

# CSCE Undergraduate Handbook 2016-2017

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# Contents

<b>CSCE Department Information .....</b>	<b>3</b>
CSCE Majors:.....	3
Computer Engineering – Bachelor of Science.....	3
Computer Science – Bachelor of Science .....	3
Computer Science – Bachelor of Arts.....	3
<b>Degree Requirement Information .....</b>	<b>3</b>
CSCE Electives.....	3
Humanities/Social Science Electives.....	4
<i>CSCE Basic Science Electives</i> .....	5
<i>Free Electives</i> .....	5
AP Credit and Exemptions.....	5
CSCE Honors Program.....	6
Freshman Engineering.....	6
Degree Program Changes:.....	6
Transfer Students.....	7
<b>Academic Advising .....</b>	<b>7</b>
<i>How Advising Works:</i> .....	7
<i>How to Get Advised:</i> .....	7
<i>Changing Majors:</i> .....	7
<i>Math Minor requirements:</i> .....	8
<b>Additional Bachelor's Degree .....</b>	<b>8</b>
<b>Accelerated M.S. Degree .....</b>	<b>8</b>
<b>Eight Semester Degree Plans .....</b>	<b>9</b>
<i>Computer Engineering 8 Semester Plan – 2016-2017</i> .....	9
<i>Computer Science 8 Semester Plan – 2016-2017</i> .....	10
<i>Computer Science BA 8 Semester Plan – 2016-2017</i> .....	11
<b>Flowcharts .....</b>	<b>12</b>
<i>Computer Engineering Bachelor of Science – Fall 2016</i> .....	12
<i>Computer Science Bachelor of Science – Fall 2016</i> .....	13
<i>Computer Science Bachelor of Arts – Fall 2016</i> .....	14
<b>Degree Audits .....</b>	<b>15</b>
<i>Computer Engineering</i> .....	15
<i>Computer Science Bachelor of Science</i> .....	16
<i>Computer Science Bachelor of Arts</i> .....	17
<b>Graduation Requirements.....</b>	<b>18</b>
<b>Application for Graduation.....</b>	<b>18</b>
<b>Faculty and Areas of Research.....</b>	<b>19</b>

## CSCE Department Information

### **CSCE Majors:**

The department offers the following undergraduate degrees:

- Bachelor of Science in Computer Engineering
- Bachelor of Science in Computer Science
- Bachelor of Arts in Computer Science

### **Computer Engineering – Bachelor of Science**

Computer Engineers engage in the design of embedded systems such as cell phones, avionics, communications networks, and digital radios, through Internet computing systems such as set top gaming boxes, and to more general purpose systems such as desktop and laptop computers, and next generation supercomputers. The Bachelor of Science in Computer Engineering provides a solid foundation in topics across the hardware-software boundary ranging from physical component structures to operating systems and programming languages to provide students with the ability to integrate physical and abstract components into working systems. Computer Engineering graduates find employment nationally with companies such as Intel, Lockheed Martin, and regionally with companies such as Texas Instruments and McDonnell Douglas.

### **Computer Science – Bachelor of Science**

Computer Scientists seek approaches and methods to efficiently automate every day jobs, create and interpret new information, and seek new applications for technology to enhance the human experience. The Bachelor of Science in Computer Science prepares students through a solid core of study in the theoretical foundations of information and computation, as well as the practical techniques for implementing applications in a wide variety of computer systems. The Computer Science degree provides the flexibility to allow students to combine their skills with a wide variety of interdisciplinary interests in other fields, such as computational biology, chemistry, and art. Computer Science graduates find employment with national companies such as Google, Microsoft, and Amazon, and with regional companies such as Acxiom, ConocoPhillips, J.B. Hunt and Wal-Mart.

### **Computer Science – Bachelor of Arts**

The Bachelor of Arts in Computer Science combines a solid core of Computer Science courses with the ability to gain knowledge in other subjects. In addition, there are numerous choices in the curriculum for science and humanities courses. Since computing is a discipline with strong links to many fields, this provides students with unparalleled flexibility to pursue other interests.

## Degree Requirement Information

### **CSCE Electives**

The B.S. degrees in both computer engineering and computer science require **four** CSCE Electives. Both degrees require the electives be chosen from any CSCE 4000+ course not required for the degree except for CSCE 490V, Individual Study. In addition, **Computer Engineering** students can

choose to take ELEG 3923 Microprocessor System Design to count towards the CSCE Elective requirement.

**Computer Engineering** – may take **one** STEM elective from the following list for a CSCE Elective:

STEM Elective

MATH 4363 Numerical Analysis  
MATH 4353 Numerical Linear Algebra  
MATH 4253 Symbolic Logic I  
MATH 4163 Dynamic Models in Biology  
MEEG 4253 Introduction to Robotics  
GEOS 4413 Principles of Remote Sensing  
GEOS 4523 Computer Mapping  
GEOS 4553 Introduction to Raster GIS  
GEOS 4583 Vector GIS  
GEOS 4593 Introduction to Global Positioning Systems  
GEOS 4653 Advanced Raster GIS  
INEG 4343 Cognitive Ergonomics  
INEG 4563 Application of Robotics  
BIOL 4233H Honors Genomics and Bioinformatics

**Computer Science** - may take **one** of the Professional electives listed below **OR one** of the Stem electives listed above for a CSCE Elective:

Professional elective

GNEG 4103 Globalization and Innovation  
ISYS 4453 Introduction to Enterprise Servers  
ISYS 4463 Enterprise Transaction Systems  
MGMT 3933 Entrepreneurship and New Venture Development  
MGMT 4253 Leadership  
MGMT 4433 Small Enterprise Management  
MGMT 4993 Entrepreneurship Practicum

If a student wishes to take a STEM or Professional elective not on the approved list, the student must petition the Undergraduate Curriculum Committee for approval ***prior*** to enrolling in the class. The petition form must be submitted electronically with supporting documents to [srh@uark.edu](mailto:srh@uark.edu).

Computer Science B.A. students can choose from any CSCE 3000-level+ course not required for the degree with the exception of CSCE 490V.

***Humanities/Social Science Electives***

All students at the University of Arkansas-Fayetteville are required to meet the University Core (State Minimum Core). If the core is not met, it will affect graduation.

All **CENG and CS** (B.S. and B.A.) students are required to take:

A) 3 hours of Fine Arts from the following courses:

Fine Arts – ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, DRAM 1003, LARC 1003, MLIT 1003

B) 3 hours of humanities - PHIL 3103 Ethics and the Professions (required course)

- **3 hours** U.S. History or Government

Choose one of the following:

HIST 2003, HIST 2013, PLSC 2003

- **9 hours** of Social Science

Courses must be taken from at *least two different* departments:

AGEC 1103, AGEC 2103

ANTH 1023

ECON 2013, ECON 2023, ECON 2143

GEOG 1123, GEOG 2003

HESC 1403, HESC 2413

HIST 1113, HIST 1123, HIST 2003\*, HIST 2013\*

HUMN 1114H, HUMN 2114H

PLSC 2003\*, PLSC 2013, PLSC 2203

PSYC 2003

RESM 2853

RSOC 2603

SOCI 2013, SOCI 2033

*\*If not selected to meet the History/Government elective*

### **CSCE Basic Science Electives**

Approved courses with lab - ASTR 2003/2001L Survey of the Universe; BIOL 1543/1541L Principles of Biology; ENSC 1003/1001L Environmental Science; GEOL 1113/1111L General Geology; BIOL 1603/1601 Principles of Zoology; BIOL 2213/2211L Human Physiology; CHEM 1133/1131L University Chemistry II for Engineers; PHYS 3544 Optics, PHYS 3613 Modern Physics

### **Free Electives**

Free electives can be chosen from any area but cannot be remedial courses. Courses that will not count are ANTH 0003, PHSC 0003, ENGL 0003, MATH 0003, CIED 0003, MATH 1203, MATH 1213, MATH 1285 and PHYS 2013/2011L College Physics.

### **AP Credit and Exemptions**

Students who have taken the AP Computer Science A exam and received a score of 5 will receive credit for CSCE 2004. Students who received a 3 or 4 will have to pass a test with a B or better to receive full credit for CSCE 2004.

Students who receive exemptions for ENGL 1013 and/or ENGL 1023 will not be required to take those courses but will have to take courses to replace the hour requirements.

### ***CSCE Honors Program***

Admission requirements for the Honors Program are as follows: entering freshman must have at least a 3.5 high school GPA and at least 28 composite score on the ACT; entering transfer students must have a 3.25 GPA on their transfer work. Students who do not qualify initially for the Honors Program are eligible after one year if they earn at least a 3.25 GPA.

Application for the Honors Program must be made through the Engineering Academic Dean's office in Bell 3189.

The department considers the following requirements necessary to graduate with honors:

- The candidate must satisfy the requirements set forth by the College of Engineering.
- A student must obtain at least a 3.5 grade-point average in required Computer Engineering and/or Computer Science courses.
- The student must complete a total of 12 hours of honors credit. Six hours of Honors credit must be in the major, including 3 hours of Honors Thesis taken as CSCE 491VH and 3 hours of non-thesis class work (courses with honors designation or 5000 level).

Guidelines for completion of the honors program and required forms for submission of thesis and verification for degree completion can be found on the College of Engineering website.

### ***Freshman Engineering***

The Freshman Engineering Program was developed to help incoming freshmen decide on engineering majors, develop and practice good study habits and, in general, prepare the incoming students for the rigors of college and the university program. All freshmen entering the College of Engineering must enroll in the Freshman Engineering Program.

### ***Degree Program Changes:***

Students must meet all requirements of their degree program and are expected to keep informed concerning current regulations, policies, and program requirements in their field of study. It is the responsibility of the student to ensure all degree requirements are met before graduation.

Changes made in curriculum at a level beyond that at which a student is enrolled **might become graduation requirements**. Changes made in the curriculum at a lower level than the one at which a student is enrolled are not required for that student. Students should consult their faculty advisor for additional information.

Students reinstated after a period of absence without continuous enrollment must meet the curriculum requirements of the catalog in effect at the time of reinstatement.

## ***Transfer Students***

Transfer students may be directed to Freshman Engineering if participation in the program would enhance progress towards their degree. However, transfer students with 24 credit hours or more are not required to enter the Freshman Engineering Program. The two courses that are required for FEP (GNEG 1111 and GNEG 1121) would be replaced with two hours of STEM electives.

## **Academic Advising**

Students are assigned a CSCE faculty advisor their first semester of enrollment in a CSCE degree program. Typically, this advisor will remain with the student throughout their academic career. Students can find the name of their faculty advisor in the UAConnect system in their student account.

### **How Advising Works:**

Priority registrations are held in the fall and spring semesters, allowing a currently enrolled student to register for classes prior to new students entering the university. Students are ***strongly encouraged*** to register during these periods because certain classes tend to fill up quickly and seating may be limited or low enrollments could mean that classes get cancelled.

Students must see their advisor prior to any registration period to review the degree progress, course plans, answer questions, and get assistance with academic problems. Advising periods are scheduled two weeks before Priority Registration begins.

### **How to Get Advised:**

Step 1:

Students have access to degree audits in UAConnect through their student account. Students should review the degree audit and plan their schedule before meeting with their advisor.

Step 2:

Students should schedule an appointment with their faculty advisor during their advertised times. Advisors will contact advisees about appointment periods. The advisor will review the course plan and verify that prerequisites have been met. The faculty advisor will remove the advising hold at the end of the appointment.

This is also a good opportunity to talk about career plans, co-ops, and other academic issues.

### **Changing Majors:**

Students wanting to switch from *CS to CE* or *CE to CS* should discuss this first with their faculty advisor. The first two semesters of study are identical, so the transfer at that point is easy. There are minor differences in the third and fourth semester that still allow for change. After the fifth and sixth semester there are differences that might create some issues (such as having to take more coursework).

Completion of the forms to process the change of major should be done in the Academic Student Office in Bell Engineering room 3189.

**Math Minor requirements:**

MATH 2564 Calculus II and

MATH 2603 Discrete Mathematics or MATH 2803 Introduction to Mathematical Proof

Plus 3 courses selected from the following:

MATH 2574 Calculus III

MATH 2584 Differential Equations and Laplace Transform

Any MATH or STAT courses at the 3000-level or higher

To declare a Math minor, go to the College of Engineering Dean's office in Bell Engineering, room 3189 to complete the paperwork.

**Additional Bachelor's Degree**

A person with a bachelor's degree from the University of Arkansas, or from any other institution, may not receive another bachelor's degree without completing at least 30 hours of additional, not necessarily subsequent, courses selected from the courses leading to a degree for which the person is a candidate.

More than 30 hours of course work may be required. In addition to the college or school requirements, the candidate must also meet all university requirements as stated in the catalog, including graduation and core requirements.

**Accelerated M.S. Degree**

High-achieving undergraduate students in either the Computer Engineering or Computer Science B.S. program at the University of Arkansas who choose to pursue graduate studies in our department may participate in the accelerated MS program. Eligible students must have a GPA of 3.5.

These students can take up to 6 credit hours of 5000-level CSCE courses as technical electives for their bachelor's degree and count those hours towards their graduate degree, should they choose to pursue one in our department. The 6 hours must be taken within the final 12 months before receiving the undergraduate degree.



## Eight Semester Degree Plans

### Computer Engineering 8 Semester Plan – 2016-2017

<p><b>Fall Semester Year 1</b></p> <p>4 MATH 2554 Calculus I            3 CHEM 1103 University Chemistry I 4 PHYS 2054 University Physics I            1 GNEG 1111 Introduction to Engineering I            3 ENGL 1013 English Composition</p> <p><b>15 Semester hours</b></p>	<p><b>Spring Semester Year 1</b></p> <p>4 MATH 2564 Calculus II            4 PHYS 2074 University Physics II            3 History/Government elective            1 GNEG 1121 Introduction to Engineering II            3 ENGL 1023 Composition II</p> <p><b>15 Semester hours</b></p>
<p><b>Fall Semester Year 2</b></p> <p>4 MATH 2574 Calculus III            4 CSCE 2004 Programming Foundations I            4 CSCE 2114 Digital Design            3 MATH 2603 Discrete Math</p> <p><b>15 Semester hours</b></p>	<p><b>Spring Semester Year 2</b></p> <p>4 MATH 2584 Differential Equations            4 CSCE 2214 Computer Organization            4 CSCE 2014 Programming Foundations II            3 Social Science elective            3 Social Science elective</p> <p><b>18 Semester hours</b></p>
<p><b>Fall Semester Year 3</b></p> <p>3 CSCE 3613 Operating Systems            3 CSCE 3953 System Synthesis &amp; Modeling            3 CSCE 3193 Programming Paradigms            3 PHIL 3103 Ethics &amp; the Professions            4 Basic Science elective with lab</p> <p><b>16 Semester hours</b></p>	<p><b>Spring Semester Year 3</b></p> <p>3 CSCE 3513 Software Engineering            3 CSCE elective 3 ELEG 3933 Circuits &amp; Electronics            3 Free elective            3 INEG 2313 Applied Probability and Statistics for Engineers I</p> <p><b>15 Semester hours</b></p>
<p><b>Fall Semester Year 4</b></p> <p>1 CSCE 4561 Capstone I            4 CSCE 4114 Embedded Systems            3 CSCE elective            3 CSCE elective            3 Fine Arts elective            3 COMM 1313 Public Speaking</p> <p><b>17 Semester hours</b></p>	<p><b>Spring Semester Year 4</b></p> <p>3 CSCE 4963 Capstone II            3 CSCE 4213 Computer Architecture            3 CSCE elective            3 Social Science elective            3 Free Elective</p> <p><b>15 Semester hours</b></p>

**126 Total hours**

## Computer Science 8 Semester Plan – 2016-2017

<p><b>Fall Semester Year 1</b></p> <p>4 MATH 2554 Calculus I            3 CHEM 1103 University Chemistry I 4 PHYS 2054 University Physics I            1 GNEG 1111 Introduction to Engineering I            3 ENGL 1013 English Composition</p> <p><b>15 Semester hours</b></p>	<p><b>Spring Semester Year 1</b></p> <p>4 MATH 2564 Calculus II            4 Freshman Science elective*            1 GNEG 1121 Intro to Engineering II            3 ENGL 1023 Composition II            3 History/Government elective</p> <p><b>15 Semester hours</b></p>
<p><b>Fall Semester Year 2</b></p> <p>3 MATH 2603 Discrete Math            4 Basic Science elective with lab            4 CSCE 2004 Programming Foundations I            4 CSCE 2114 Digital Design            3 Social Science elective</p> <p><b>18 Semester hours</b></p>	<p><b>Spring Semester Year 2</b></p> <p>3 MATH 3103 Combinatorics            4 CSCE 2014 Programming Foundations II            4 CSCE 2214 Computer Organization            3 Fine Arts elective            3 Social science elective</p> <p><b>17 Semester hours</b></p>
<p><b>Fall Semester Year 3</b></p> <p>3 CSCE 3193 Programming Paradigms            3 CSCE 3613 Operating Systems            3 COMM 1313 Public Speaking            3 MATH 3083 Linear Algebra            3 PHIL 3103 Ethics &amp; the Professions</p> <p><b>15 Semester hours</b></p>	<p><b>Spring Semester Year 3</b></p> <p>3 CSCE 4523 Database Management            3 CSCE 3513 Software Engineering            3 CSCE elective            3 Free elective            3 INEG 2313 Applied Probability and Statistics for Engineers I</p> <p><b>15 Semester hours</b></p>
<p><b>Fall Semester Year 4</b></p> <p>1 CSCE 4561 Capstone I            3 CSCE 4133 Algorithms            3 CSCE elective            3 CSCE elective            3 Free elective            3 Free elective</p> <p><b>16 Semester hours</b></p>	<p><b>Spring Semester Year 4</b></p> <p>3 CSCE 4963 Capstone II            3 CSCE elective            3 CSCE 4323 Formal Languages            3 Free elective            3 Social Science elective</p> <p><b>15 Semester hours</b></p>

### 126 Total hours

\* Choose between PHYS 2074 University Physics II or CHEM 1133/1131L University Chemistry II for Engineers and lab.

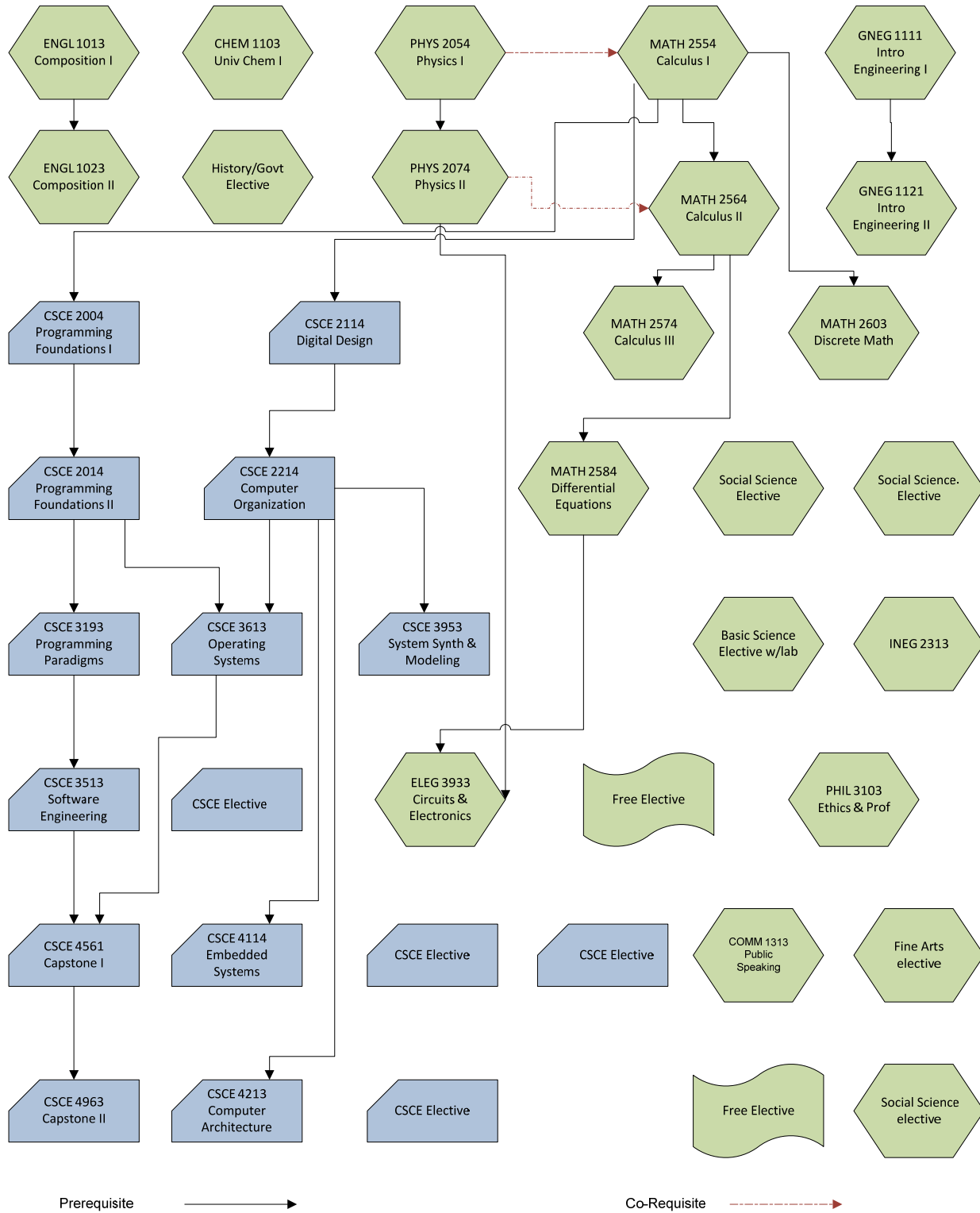
## Computer Science BA 8 Semester Plan – 2016-2017

<p><b>Fall Semester Year 1</b></p> <p>3 ENGL 1013 Composition I            4 MATH 2554 Calculus I            3 HIST 2003 or HIST 2013 or PLSC 2003            3 Social science elective</p> <p><b>13 Semester hours</b></p>	<p><b>Spring Semester Year 1</b></p> <p>4 CSCE 2004 Programming Foundations I            4 CSCE 2114 Digital Design            3 MATH 2603 Discrete Mathematics            3 ENGL 1023 Technical Composition II</p> <p><b>14 Semester hours</b></p>
<p><b>Fall Semester Year 2</b></p> <p>4 CSCE 2014 Programming Foundations II            4 CSCE 2214 Computer Organization            3 Fine Arts elective (from University core)            3 Social Science elective (from University core)            3 Free Electives</p> <p><b>17 Semester hours</b></p>	<p><b>Spring Semester Year 2</b></p> <p>3 CSCE 3193 Programming Paradigms            3 STAT 2303 Principles of Statistics            3 COMM 1313 Public Speaking            3 Free Electives            3 Free Electives</p> <p><b>15 Semester hours</b></p>
<p><b>Fall Semester Year 3</b></p> <p>3 CSCE elective (3000-level or higher)            3 ENGL 3053 Tech/Report Writing            4 Science elective with lab            3 Free Electives            3 Free Electives</p> <p><b>16 Semester hours</b></p>	<p><b>Spring Semester Year 3</b></p> <p>3 CSCE elective (3000-level or higher)            3 PHIL 3103 Ethics and the Profession            5 Free Elective            3 Social Science elective (from University core)</p> <p><b>14 Semester hours</b></p>
<p><b>Fall Semester Year 4</b></p> <p>3 CSCE Elective (3000-level or higher)            3 CSCE Elective (3000-level or higher)            4 Science elective            3 Free elective (3000-level or higher)</p> <p><b>16 Semester hours</b></p>	<p><b>Spring Semester Year 4</b></p> <p>3 CSCE elective (3000-level or higher)            3 CSCE elective (3000-level or higher)            3 Free Elective (3000-level or higher)            3 Free elective (3000-level or higher)            3 Free elective (3000-level or higher)</p> <p><b>15 Semester hours</b></p>

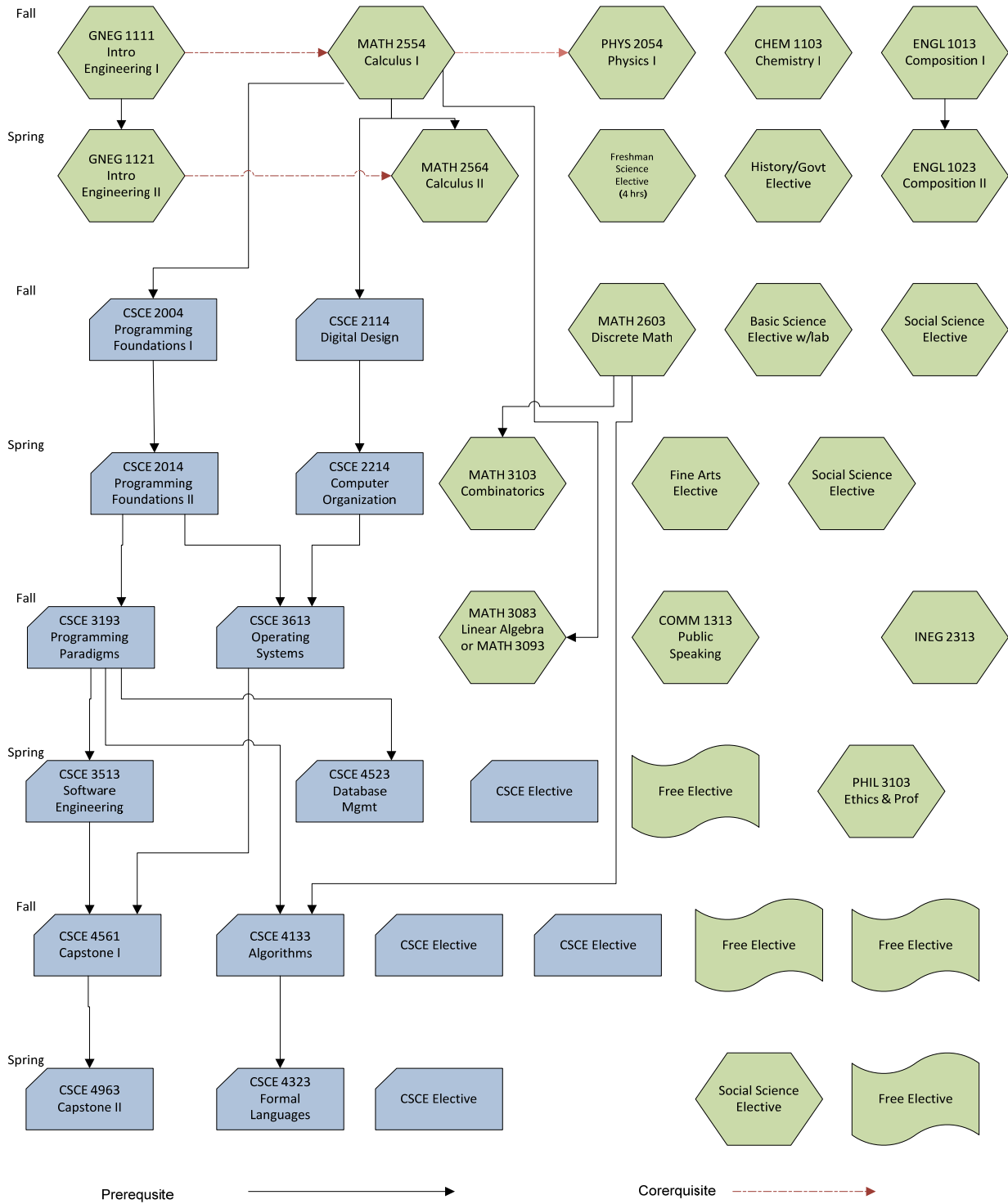
**120 Total hours**

# Flowcharts

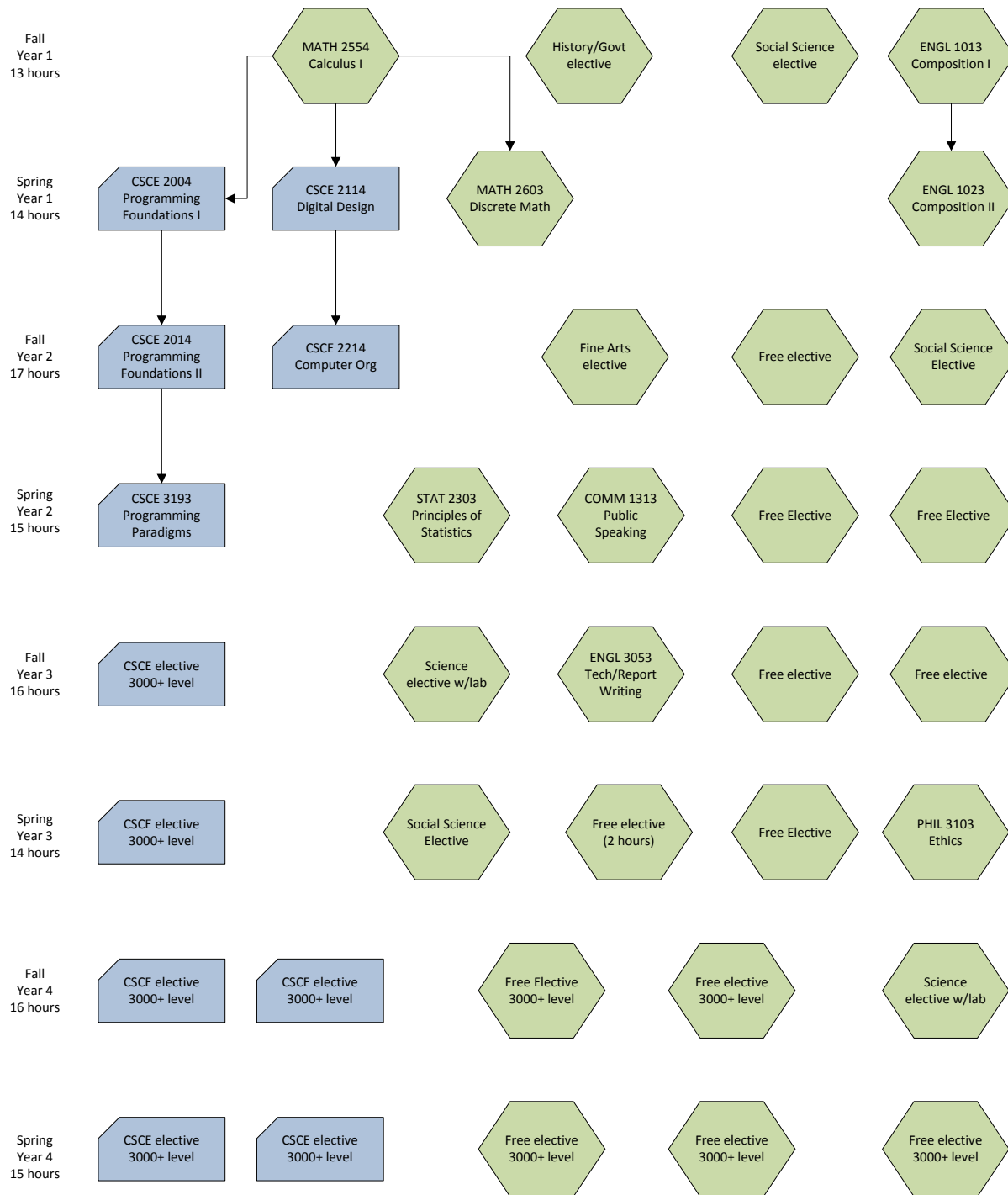
## Computer Engineering Bachelor of Science – Fall 2016



# Computer Science Bachelor of Science – Fall 2016



# Computer Science Bachelor of Arts – Fall 2016











## Graduation Requirements

In addition to the specific departmental requirements for degree plans, students should refer to the Academic Regulations section of the Catalog of Studies for general university requirements.

The College of Engineering has these additional requirements.

1. **Grade-Point Average** – A candidate for a degree from the College of Engineering must have earned a grade-point average of no less than 2.00 on all courses in the student’s major area of study.
2. **Courses That Do Not Count Toward a Degree** – The following courses, which may be required, do not count toward degree credit for Bachelor of Science or the Bachelor of Arts degrees in the College of Engineering: ENGL 002, ENGL 0013, MATH 0003, MATH 1203, MATH 1213, MATH 1284, and GNEG 1514.
3. **“D” Rule** – No students will be allowed to graduate if the student has “D” grades in more than 8 hours presented to meet the requirements for a degree.
4. **Transfer of Courses** – Advanced (3000- and 4000-level at the University of Arkansas) engineering courses may not normally be transferred from institutions that do not have programs accredited by the Engineering Accreditation Commission.
5. **Resident Requirements** – A candidate must earn a minimum of 20 credit hours at the 3000-level and above in the College of Engineering from the University of Arkansas.

## Application for Graduation

Students who plan to graduate must file an official application to do so. Applications should be filed for the term in which degree requirements will be completed. A graduation fee will be required at the time of application.

To ensure that students will be certified for graduation in a timely manner, the following graduation application deadlines have been established:

<b>Date</b>	<b>Description</b>
October 1	for students graduating in Fall
March 1	for students graduating in Spring
July 1	for students graduating in Summer

Students must apply by the established deadline for that term. A student who fails to complete the degree during the intended semester **must contact the Office of the Registrar** to renew the application for the term in which the degree requirements will be completed.

## Faculty and Areas of Research

**David Andrews**, Professor, Thomas Clinton Mullins Endowed Chair in Engineering; Hybrid Threads, Embedded Systems, Computer Architecture, Reconfigurable Computing

**Gordon Beavers**, Associate Professor, Associate Head

**Christophe Bobda**, Professor; System on Chip Design, Embedded Systems, Computer Architecture, Reconfigurable Computing, Real-Time Operating Systems, Self-Organizing Embedded Systems, Distributed Smart Cameras

**Jia Di**, Professor, 21<sup>st</sup> Century Research Leadership Chair; Digital Integrated Circuit Design and Analysis, Asynchronous Circuit Design, Extreme Environment Electronics, Hardware Security

**Michael Gashler**, Assistant Professor; Machine Learning, Neural Networks, Dimensionality Reduction, Predictive Modeling, Data Mining, Manifold Learning

**John Gauch**, Professor; Digital Image Processing, Digital Video Processing, Computer Vision

**Susan Gauch**, Professor; Intelligent Information Retrieval, Personalization and Web Search, Semi-Automated Ontology Construction and Modification

**Miaoqing Huang**, Associate Professor; Heterogeneous Many-core Architecture, High Performance Computing, Hardware-oriented Security, Hardware Design

**Qinghua Li**, Assistant Professor; Security and Privacy, Mobile Computing, Smart Grid, Big Data, Access Control

**Wing Ning Li**, Professor; Design Automation, Design and Analysis of Algorithms, Combinatorial Optimization, Software Reuse, Parallel Computing

**Frank Liu**, Professor, Department Head, Rodger S. Kline Leadership Chair; Software Engineering, Service Computing, Collective Intelligence, Web-based Argumentation, Intelligent Systems, Software Applications

**Brajendra Panda**, Professor; Database Systems, Computer Security, Computer Forensics, Information Assurance

**Pat Parkerson**, Associate Professor; IC & ASIC Design, Design Methodologies, Integrated Passive Components, Electronic Packaging Design, Electronic Circuits for Aerospace Applications

**Matthew Patitz**, Assistant Professor; Nanoscale, Algorithmic Self-assembly

**Dale Thompson**, Associate Professor; Security and Privacy, Computer Networking, Mobile Security

**Xintao Wu, Professor**, Charles D. Morgan/Axiom Graduate Research Chair; Privacy Preserving Data Mining, Fraud Detection, Anti-Discrimination Learning, Spectral Graph Analysis