

# COMPUTER SCIENCE

---

**Home Department:** Computer Science

**Department Head:**

Michael Farmer, Ph.D.  
Room 2-300 AB, 810-762-7963  
computerscience@kettering.edu (jgeske@kettering.edu)

## Program Overview

Computer Science touches virtually every aspect of human endeavor. Its impact on society is seen in the proliferation of computers, information systems, game systems, web browsers, search engines, computerization and automation of automobiles, and all the wonderful application programs that have been developed to make computers more productive and easier to use. An important aspect of the field deals with how to make programming easier, software more reliable, and the processing and retrieval of information more accessible, but fundamentally, computer science is a science of abstraction - creating the correct models for real-world problems that can be represented and manipulated inside a computer.

Computer scientists are experts in solving complex problems. They use the tools of computation and information representation to devise novel and innovative solutions to these problems. Through this program students learn these tools in terms of the theory of the fundamental capabilities and limitations of computation, as well as how computation can be practically realized and applied. A computer scientist understands how to design and analyze algorithms that apply computation effectively, and how to represent, store, and retrieve information efficiently, and how to design software systems to solve complex problems.

The program for Computer Science majors is broad and rigorous; students are required to have a solid foundation in computer software, hardware, and theory. Yet, the program is structured in a way that supports in-depth study of areas in and outside the computing field. Numerous technical and free electives give students the opportunity to tailor the degree to their unique interests. Students may opt to take a Concentration in Computer Gaming, Cybersecurity or Artificial Intelligence by selecting groups of elective courses within these domains. Additionally students can easily obtain minors in diverse fields such as Computer Engineering, Electrical Engineering, Innovation and Entrepreneurship, and Economics.

A wide variety of exciting professional and academic opportunities exist for graduates of computer science including Software Engineering, Internet Systems and Technology, Security, Hardware Development, Information Systems, Biotechnology, Business, and Consulting, as well as masters and doctoral studies in computing related fields. With the aid of a Computer Science faculty advisor, the computer science student develops a coherent program of study that uniquely supports their career objectives and is true to the aims of a liberal education.

The program in Computer Science is accredited by the Computing Accreditation Commission of ABET.

## Computer Science vs. Computer Engineering

Historically, the discipline of computer science draws its roots from two separate disciplines.

- **Electrical Engineering:** the development of devices that depend on electricity and magnetism.
- **Mathematics:** the study of the properties and interactions of idealized objects, such as numbers and symbols.

Computer science lies at the intersection of these two disciplines. It is the study of a particular class of electrical devices (i.e. computers) which can perform mathematical, logical operations (i.e. software).

The computer engineering and computer science programs have a common core of classes. Students in both programs study programming, the design of digital systems, computer architecture, and operating systems, as well as a solid foundation in mathematics, science, and general education.

The computer engineering program emphasizes the design and development of physical computer systems. In addition to a common engineering core, students in computer engineering study topics such as the analysis of electrical circuits, and electronics, with an emphasis on electrical and digital design.

The computer science program emphasizes the design and development of software systems. Students in computer science study topics such as algorithms and data structures, software engineering, compiler design, database systems, artificial intelligence, and the theoretical foundations of computation.

Both programs prepare students for work in the computer industry, though with emphasis on different areas. Students should select the program which fits their skills and interests best. Both programs offer minors, so students may take additional courses in these areas and have it designated on their transcript.

## Program Educational Objectives

1. Computer Science graduates will have sufficient depth of understanding of the fundamental areas of computer science to enable them for success in today's workplace.
2. Computer Science graduates will have sufficient breadth of understanding to enable continued professional development and lifelong learning throughout their careers.
3. Computer Science graduates will have sufficient teamwork, communication, and interpersonal skills to enable them to work with others effectively in their professional careers.
4. Computer Science graduates will be sufficiently prepared to be innovative and ethical leaders in a global society.

## BS/MASTERS PATHWAY

Undergraduate students also have an opportunity to get their bachelor's and master's degrees in five years with the BS/MASTERS Pathway.

# Computer Science Program Curriculum Requirements

Code	Title	Credit Hours
<b>First Year Experience</b>		
CILE-101	First Year Foundations	1
<b>General Education</b>		
COMM-101	Rhetoric & Writing	4
ECON-201	Economic Principles	4
LA-201	Sophomore Seminar: Exploring the Human Condition	4
LA-489	Sr. Seminar: Leadership, Ethics	4
Advanced Humanities Electives <sup>1</sup>		8
Advanced Social Science Electives <sup>1</sup>		8
<b>Total Credit Hours</b>		<b>33</b>

<sup>1</sup> Humanities and Social Science advanced electives must be selected from approved 300 and 400 level courses.

Code	Title	Credit Hours
<b>Basic Science</b>		
Science Electives		8
<i>Credit Hours Subtotal:</i>		<i>8</i>
<b>Computer Science</b>		
CS-101	Computing & Algorithms I	4
CS-102	Computing & Algorithms II	4
CS-203	Computing & Algorithms III	4
CS-211	Discrete Mathematics	4
CS-231	Programming Language Paradigms	4
CS-300	The Computing Professional	4
CS-312	Theory of Computation	4
CS-351	Cloud Computing	4
CS-451	Operating Systems	4
CS-471	Software Engineering	4
Computer Science Technical Electives		16
<i>Credit Hours Subtotal:</i>		<i>56</i>
<b>Computer Engineering</b>		
CE-210	Intro to Digital Systems Design	4
CE-320	Intro to Microcomputers	4
<i>Credit Hours Subtotal:</i>		<i>8</i>
<b>Mathematics</b>		
MATH-101	Calculus I	4
or MATH-101X	Calculus I	
MATH-102	Calculus II	4
or MATH-102X	Calculus II	
or MATH-102H	Calculus II - Honors	
Mathematics Electives		8
<i>Credit Hours Subtotal:</i>		<i>16</i>
<b>Electives</b>		
Free Electives		16
<i>Credit Hours Subtotal:</i>		<i>16</i>

## Culminating Undergraduate Experience

CILE-400 & CILE-401	Undergraduate Thesis Initiation and Undergraduate Thesis Completion <sup>1</sup>	4
<b>Total Credit Hours</b>		<b>108</b>

**(Minimum) Total Credits Required for Program: 141**

<sup>1</sup> Students are automatically registered for CILE-400 in a co-op term when they reach Junior II status.

## Concentrations

The Computer Science concentrations provide students with a technical depth of study in an emerging area of interest. The student's degree remains in Computer Science, and this concentration does not prevent students from working within any government or industry position in the computer science arena. Students interested in the Computer Gaming, Cybersecurity or Artificial Intelligence concentrations should contact Dr. Michael Farmer, Department Head of Computer Science.

### Artificial Intelligence

Students majoring in Computer Science may select a concentration in Artificial Intelligence consisting of the following 16 credit hours of Computer Science technical electives as listed below.

Code	Title	Credit Hours
CS-481	Artificial Intelligence	4
CS-482	Machine Learning	4
Select Two of the following (At least one must be from CS)		8
CS-441	Foundations of Data Science	
CS-465	Information Retrieval and Data Mining	
CS-483	Algorithms for Deep Learning	
CE-442	Mobile Robotics	
CE-452	Artificial Intelligence for Autonomous Driving	
CE-454	Computer Vision for Autonomous Driving	
IME-408	Industrial Robotics	
MGMT-423	Data Analytics	

### Computer Gaming

Students majoring in Computer Science may select a concentration in Computer Gaming consisting of the following 16 credit hours of Computer Science technical electives as listed below.

Code	Title	Credit Hours
<b>Required Courses</b>		
CS-320	Computer Graphics	4
CS-385	Elements of Game Design	4
CS-420	Virtual Reality	4
CS-485	Advanced Game Development	4

## Cybersecurity

Students majoring in Computer Science may select a concentration in Cybersecurity consisting of the following 24 credit hours of Computer Science technical electives as listed below.

Code	Title	Credit Hours
<b>Required Courses</b>		
CS-355	Introduction to Cybersecurity	4
CS-381	Ethical Hacking	4
CS-415	Cryptography	4
CS-457	Wireless and Mobile Security	4
CS-458	Digital Forensics	4
CE-480	Computer Networks	4
<b>Total Credit Hours</b>		<b>24</b>

## Representative Program

Course	Title	Credit Hours
<b>Freshman I</b>		
CILE-101	First Year Foundations	1
COMM-101	Rhetoric & Writing	4
CS-101	Computing & Algorithms I	4
MATH-101	Calculus I	4
Science Elective <sup>1</sup>		4
<b>Credit Hours</b>		<b>17</b>
<b>Freshman II</b>		
CS-102	Computing & Algorithms II	4
CS-211	Discrete Mathematics	4
MATH-102	Calculus II	4
ECON-201	Economic Principles	4
<b>Credit Hours</b>		<b>16</b>
<b>Sophomore I</b>		
CS-203	Computing & Algorithms III	4
LA-201	Sophomore Seminar: Exploring the Human Condition	4
Mathematics Elective		4
Science Elective <sup>1</sup>		4
<b>Credit Hours</b>		<b>16</b>
<b>Sophomore II</b>		
CE-210	Intro to Digital Systems Design	4
CS-231	Programming Language Paradigms	4
Free Elective		4
Advanced HUMN/SSCI Elective		4
<b>Credit Hours</b>		<b>16</b>
<b>Junior I</b>		
CE-320	Intro to Microcomputers	4
CS-300	The Computing Professional	4
CS Technical Elective <sup>2</sup>		4
Advanced HUMN/SSCI Elective		4
<b>Credit Hours</b>		<b>16</b>
<b>Junior II</b>		
CS-351	Cloud Computing	4

Advanced HUMN/SSCI Elective	4	
CS Technical Elective <sup>2</sup>	4	
Mathematics Elective	4	
<b>Credit Hours</b>		<b>16</b>

<b>Senior I</b>		
CS-312	Theory of Computation	4
Advanced HUMN/SSCI Elective		4
CS Technical Elective <sup>2</sup>		4
Free Electives		4
<b>Credit Hours</b>		<b>16</b>

<b>Senior II</b>		
CS-471	Software Engineering	4
LA-489	Sr. Seminar: Leadership, Ethics	4
CS Technical Elective <sup>2</sup>		4
Free Elective		4
<b>Credit Hours</b>		<b>16</b>

<b>Senior III</b>		
CS-451	Operating Systems	4
Free Elective		4
<b>Credit Hours</b>		<b>8</b>

<b>Any Term</b>		
CILE-400 & CILE-401	Undergraduate Thesis Initiation and Undergraduate Thesis Completion	4
<b>Credit Hours</b>		<b>4</b>
<b>Total Credit Hours</b>		<b>141</b>

(Minimum) Total Credits Required for Program: 141

<sup>1</sup> Must include two courses (8 credits) with a laboratory component.

<sup>2</sup> A list of approved technical electives is available from the department and listed on the department web-site.