electrical Engineering

The Electrical Engineering Department maintains the following student learning outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics,
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,
3. An ability to communicate effectively with a range of audiences,
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,
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,
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions,
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

For more information visit www.abet.org (http://www.abet.org/).

The electrical engineering curriculum is designed to provide students with knowledge of scientific principles and methods of engineering analysis to form a solid foundation for a career in design, research and development, manufacturing and processing, measurement and characterization, or management. Students progressively build their design experience throughout the curriculum and demonstrate this ability in the senior electrical engineering design laboratories. The curriculum also introduces students to subjects in the humanities, social sciences, and ethics so they may better understand the interaction of technology and society.

The electrical engineering curriculum is divided into three phases. The first year concentrates on the development of a sound understanding of basic sciences and mathematics. The second and third years further develop scientific principles and cover the basic core of electrical engineering. The fourth year is composed primarily of senior-level elective courses. At this time, the students, in consultation with their advisers, may choose classes related to one or more of the major areas of electrical engineering detailed (e.g., analog and mixed-signal circuit design/test, biomedical, communications, computer hardware and digital circuit design, control systems, electronic packaging, embedded systems design, microwave and radar engineering, nanophotonics, nanotechnology/microelectronics/optoelectronics, pattern recognition and artificial intelligence, power electronics, and renewable energy and power). This final year permits the student to tailor a program suited to

her or his individual career objectives. The graduation requirement in electrical engineering is 125 semester hours as given below.

Recommended Technical Studies

Students in electrical engineering are required to complete 21 semester hours of technical electives of which a minimum of 9 semester hours must be 4000- or 5000-level electrical engineering elective courses. A student may select the remaining 12 semester hours from 4000- or 5000-level electrical engineering elective courses or upper-division technical courses in mathematics, engineering, and the sciences with the approval of an adviser. One of these courses may be an approved Math/Science Elective and another may be an approved Engineering Science Elective. History and social science courses taught by Math and Science departments are not eligible for technical elective credit. Not more than 6 semester hours total of ELEG 488V and ELEG 400VH may be credited toward technical electives. Students who have taken full-time co-op experiences under GNEG 3811, and whose grades in these courses were A or B, may get credit for not more than three hours of non-ELEG technical electives if the work performed is of comparable quality to a technical elective; consult with the Department Co-op Coordinator. Descriptions of all electrical engineering courses are in the Course Descriptions chapter of this Catalog of Studies. The schedule of technical electives offered in a given semester is determined the previous semester since the selection depends on a number of varying factors such as student interest in a particular topic, the importance of a particular technology for the student's professional career, and teaching faculty availability.

Electrical Engineering B.S.E.E. Eight-Semester Degree Program

The following section contains the list of courses required for the Bachelor of Science in Electrical Engineering and a suggested eight-semester sequence. See the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) for more details. Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites.

First Year	Units	
	Fall	Spring
GNEG 11101 Introduction to Engineering I	1	
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3	
Select one of the following (Satisfies General Education Outcome 4.2):	3	
HIST 20003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)		
HIST 20103 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)		
PLSC 20003 American National Government (ACTS Equivalency = PLSC 2003)		
GNEG 11201 Introduction to Engineering II		1
ENGL 10303 Technical Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.2)		3
MATH 25004 Calculus II		4
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)		4
Sophomore Science Elective[2]		4
Year Total:	14	16

Second Year	Units	
	Fall	Spring
ELEG 21003 Electric Circuits I	3	
ELEG 21001 Electric Circuits I Laboratory	1	
MATH 25804 Elementary Differential Equations	4	
PHYS 20404 University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4	
Humanities Elective (Satisfies General Education Outcome 3.2 & 5.1)[3]	3	
ELEG 21103 Electric Circuits II		3
ELEG 21101 Electric Circuits II Laboratory		1
CSCE 20004 Programming Foundations I		4
MATH 26004 Calculus III		4
ELEG 29004 Digital Design		4
Year Total:	15	16

Third Year	Units	
	Fall	Spring
ELEG 31204 System & Signal Analysis	4	
ELEG 32103 Electronics I	3	
ELEG 32101 Electronics I Laboratory	1	
ELEG 39204 Microprocessor Systems Design	4	
ELEG 37004 Applied Electromagnetics	4	
ELEG 31403 Probability & Stochastic Processes		3
ELEG 32203 Electronics II		3
ELEG 32201 Electronics II Laboratory		1
ELEG 33004 Energy Systems		4
Social Sciences Elective (Satisfies General Education Outcome 3.3 & 4.1)[4]		3
Math/Science/Technical Elective[9]		3
Year Total:	16	17

Fourth Year	Units	
	Fall	Spring
Engineering Science/Technical Elective[5]	3	
Two Electrical Engineering Technical Elective[6]	6	
ELEG 40603 Electrical Engineering Design I	3	
Select one of the following:	3	
ECON 21003 Principles of Macroeconomics (ACTS Equivalency = ECON 2103)		
ECON 22003 Principles of Microeconomics (ACTS Equivalency = ECON 2203)		
ECON 21403 Basic Economics: Theory and Practice		

Electrical Engineering Technical Elective[6]		3
ELEG 40701 Electrical Engineering Design II (Satisfies General Education Outcome 6.1)		1
Two Technical Elective[10]		6
Social Sciences Elective [7]		3
Fine Arts Elective (Satisfies General Education Outcome 3.1)[8]		3
Year Total:	15	16
Total Units in Sequence:		**125**

1 Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

2 CHEM 14203/CHEM 14201 or BIOL 10103/BIOL 10101 or BIOL 24103/BIOL 24001, or PHYS 20504 or GEOL 11103/GEOL 11101

3 The Humanities Elective courses that satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, PHIL 21003.

4 The Social Sciences Elective courses that satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 1123, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 281H3, RESM 28503, SOCI 10103, SOCI 201H3, or SOCI 20103.

5 Engineering Science/Technical Elective: **Any Engineering/Science/Math Technical Elective** or one of these 2000 level courses: MEEG 20103, MEEG 23003, MEEG 24003, CHEG 23103, or INEG 24103

6 ELEG TECHNICAL ELECTIVES are defined as ELEG 4000 or ELEG 5000 level courses. CSCE 41104, CSCE 46103, or CSCE 42303 are approved ELEG Technical Electives for students pursuing a dual ELEG/CSCE undergraduate degree. Not more than 6 hours may be ELEG 4880V or ELEG 400HV courses.

7 The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 2013, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 21003, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103, SOCI 201H3, SOCI 20103. Note, courses cannot be counted twice in degree requirements.

8 The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

9 MATH SCIENCE/TECHNICAL ELECTIVES: **Any Engineering/Science/Math Technical Elective,** suggested classes BIOL 10103/BIOL 10101, CHEM 14203/CHEM 14201, CHEM 35004, CHEM 36053, MATH 30803, MATH 44403, PHYS 35404, PHYS 35404, PHYS 36103, MEEG 27003 or STAT 30043.

10 TECHNICAL ELECTIVES are 3000 or above level courses in Math, Engineering, or the sciences after the approval by ELEG advisor. CSCE 20104, Programming 2, CSCE 22104, Computer Organization, and SEVI 52103 Business Foundations for Entrepreneurs are allowable non-ELEG technical electives. **Courses not eligible** for technical elective credit include ELEG 39003, ELEG 39903 and any history courses in math and the sciences (e.g., MATH 31303) .

Students should become very familiar with the Academic Regulations chapter for university requirements that apply to the electrical engineering program as well as the College of Engineering requirements (in particular the “D rule” and the “Transfer of Credit” for courses taken at another institution). Students are required to complete 40 hours of upper division courses (3000-4000 level). It is recommended that students consult with their adviser when making course selections. In addition to these graduation requirements, candidates for an electrical engineering degree must have earned a grade-point average of no less than 2.00 on all ELEG courses.

Requirements for a Minor in Computer Science:

CSCE 20004	Programming Foundations I	4
CSCE 20104	Programming Foundations II	4
CSCE 31903	Programming Paradigms	3
Three additional CSCE courses numbered above 2000.		9
Total Hours		**20**

Requirements for Departmental Honors in Computer Science and Computer Engineering

The Honors Program in Computer Science and Computer Engineering is designed for the superior student and is intended to help the student develop a more comprehensive view of Computer Science and Computer Engineering. The program provides a vehicle for the recognition of achievements beyond the usual course of study. Higher degree distinctions are recommended only in truly exceptional cases and are based upon the candidate’s whole program of honors studies. A minimum of 12 hours of honors coursework is required.

The following requirements are necessary for graduation with honors in either the Computer Engineering or Computer Science Bachelor of Science program:

1. The candidate must satisfy the requirements set forth by the College of Engineering.
2. The student must obtain at least a 3.50 grade-point average in required Computer Engineering and/or Computer Science courses.
3. The student must complete 6 hours of Honors credit in the major, which includes 3 hours of Honors Thesis taken as successive semesters of CSCE 491HV and 3 hours of CSCE coursework.

Electrical Engineering Honors Program

To graduate with Honors in electrical engineering, students must be a member of the Honors College, have a minimum cumulative GPA of 3.50, and complete a minimum of 12 hours of honors credit of which 6 hours must be Electrical Engineering Honors courses that include the following: ELEG 406H3 Honors Electrical Engineering Design I, ELEG 407H1 Honors Electrical Engineering Design II, and ELEG 400HV Honors Senior Thesis. Special problems credit hours (ELEG 4880V) will not be counted in the requirement for graduation with Honors in Electrical Engineering.

Electrical Engineering Honors Courses:

ELEG 3124H, ELEG 3143H, ELEG 3214H, ELEG 3224H, ELEG 3304H, ELEG 3704H, ELEG 3924H
Required ELEG junior courses with Honors section (all junior required courses include honors sections).

ELEG 4061H Honors Electrical Engineering Design I (Sp, Fa)

ELEG 4073H Honors Electrical Engineering Design II

ELEG 400VH Honors Senior Thesis (Sp, Su, Fa)

ELEG 4203H, ELEG 4233H, ELEG 4403H, ELEG 4503H, ELEG 4703H, ELEG 4783H, ELEG 4814H, ELEG 4963H: ELEG technical elective courses that have an Honors section
(Please check the offering of these Honors Sections for a particular semester).

ELEG 5000 or above: Any graduate level course.

Faculty

Andrews, David, Ph.D. (Syracuse University), M.S., B.S.E.E. (University of Missouri-Columbia), Professor, Thomas Mullins Chair of Computer Science and Computer Engineering, 2008.
Balda, Juan Carlos, Ph.D. (University of Natal), B.S. (Universidad Nacional del Sur), University Professor, 1989, 2013.
Chen, Zhong, Ph.D. (North Carolina State University), M.Eng. (National University of Singapore), B.S. (Zhejiang University), Assistant Professor, 2015.
Di, Jia, Ph.D. (University of Central Florida), M.S., B.S. (Tsinghua University), Professor, 21st Century Research Leadership Chair, 2004, 2014.
Dix, Jeffrey, Ph.D., M.S., B.S.E.E., (University of Tennessee, Knoxville), Assistant Professor, 2018.
El-Ghazaly, Samir M., Ph.D. (University of Texas at Austin), M.S., B.S. (Cairo University), Distinguished Professor, 2007.
El-Shenawee, Magda O., Ph.D. (University of Nebraska-Lincoln), M.S., B.S. (Assiut University, Egypt), Professor, 2001, 2010.
Farnell, Chris, Ph.D., M.S.E.E., B.S.E.E. (University of Arkansas), Assistant Professor, 2021, 2023.
Gashler, Michael, Ph.D., M.S., B.S. (Brigham Young University), Teaching Associate Professor, 2023.
Gauch, John Michael, Ph.D. (University of North Carolina at Chapel Hill), M.Sc., B.Sc. (Queen's University, Canada), Professor, 2008.
Gauch, Susan E., Ph.D. (University of North Carolina at Chapel Hill), M.Sc., B.Sc. (Queen's University, Canada), Professor, 2007.
Huang, Miaoqing, Ph.D. (George Washington University), B.S. (Fudan University), Associate Professor, 2010, 2016.
Jin, Kevin, Ph.D., M.S., (University of Illinois at Urbana-Champaign), B.E. (Nanyang Technological University, Singapore), Associate Professor, , 2021.
Le, Thi Hoang Ngan, Ph.D. (Carnegie Mellon University), M.S., B.S. (University of Natural Sciences, Ho Chi Minh City, Vietnam), Assistant Professor, 2019.
Li, Qinghua, Ph.D. (Pennsylvania State University), M.S. (Tsinghua University), B.E. (Xi'an Jiaotong University), Associate Professor, 2013.
Luu, Khoa, Ph.D. (Concordia University), Assistant Professor, 2018.
Manasreh, Omar, Ph.D. (University of Arkansas), M.S. (University of Puerto Rico-Rio Piedras), B.S. (University of Jordan), Professor, 2003.
Mantooth, Alan, Ph.D. (Georgia Institute of Technology), M.S., B.S. (University of Arkansas), Distinguished Professor, Twenty-First Century Chair in Mixed-Signal IC Design and CAD, 1998, 2011.
Martin, Terry W., Ph.D., M.S.E.E., B.S.E.E. (University of Arkansas), Professor, 1990, 2002.
McCann, Roy A., Ph.D. (University of Dayton), M.S.E.E., B.S.E.E. (University of Illinois), Professor, 2003, 2009.
Nakamoto, Ukeles, Ph.D. (University at Buffalo), M.S. (Oklahoma State University), Assistant Professor, 2020.
Nelson, Alexander H., Ph.D. (University of Maryland), M.S., B.S. (University of Arkansas), Associate Professor, 2017, 2023.
Pan, Yanjun, Ph.D., (University of Arizona), B.E. (Nanjing University of Aeronautics and Astronautics, China), Assistant Professor, 2022.
Panda, Brajendra Nath, Ph.D. (North Dakota St. University), M.S. (Utkal University, India), Professor, 2001, 2007.
Parkerson, Pat, Ph.D., B.S. (University of Arkansas), Associate Professor, 1990, 2009.
Patitz, Matthew J., Ph.D., M.S., B.S. (Iowa State University), Associate Professor, 2012, 2018.
Peng, Yarui, Ph.D., M.S. (Georgia Institute of Technology), B.S. (Tsinghua University), Assistant Professor, 2017.
Saunders, Robert F., M.S.E.E., M.S. (University of Arkansas), Instructor, 2012.
Song, Xiaoqing, Ph.D. (North Carolina State University), M.S., B.S. (Beijing Institute of Technology), Assistant Professor, 2022.
Spiesshoefer, Silke, Ph.D., M.S.E.E., B.S.Ch.E. (University of Arkansas), Clinical Assistant Professor, 2014.
Streeter, Lora, Ph.D., M.S. (University of Arkansas, Fayetteville), Teaching Assistant Professor, 2019.
Thompson, Dale R., Ph.D. (North Carolina State University), M.S., B.S. (Mississippi State University), Professor, 2000, 2022.
Ware, Morgan, Ph.D. (North Carolina State University), B.S. (Florida State University), Assistant Professor, 2005.
Wu, Jingxian, Ph.D. (University of Missouri-Columbia), M.S. (Tsinghua University), B.S. (Beijing University of Aeronautics and Astronautics), Associate Professor, 2008, 2013.
Wu, Xintao, Ph.D. (George Mason University), M.E. (Chinese Academy of Space Technology), B.S. (University of Science and Technology of China), Professor, Charles D. Morgan/Acxiom Graduate Research Chair, 2014, 2019.
Yu, Fisher, Ph.D. (Arizona State University), M.S., B.S. (Peking University), Associate Professor, 2008, 2014.
Zhang, Lu, Ph.D. (Nanyang Technological University, Singapore), Assistant Professor, 2018.
Zhao, Yue, Ph.D. (University of Nebraska-Lincoln), B.S. (Beijing University), Assistant Professor, 2015.

Computer Science and Computer Engineering Courses

CSCE 20004. Programming Foundations I. 4 Hours.
Introductory programming course for students majoring in computer science or computer engineering. Software development process: problem specification, program design, implementation, testing and documentation. Programming topics: data representation, conditional and iterative statements, functions, arrays, strings, file I/O and classes. Using C++ in a UNIX environment. Corequisite: Lab component. Prerequisite: MATH 24005 or MATH 24004 with a grade of C or better, a College of Engineering (ENGR) student, a Computer Science Minor (CSCE-M), or a math major (MATHBS or MATHBA). (Typically offered: Fall and Spring)

CSCE 20104. Programming Foundations II. 4 Hours.
This course continues developing problem solving techniques by focusing on fundamental data structures and associated algorithms. Topics include: abstract data types, introduction to object-oriented programming, linked lists, stacks, queues, hash tables, binary trees, graphs, recursion, and searching and sorting algorithms. Using C++ in a UNIX environment. Corequisite: Lab component. Prerequisite: CSCE 20004 with a grade of C or better. (Typically offered: Fall and Spring)

CSCE 20203. Introduction to Programming in Java. 3 Hours.
Introduction to programming in Java with emphasis on engineering applications. Programming techniques: data representation and expressions, conditional and iterative statements, arrays, lists, file I/O, methods. Object oriented programming: designing, implementing and using classes, collections and composite objects. Students will gain hands-on programming experience and exposure to classic engineering problem solving techniques. Prerequisite: MATH 24005 or MATH 24004 or MATH 24004, each with a grade of C or higher. (Typically offered: Irregular)

CSCE 21104. Digital Design. 4 Hours.
Introduction to the hardware aspects of digital computers, logic gates, flip-flops, reduction, finite state machines, sequential logic design, digital systems, software design tools, hardware description language (VHDL), and implementation technologies. Corequisite: Lab component. Prerequisite: MATH 24004 or MATH 24004 with a grade of C or better. (Typically offered: Fall and Spring)

CSCE 22104. Computer Organization. 4 Hours.
Presents the relationship between computing hardware and software with a focus on the concepts for current computers. CPU design topics are covered including various techniques for microprocessor design and performance evaluation. Corequisite: Lab component. Prerequisite: CSCE 21104 with a grade of C or better. (Typically offered: Fall and Spring)

CSCE 31903. Programming Paradigms. 3 Hours.
Programming in different paradigms with emphasis on object oriented programming and network programming. Survey of programming languages, event driven programming, and concurrency. Prerequisite: CSCE 20104 or DASC 21003, each with a grade of C or better. (Typically offered: Fall and Spring)

CSCE 319H3. Honors Programming Paradigms. 3 Hours.
Programming in different paradigms with emphasis on object oriented programming and network programming. Survey of programming languages, event driven programming, and concurrency. Prerequisite: Honors standing and (CSCE 20104 or DASC 21003, each with a grade of C or better). (Typically offered: Fall and Spring)

CSCE 35103. Software Engineering. 3 Hours.
A modern approach to the current techniques used in software design and development. This course emphasizes the use of modern software development tools, multi-module programming, and team design and engineering. Prerequisite: CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better. (Typically offered: Fall and Spring)

CSCE 36103. Operating Systems. 3 Hours.
An introduction to operating systems including topics in system structures, process management, storage management, files, distributed systems, and case studies. Prerequisite: CSCE 20104 and CSCE 22104, each with a grade of C or better. (Typically offered: Fall and Spring)

CSCE 361H3. Honors Operating Systems. 3 Hours.
An introduction to operating systems including topics in system structures, process management, storage management, files, distributed systems, and case studies. Prerequisite: CSCE 20104 and CSCE 22104, each with a grade of C or better. (Typically offered: Spring)

CSCE 39503. System Synthesis and Modeling. 3 Hours.
This course instructs the students in the use of modern synthesis and modeling languages and approaches for design automation. This course will teach students the use of HDLs and modeling languages for representing and implementing digital computer systems. Prerequisite: CSCE 22104 with a grade of C or better. (Typically offered: Fall)

CSCE 40103. Special Topics. 3 Hours.
Consideration of computer science topics not covered in other courses. Prerequisite: CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better. (Typically offered: Irregular) May be repeated for up to 12 hours of degree credit.

CSCE 40403. RFID Information Systems Security. 3 Hours.
Radio frequency identification (RFID) information systems provide information to users about objects with RFID tags. They require the application of information systems security (INFOSEC) to protect the information from tampering, unauthorized information disclosure, and denial of service to authorized users. This course addresses security and privacy in an RFID system. Prerequisite: INEG 23104. (Typically offered: Irregular)

CSCE 41104. Embedded Systems. 4 Hours.
The architecture, software, and hardware of embedded systems. Involves a mixture of hardware and software for the control of a system (including electrical, electro-mechanical, and electro-chemical systems). They are found in a variety of products including cars, VCRs, HDTVs, cell phones, pacemakers, spacecraft, missile systems, and robots for factory automation. Corequisite: Lab component. Prerequisite: CSCE 22104 with a grade of C or better. (Typically offered: Fall)

CSCE 41203. Programming Challenges. 3 Hours.
This course studies the principle methods used in the solution of programming contest problems, e.g., data structures strings, sorting, machine arithmetic and algebra, combinatorics, number theory, backtracking, graph traversal, graph algorithms, dynamic programming, grids, and computational geometry. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 41303. Algorithms. 3 Hours.
Provides an introduction to formal techniques for analyzing the complexity of algorithms. The course surveys important classes of algorithms used in computer science and engineering. Prerequisite: (CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better) and (MATH 26103 or MATH 28003). (Typically offered: Fall)

CSCE 41403. Data Mining. 3 Hours.
The course focuses on the principles, theory, design, and implementation of data mining algorithms for large-scale data. Topics include foundations of data mining; preprocessing; mining frequent patterns, associations and correlations; supervised learning including decision tree induction, naïve Bayesian classification, support vector machine, logistic regression, Bayesian network, and K-nearest neighbor learning; unsupervised learning including K-means clustering, hierarchical clustering, density-based clustering, and grid-based clustering; outlier analysis; graph mining; scalable and distributed data mining. Prerequisite: (CSCE 31903 or CSCE 319H3 or DASC 21003) or (CSCE 20104 and INEG 23303 and INEG 23104) or (CSCE 20104 and STAT 30133 and STAT 30043)). (Typically offered: Fall)

CSCE 42103. Computer Architecture. 3 Hours.
The architecture of modern scalar and parallel computing systems. Techniques for dynamic instruction scheduling, branch prediction, instruction level parallelism, shared and distributed memory multiprocessor systems, array processors, and memory hierarchies. Prerequisite: CSCE 22104 with a grade of C or better. (Typically offered: Spring)

CSCE 42303. Low Power Digital Systems. 3 Hours.
The reduction of power consumption is rapidly becoming one of the key issues in digital system design. Traditionally, digital system design has mainly focused on performance and area trade-offs. This course will provide a thorough introduction to digital design for lower consumption at the circuit, logic, and architectural level. Prerequisite: CSCE 22104 with a grade of C or better. (Typically offered: Irregular)

CSCE 42503. Concurrent Computing. 3 Hours.
Programming concurrent processes; computer interconnection network topologies; loosely coupled and tightly coupled paralleled computer architectures; designing algorithms for concurrency; distributed computer architectures. Prerequisite: CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better. (Typically offered: Irregular)

CSCE 42603. Advanced Data Structures. 3 Hours.
This course continues the study of data structures, algorithmic analysis for these data structures, and their efficient implementation to support standard library in programming languages. Topics include: AVL trees, Red-Black trees, Splay trees, Optimal Binary Search trees, 2-3 tree, 2-3-4 tree, B-trees, Segment trees, Leftist Heaps, Binomial Heaps, Fibonacci Heap, Disjoint Set, Hashing, and big integer with hundreds to thousands of digits. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 42703. Big Data Analytics and Management. 3 Hours.
Introduction to tools and techniques for distributed data computing and management, big data analytics, scalable machine learning, and real-time streaming data analysis. Students cannot receive credit for both CSCE 42703 and CSCE 52703. Prerequisite: CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better. (Typically offered: Irregular)

CSCE 43203. Formal Languages and Computability. 3 Hours.
Finite Automata and regular languages, regular expressions, context-free languages and pushdown automata, nondeterminism, grammars, and Turing machines. Church's thesis, halting problem, time complexity, space complexity and undecidability. Prerequisite: (CSCE 31903 or CSCE 319H3, each with a grade of C or better) and (MATH 26103 or MATH 28003). (Typically offered: Spring)

CSCE 43303. Introduction to Integrated Circuit Design. 3 Hours.
Design and layout of large scale digital integrated circuits using CMOS technology. Topics include MOS devices and basic circuits, integrated circuit layout and fabrication, dynamic logic, circuit design and layout strategies for large scale CMOS circuits. Students may not receive credit for both CSCE 43303 and CSCE 52203. Prerequisite: ELEG 32103 or ELEG 39903 and MATH 25804 (Typically offered: Fall)

CSCE 43503. CPLD/FPGA-Based System Design. 3 Hours.
Field Programmable Logic devices (FPGAs/CPLDs) have become extremely popular as basic building blocks for digital systems. They offer a general architecture that users can customize by inducing permanent or reversible physical changes. This course will deal with the implementation of logic options using these devices. Prerequisite: CSCE 22104 with a grade of C or better. (Typically offered: Irregular)

CSCE 43703. Electronic Design Automation. 3 Hours.
This course studies physical design, analysis and optimization of VLSI circuits and systems with emphasis on computational realizations and optimization. We start with some related topics such as graph algorithms and discuss various well-known algorithms and methodologies in the design process of VLSI circuits, including design partitioning, logic synthesis, floorplanning, routing, static timing analysis and performance-driven layout. It requires a basic knowledge of digital circuit design, data structure, and object-oriented programming. Students cannot receive credit for both CSCE 43703 and CSCE 53703. Prerequisite: CSCE 39503 and CSCE 31903, each with a C or higher. (Typically offered: Irregular)

CSCE 44203. Computer Systems Modeling. 3 Hours.
Basic concepts of problem analysis, model design, and simulation experiments. A simulation will be introduced and used in this course. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 44303. Cryptography. 3 Hours.
This course provides a general introduction to modern cryptography. Topics include: stream ciphers, block ciphers, message authentication codes, public key encryption, key exchange, and signature schemes. Prerequisite: (CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better) and (MATH 26103 or MATH 28003). (Typically offered: Irregular)

CSCE 44803. Wearable and Ubiquitous Computing. 3 Hours.
This course will introduce wearable and ubiquitous computing paradigms with emphasis on the engineering and development. Three key themes that will be taught during this course the systems and infrastructures which compose IoT and wearable systems, the devices and techniques for gathering data and communicating with the user, and the applications of these technologies including the user experience. Students cannot receive credit for both CSCE 44803 and CSCE 54803. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 45203. Database Management Systems. 3 Hours.
Introduction to database management systems, architecture, storage structures, indexing, relational data model, E-R diagrams, query languages, SQL, ODBC, transaction management, integrity, and security. Students may not receive credit for both CSCE 45203 and CSCE 55203. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Spring)

CSCE 45403. Software Architecture. 3 Hours.
A study of software architecture through the use of case studies drawn from real systems designed to solve real problems from technical as well as managerial perspectives. Techniques for designing, building, and evaluating software architectures. Prerequisite: CSCE 41303 and CSCE 35103. (Typically offered: Irregular)

CSCE 45503. Information Retrieval. 3 Hours.
The objective of this course is to give students a hands-on introduction to information retrieval systems. Classical textual information retrieval systems are studied, including text preprocessing, file structures, term-weighting schemes, and web search engines. Students may not receive credit for both CSCE 45503 and CSCE 55303. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 45601. Capstone I. 1 Hour.
CSCE students complete a comprehensive software capstone project during their final year of undergraduate studies. The project is done over 2 semesters in phases: concept, formal proposal, implementation, and presentation. The projects include and may require the integration of software and human factors and hardware elements and are developed to software engineering methodologies. Prerequisite: CSCE 35103 and (CSCE 36103 or CSCE 361H3) and completion of 91 credit hours. (Typically offered: Fall)

CSCE 46103. Artificial Intelligence. 3 Hours.
Introduction to intelligent agents, AI languages, search, first order logic, knowledge representation, ontologies, problem solving, natural language processing, machine vision, machine learning, and robotics. Prerequisite: CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better. (Typically offered: Irregular)

CSCE 46203. Mobile Programming. 3 Hours.
An introduction to software development on mobile devices. The major topics covered in this course include underlying concepts and principles in mobile programming, as well as hands-on programming experience on mobile devices with an emphasis on smartphones. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 46403. Graphics Processing Units Programming. 3 Hours.
This course provides an introduction to massively parallel programming using Graphics Processing Units (GPUs). Topics include basic programming model, GPU thread hierarchy, GPU memory architecture, and performance optimization techniques and parallel patterns needed to develop real-life applications. Prerequisite: CSCE 20104 with a grade of C or better. (Typically offered: Irregular)

CSCE 47503. Computer Networks. 3 Hours.
This course is an introductory course on computer networks. Using the Internet as a vehicle, this course introduces underlying concepts and principles of modern computer networks, with emphasis on protocols, architectures, and implementation issues. Students cannot receive graduate credit for CSCE 47503. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 47803. Cloud Computing and Security. 3 Hours.
Cloud computing has entered the mainstream of information technology, providing highly elastic scalability in delivery of enterprise applications and services. In this course, we will focus on the architecture of today's cloud computing, the technologies used within them, application development using contemporary cloud computing tools, and the security risks and management in the cloud. Students cannot receive credit for both CSCE 47803 and CSCE 57803. Prerequisite: CSCE 36103 or CSCE 361H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 48103. Computer Graphics. 3 Hours.
Introduction to the theory and algorithms used in computer graphics systems and applications. Topics include: 2D and 3D geometric models (points, lines, polygons, surfaces), affine transformations (rotation, translation, scaling), viewpoint calculation (clipping, projection), lighting models (light-material interactions, illumination and shadow calculation). Students will implement their own graphics pipeline to demonstrate many of these techniques. Higher level computer graphics applications will be created using OpenGL. Prerequisite: CSCE 31903 or CSCE 319H3, each with a grade of C or better. (Typically offered: Irregular)

CSCE 48503. Information Security. 3 Hours.
This course covers principles, mechanisms, and policies governing confidentiality, integrity, and availability of digital information. Topics to be covered include security concepts and mechanisms, security policies, multilevel security models, system vulnerability, threat and risk assessment, basic cryptography and its applications, intrusion detection systems. Prerequisite: CSCE 31903 or CSCE 319H3 or DASC 21003, each with a grade of C or better. (Typically offered: Irregular)

CSCE 4900V. Individual Study. 1-6 Hour.
Individual study directed by faculty in current research topics, state of the art, or advanced methodology in one of the major computer science or computer engineering areas. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.

CSCE 49104. Advanced Digital Design. 4 Hours.
To master advanced logic design concepts, including the design and testing of synchronous and asynchronous combinational and sequential circuits using state of the art CAD tools. Corequisite: Lab component. Prerequisite: CSCE 21104 or ELEG 29004. (Typically offered: Irregular)

CSCE 491HV. Honors Thesis. 1-3 Hour.
To provide honors students with experience in presenting their research accomplishments to their peers and faculty. Prerequisite: Honors standing. (Typically offered: Fall and Spring) May be repeated for up to 3 hours of degree credit.

CSCE 49603. Capstone II. 3 Hours.
CSCE students complete a comprehensive capstone project during their final year of undergraduate studies. The project is done over two consecutive semesters in phases: concepts, formal proposal, implementation, and presentation. The projects include and may require the integration of software, human factors, and hardware elements and are developed using software engineering methodologies. Prerequisite: CSCE 45601. (Typically offered: Spring)

Electrical Engineering Courses

ELEG 21001. Electric Circuits I Laboratory. 1 Hour.
Experimental investigation of the steady-state behavior of resistive circuits excited by DC sources and transient behavior of simple R, L, and C circuits. Topics include fundamental laws of circuit theory applied to resistive networks and time response functions of R-L and R-C circuits. Corequisite: ELEG 21003. (Typically offered: Fall and Summer)

ELEG 21003. Electric Circuits I. 3 Hours.
Introduction to circuit variables, elements, and simple resistive circuits. Analysis techniques applied to resistive circuits. The concept of inductance, capacitance and mutual inductance. The natural and step responses of RL, RC, and RLC circuits. Corequisite: ELEG 21001. Pre- or Corequisite: (MATH 25004 or MATH 25004) and PHYS 20404. Prerequisite: PHYS 20304. (Typically offered: Fall and Summer)

ELEG 21101. Electric Circuits II Laboratory. 1 Hour.
Experimental investigation of the steady-state behavior of circuits excited by sinusoidal sources. Topics include complex power, three-phase circuits, transformers, and resonance. Corequisite: ELEG 21103. (Typically offered: Spring and Summer)

ELEG 21103. Electric Circuits II. 3 Hours.
Introduction to complex numbers. Sinusoidal steady-state analysis of electric circuits, active, reactive, apparent and complex power; balanced and unbalanced three-phase circuits; mutual inductance; the use of the Laplace transform for electric circuit analysis and two-port networks. Corequisite: ELEG 21101. Pre- or Corequisite: MATH 25804. Prerequisite: ELEG 21003, ELEG 21001 and PHYS 20404. (Typically offered: Spring and Summer)

ELEG 2870V. Special Topics in Electrical Engineering. 1-4 Hour.
Consideration of current electrical engineering topics not covered in other courses. (Typically offered: Irregular) May be repeated for up to 4 hours of degree credit.

ELEG 29004. Digital Design. 4 Hours.
To introduce students to modern logic concepts, problem solving and design principles, and vocabulary and philosophy of the digital world. Corequisite: Lab component. Prerequisite: Engineering major. (Typically offered: Fall)

ELEG 31204. System & Signal Analysis. 4 Hours.
Definition and description of signals and systems; analog, digital, continuous- and discrete-time and frequency analysis of systems, Z- and Fourier Transforms, sampling and signal reconstruction, filter design and engineering applications. Pre- or Corequisite: MATH 25804. Corequisite: Lab component. Prerequisite: ELEG 21003 or ELEG 39003 or BMEG 29004. (Typically offered: Fall)

ELEG 312H4. Honors System & Signal Analysis. 4 Hours.
Definition and description of signals and systems; analog, digital, continuous- and discrete-time and frequency analysis of systems, Z- and Fourier Transforms, sampling and signal reconstruction, filter design and engineering applications. Pre- or Corequisite: MATH 25804. Corequisite: Lab component. Prerequisite: ELEG 21003 or ELEG 39003 or BMEG 29004. (Typically offered: Fall)

ELEG 31403. Probability & Stochastic Processes. 3 Hours.
Review of system analysis, probability, random variables, stochastic processes, auto correlation, power spectral density, systems with random inputs in the time and frequency domain, and applications. Prerequisite: ELEG 31204. Pre- or Corequisite: MATH 26004. (Typically offered: Spring)

ELEG 314H3. Honors Probability & Stochastic Processes. 3 Hours.
Review of system analysis, probability, random variables, stochastic processes, auto correlation, power spectral density, systems with random inputs in the time and frequency domain, and applications. Pre- or Corequisite: ELEG 31204. (Typically offered: Spring)

ELEG 32101. Electronics I Laboratory. 1 Hour.
Experimental investigation into electronic circuit analysis concepts. Topics include: diode behavior and applications, zener diode regulator design, bipolar junction transistor biasing, BJT common-emitter amplifier design, and operational amplifier fundamentals. Corequisite: ELEG 32103. (Typically offered: Fall and Spring)

ELEG 32103. Electronics I. 3 Hours.
Introduction to electronic systems and signal processing, operational amplifiers, diodes, non-linear circuit applications, MOSFETS, and BJTs. Course has a lab component. Pre- or Corequisite: MATH 26004 and ELEG 21103. Corequisite: ELEG 32101. Prerequisite: MATH 25804. (Typically offered: Fall and Spring)

ELEG 321H1. Honors Electronics I Laboratory. 1 Hour.
Experimental investigation into electronic circuit analysis concepts. Topics include: diode behavior and applications, zener diode regulator design, bipolar junction transistor biasing, BJT common-emitter amplifier design, and operational amplifier fundamentals. Corequisite: ELEG 321H3. Prerequisite: Honors standing. (Typically offered: Fall and Spring)

ELEG 321H3. Honors Electronics I. 3 Hours.
Introduction to electronic systems and signal processing, operational amplifiers, diodes, non-linear circuit applications, MOSFETS, and BJTs. Pre- or Corequisite: MATH 26004 and ELEG 21103. Corequisite: ELEG 321H1. Prerequisite: Honors standing and PHYS 20404. (Typically offered: Fall and Spring)

ELEG 32201. Electronics II Laboratory. 1 Hour.
Selected experiments to illustrate and complement topics covered in companion course ELEG 32203 - Electronics II Laboratory. Corequisite: ELEG 32203. (Typically offered: Spring)

ELEG 32203. Electronics II. 3 Hours.
Differential pair amplifier, current mirrors, active loads, multistage amplifiers, amplifier frequency response, bode plots, Millers theorem, short circuit and open circuit time constant methods, feedback amplifiers, and stability of feedback amplifiers. Corequisite: ELEG 32201. Prerequisite: ELEG 32103 and ELEG 21103. (Typically offered: Spring)

ELEG 322H1. Honors Electronics II Laboratory. 1 Hour.
Selected experiments to illustrate and complement topics covered in companion course ELEG 32203 - Electronics II Laboratory. Corequisite: ELEG 322H3. Prerequisite: Honors standing. (Typically offered: Spring)

ELEG 322H3. Honors Electronics II. 3 Hours.
Differential pair amplifier, current mirrors, active loads, multistage amplifiers, amplifier frequency response, bode plots, Millers theorem, short circuit and open circuit time constant methods, feedback amplifiers, and stability of feedback amplifiers. Corequisite: ELEG 322H1. Prerequisite: Honors standing, ELEG 32103 and MATH 25804. (Typically offered: Spring)

ELEG 33004. Energy Systems. 4 Hours.
Steady state analysis of DC machines, transformers, induction machines and synchronous machines. Introduction to speed control of electric machines using power electronics. Corequisite: Lab component. Prerequisite: ELEG 21103. (Typically offered: Spring)

ELEG 330H4. Honors Energy Systems. 4 Hours.
Steady state analysis of DC machines, transformers, induction machines and synchronous machines. Introduction to speed control of electric machines using power electronics. Corequisite: Lab component. Prerequisite: ELEG 21103. (Typically offered: Spring)

ELEG 37004. Applied Electromagnetics. 4 Hours.
Analysis of transmission lines with sinusoidal and transient excitation. Development and use of the Smith Chart and methods of impedance matching. Vector analysis, static form of Maxwell's equations, electrostatics, and magnetostatics. Corequisite: Lab component. Pre- or Corequisite: PHYS 20404. Prerequisite: ELEG 21103 and MATH 26004. (Typically offered: Fall)

ELEG 370H4. Honors Applied Electromagnetics. 4 Hours.
Analysis of transmission lines with sinusoidal and transient excitation. Development and use of the Smith Chart and methods of impedance matching. Vector analysis, static form of Maxwell's equations, electrostatics, and magnetostatics. Corequisite: Lab component. Pre- or Corequisite: PHYS 20404 and MATH 26004. Prerequisite: ELEG 21103. (Typically offered: Fall)

ELEG 3870V. Special Topics in Electrical Engineering. 1-4 Hour.
Consideration of current electrical engineering topics not covered in other courses. (Typically offered: Irregular) May be repeated for up to 9 hours of degree credit.

ELEG 39003. Electric Circuits and Machines. 3 Hours.
Basic electrical principles and circuits; Introduction to sinusoidal steady-state analysis of electric circuits, active, reactive, and complex power; balanced three-phase circuits; Steady-state analysis of electric machines and transformers. Introduction to power electronics for machine speed control and alternative energy sources. For engineering students other than those in electrical engineering. Prerequisite: MATH 25004 and PHYS 20404. (Typically offered: Fall and Spring)

ELEG 39204. Microprocessor Systems Design. 4 Hours.
Introduction to 8-bit microprocessors and their application. Microprocessor architecture and assembly language; interface devices; system design using microprocessors. Corequisite: Lab component. Pre- or Corequisite: ELEG 29004. (Typically offered: Fall)

ELEG 392H4. Honors Microprocessor Systems Design. 4 Hours.
Introduction to 8-bit microprocessors and their application. Microprocessor architecture and assembly language; interface devices; system design using microprocessors. Corequisite: Lab component. Prerequisite: ELEG 29004. (Typically offered: Fall)

ELEG 39903. Circuits & Electronics. 3 Hours.
Basic principles of electric and electronic circuits and devices. For engineering students who are not pursuing a degree in electrical engineering. Prerequisite: MATH 25804 and PHYS 20404. (Typically offered: Spring)

ELEG 400HV. Honors Senior Thesis. 1-3 Hour.
Honors senior thesis. Prerequisite: Senior standing. (Typically offered: Fall, Spring and Summer)

ELEG 40603. Electrical Engineering Design I. 3 Hours.
Capstone design and application in electrical engineering. Prerequisite: ELEG 32203 and ELEG 39204. (Typically offered: Fall and Spring)

ELEG 406H3. Honors Electrical Engineering Design I. 3 Hours.
Design and application in electrical engineering. Prerequisite: ELEG 32203 and ELEG 39204. (Typically offered: Fall and Spring)

ELEG 40701. Electrical Engineering Design II. 1 Hour.
Design and application in electrical engineering. Prerequisite: ELEG 40603. (Typically offered: Fall and Spring)

ELEG 407H1. Honors Electrical Engineering Design II. 1 Hour.
Design and application in electrical engineering. Prerequisite: ELEG 40603. (Typically offered: Fall and Spring)

ELEG 42003. Semiconductor Devices. 3 Hours.
Crystal properties and growth of semiconductors, energy bands and charge carriers in semiconductors, excess carriers in semiconductors, analysis and design of p/n junctions, analysis and design of bipolar junction transistors, and analysis and design of field-effect transistors. Students may not receive credit for both ELEG 42003 and ELEG 52003. Prerequisite: MATH 25804 and ELEG 32103, or graduate standing. (Typically offered: Irregular)

ELEG 420H3. Honors Semiconductor Devices. 3 Hours.
Crystal properties and growth of semiconductors, energy bands and charge carriers in semiconductors, excess carriers in semiconductors, analysis and design of p/n junctions, analysis and design of bipolar junction transistors, and analysis and design of field-effect transistors. Students may not receive credit for both ELEG 42003 and ELEG 52003. Prerequisite: MATH 25804 and ELEG 32103, or graduate standing. (Typically offered: Irregular)

ELEG 42303. Introduction to Integrated Circuit Design. 3 Hours.
Design and layout of large scale digital integrated circuits using CMOS technology. Topics include MOS devices and basic circuits, integrated circuit layout and fabrication, dynamic logic, circuit design, and layout strategies for large scale CMOS circuits. Students may not receive credit for both ELEG 42303 and ELEG 59203. Prerequisite: ELEG 32103 or ELEG 39903 and ELEG 29004 or equivalent. (Typically offered: Fall)

ELEG 42403. Analog Integrated Circuits. 3 Hours.
Theory and design techniques for linear and analog integrated circuits. Current mirrors, voltage to base emitter matching, active loads, compensation, level shifting, amplifier design techniques, circuit simulation using computer-assisted design programs. Prerequisite: ELEG 32203. (Typically offered: Irregular)

ELEG 42503. Integrated Circuit Design Lab I. 3 Hours.
This course will cover digital VLSI design and integrated circuit design tools. The course is structured with lectures. This course is offered to both senior undergraduate and graduate students. Students cannot get credit for both the undergraduate and graduate version of the course. Students cannot receive credit for both ELEG 42503 and ELEG 52503. Prerequisite: ELEG 42303 or ELEG 59203. (Typically offered: Spring)

ELEG 42803. Mixed Signal Test Engineering I. 3 Hours.
Overview of mixed signal testing, the test specification process, DC and parametric measurements, measurement accuracy, tester hardware, sampling theory, DSP-based testing, analog channel testing, digital channel testing. Prerequisite: Senior or graduate standing. (Typically offered: Irregular)

ELEG 43003. Introduction to Nanomaterials and Devices. 3 Hours.
This course provides the students with an introduction to nanomaterials and devices. The students will be introduced to the quantization of energy levels in nanomaterials, growth of nanomaterials, electrical and optical properties, and devices based on these nanomaterials, such as tunneling resonant diodes, transistors, detector, and emitters. Graduate students will be given additional or different assignments. Graduate students will be expected to explore and demonstrate an understanding of the material with a greater level of depth and breadth than the undergraduates. Each group of students will have different expectations and grading systems. The instructor will prepare and distribute two distinct syllabi. Corequisite: ELEG 42003. Prerequisite: ELEG 32103 and PHYS 20404. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.

ELEG 44003. Control Systems. 3 Hours.
Mathematical modeling of dynamic systems, stability analysis, control system architectures and sensor technologies. Time-domain and frequency-domain design of feedback control systems: lead, lag, PID compensators. Special topics in microprocessor implementation. Students may not receive credit for both ELEG 44003 and ELEG 54003. Prerequisite: ELEG 31204. (Typically offered: Irregular)

ELEG 440H3. Honors Control Systems. 3 Hours.
Mathematical modeling of dynamic systems, stability analysis, control system architectures and sensor technologies. Time-domain and frequency-domain design of feedback control systems: lead, lag, PID compensators. Special topics in microprocessor implementation. Students may not receive credit for both ELEG 44003 and ELEG 54003. Prerequisite: ELEG 31204. (Typically offered: Irregular)

ELEG 44103. Advanced Control Systems. 3 Hours.
A second course in linear control systems. Emphasis on multiple-input and multiple-output systems: State-space analysis, similarity transformations, eigenvalue and eigenvector decomposition, stability in the sense of Lyapunov, controllability and observability, pole placement, quadratic optimization. Students may not receive credit for both ELEG 44103 and ELEG 54103. Prerequisite: ELEG 44003 or equivalent course. (Typically offered: Irregular)

ELEG 44203. Optimal Control. 3 Hours.
Introductory theory of optimizing dynamic systems: Formulation of performance objectives; calculus of variations; linear quadratic optimal control; discrete-time optimization; robustness and frequency domain techniques; reinforcement learning and optimal adaptive control. Prerequisite: ELEG 44003. (Typically offered: Irregular)

ELEG 44603. Control Systems Laboratory. 3 Hours.
Experimental study of various control systems and components. The use of programmable logic controllers in the measurement of systems parameters, ladder-logic applications, process-control applications, and electromechanical systems. Prerequisite: ELEG 39204 and ELEG 31204. (Typically offered: Irregular)

ELEG 45003. Design of Advanced Electric Power Distribution Systems. 3 Hours.
Design considerations of electric power distribution systems, including distribution transformer usage, distribution system protection implementation, primary and secondary networks design, applications of advanced equipment based on power electronics, and use of capacitors and voltage regulation. Students may not receive credit for both ELEG 45003 and ELEG 55003. Prerequisite: ELEG 33004. (Typically offered: Irregular)

ELEG 45103. Power and Energy Systems Analysis. 3 Hours.
Modeling and analysis of electric power systems: Energy sources and conversion; load flow analysis; reference frame transformations; symmetrical and unsymmetrical fault conditions; load forecasting and economic dispatch. Students may not receive credit for both ELEG 45103 and ELEG 55103. Prerequisite: ELEG 21103. (Typically offered: Irregular)

ELEG 45303. Power Electronics and Motor Drives. 3 Hours.
Characteristics of Insulated Gate Bipolar Transistors (IGBTs), Silicon Carbide (SiC) MOSFETs, Gallium Nitride (GaN) devices, Design of driver and snubber circuits for IGBTs and SiC MOSFETs, and an introduction to electric motor drives. Students may not receive credit for both ELEG 45303 and ELEG 55303. Prerequisite: ELEG 33004 and ELEG 32203. (Typically offered: Irregular)

ELEG 45403. Introduction to Power Electronics. 3 Hours.
Presents basics of emerging areas in power electronics and a broad range of topics such as power switching devices, electric power conversion techniques and analysis, as well as their applications. Students may not receive credit for both ELEG 55403 and ELEG 45403. Prerequisite: ELEG 21103 and ELEG 32103. (Typically offered: Irregular)

ELEG 45503. Switch Mode Power Conversion. 3 Hours.
Basic switching converter topologies: buck, boost, buck-boost, Cuk, flyback, resonant; pulse-width modulation; integrated circuit controllers; switching converter design case studies; SPICE analyses of switching converters; state-space averaging and linearization; and switching converter transfer functions. Prerequisite: ELEG 32203 and ELEG 31204. (Typically offered: Irregular)

ELEG 45603. EMI in Power Electronics Converters: Generation, Propagation and Mitigation. 3 Hours.
Concepts of electro-magnetic-interference issues in power electronics converters. Basic concepts of EMI measurement, modeling and mitigation, with a focus on conducted EMI in power electronics converters. The course is structured with lectures and a lab session. Students can not receive credit for both ELEG 45603 and ELEG 55603. Prerequisite: ELEG 21003 or equivalent and MATH 26004. (Typically offered: Irregular)

ELEG 45803. Programming for Power Electronics: DSPs. 3 Hours.
This course will focus on the development of both theoretical and practical skills needed to design and implement controls for power electronic systems using a Digital Signal Processors (DSPs). The course is structured with lectures and utilizes a project-based approach. Students cannot receive credit for both ELEG 55803 and ELEG 45803. Prerequisite: Senior standing, ELEG 29004, ELEG 39204, and CSCE 20004. (Typically offered: Spring)

ELEG 45903. Programming for Power Electronics: FPGA. 3 Hours.
This course will focus on the development of both theoretical and practical skills needed to design and implement controls for power electronic system using Field Programmable Gate Arrays (FPGAs). The course is structured with lectures and utilizes a project-based approach. Students cannot receive credit for both ELEG 55903 and ELEG 45903. Prerequisite: Senior standing, ELEG 29004, ELEG 39204 and CSCE 20004. (Typically offered: Spring)

ELEG 46003. Deterministic Digital Signal Processing System Design. 3 Hours.
Design of Digital Signal Processing systems with deterministic inputs. Sampling, quantisizing, oversampling, ADC trade-offs, distortion, equalizers, anti-aliasing, coherency, frequency domain design, audio and video compression. Prerequisite: ELEG 31204. (Typically offered: Irregular)

ELEG 46203. Communication Systems. 3 Hours.
Various modulation systems used in communications. AM and FM fundamentals, pulse modulation, signal to noise ratio, threshold in FM, the phase locked loop, matched filter detection, probability of error in PSK, FKS, and DPSK. The effects of quantization and thermal noise in digital systems. Information theory and coding. Students may not receive credit for both ELEG 46203 and ELEG 56603. Pre- or Corequisite: ELEG 31403. (Typically offered: Irregular)

ELEG 47003. Introduction to RF and Microwave Design. 3 Hours.
An introduction to microwave design principles. Transmission lines, passive devices, networks, impedance matching, filters, dividers, and hybrids will be discussed in detail. Active microwave devices will also be introduced. In addition, the applications of this technology as it relates to radar and communications systems will be reviewed. Prerequisite: ELEG 37004. (Typically offered: Irregular)

ELEG 47803. Introduction to Antennas. 3 Hours.
Basic antenna types: small dipoles, half wave dipoles, image theory, monopoles, small loop antennas. Antenna arrays: array factor, uniformly excited equally spaced arrays, pattern multiplication principles, nonuniformly excited arrays, phased arrays. Use of MATLAB programming and mathematical techniques for antenna analysis and design. Emphasis will be on using simulation to visualize variety of antenna radiation patterns. Corequisite: Drill component. Prerequisite: ELEG 37004. (Typically offered: Irregular)

ELEG 478H3. Honors Introduction to Antennas. 3 Hours.
Basic antenna types: small dipoles, half wave dipoles, image theory, monopoles, small loop antennas. Antenna arrays: array factor, uniformly excited equally spaced arrays, pattern multiplication principles, nonuniformly excited arrays, phased arrays. Use of MATLAB programming and mathematical techniques for antenna analysis and design. Emphasis will be on using simulation to visualize variety of antenna radiation patterns. Corequisite: Drill component. Prerequisite: ELEG 37004. (Typically offered: Irregular)

ELEG 4870V. Special Topics in Electrical Engineering. 1-3 Hour.
Consideration of current electrical engineering topics not covered in other courses. Prerequisite: Senior standing. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.

ELEG 4880V. Special Problems. 1-3 Hour.
Individual study and research on a topic mutually agreeable to the student and a faculty member. Prerequisite: Senior standing. (Typically offered: Fall, Spring and Summer) May be repeated for up to 6 hours of degree credit.

ELEG 49603. CPLD/FPGA Based System Design. 3 Hours.
Field Programmable logic devices (FPGAs/CPLDs) have become extremely popular as basic building blocks for digital systems. They offer a general architecture that users can customize by inducing permanent or reversible physical changes. This course will deal with the implementation of logic options using these devices. Corequisite: Lab component. Prerequisite: CSCE 21104 with "C" grade or higher. (Typically offered: Irregular)

ELEG 49803. Computer Architecture. 3 Hours.
Design of a single board computer including basic computer organization, memory subsystem design, peripheral interfacing, DMA control, interrupt control, and bus organization. Prerequisite: ELEG 39204. (Typically offered: Irregular)