Computer Science and Engineering

Requirements:

One half-credit course

Courses Offered in 2024-2025

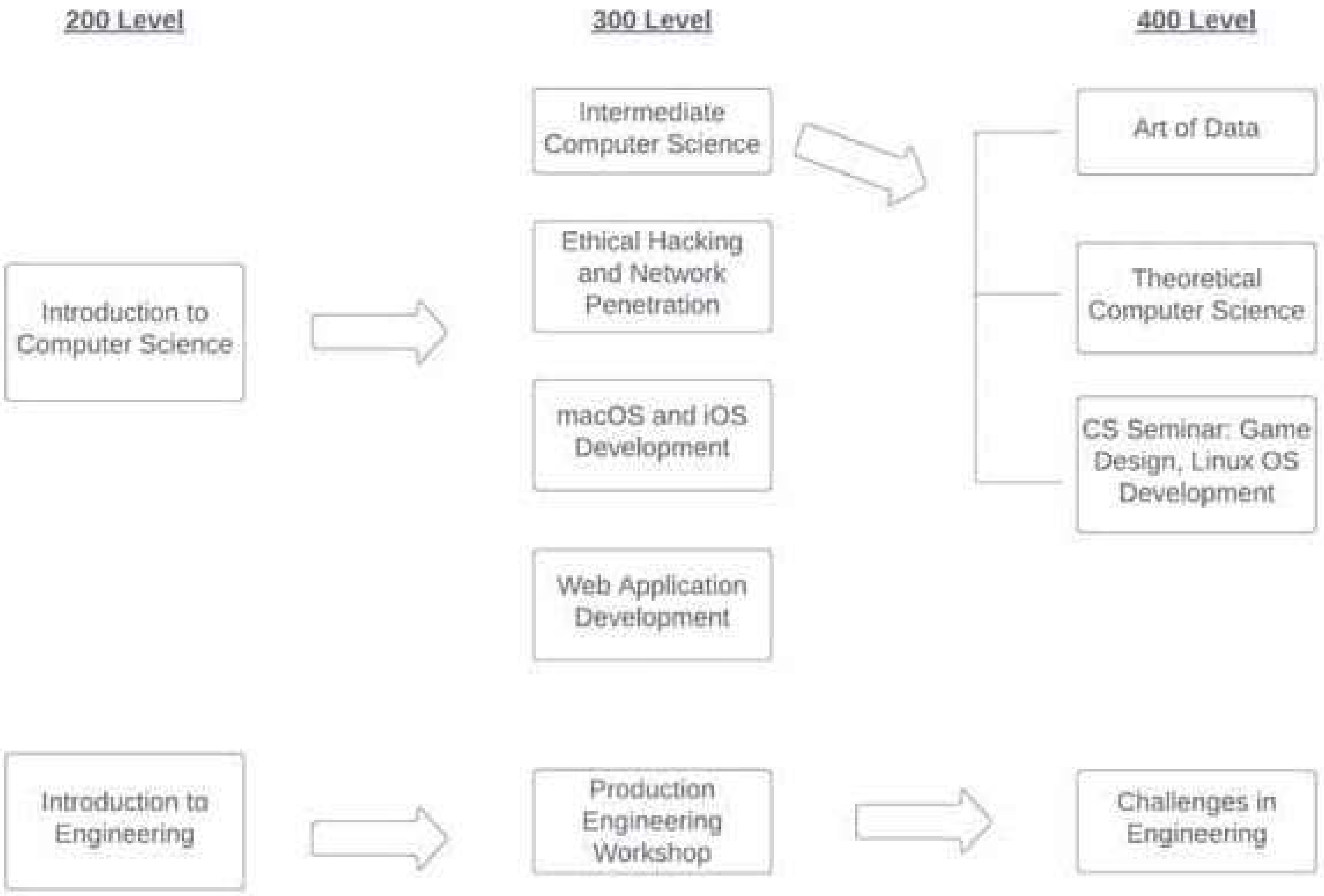
Half-credit courses

- □ Introduction to Computer Science (CMPE 211)
- □ Introduction to Engineering (CMPE 215)
- □ Intermediate Computer Science (CMPE 320)
- □ Ethical Hacking and Network Penetration (CMPE 321)
- □ macOS and iOS Development (CMPE 322)
- □ Web Application Development (CMPE 323)
- □ Production Engineering Workshop (CMPE 325)
- □ Theoretical Computer Science (CMPE 410)

Full-credit courses

- □ Art of Data (CMPE 411)
- □ Computer Science Seminar (CMPE 431.1):
  Video Game Design and Development, Linux OS Development
- □ Challenges in Engineering (CMPE 435)

Computer Science and Engineering Courses Offerings 2024-2025



200 Level

300 Level

400 Level

Introduction to Computer Science

Intermediate Computer Science

Ethical Hacking and Network Penetration

macOS and iOS Development

Web Application Development

Art of Data

Theoretical Computer Science

CS Seminar: Game Design, Linux OS Development

Introduction to Engineering

Production Engineering Workshop

Challenges in Engineering

Computer Science and Engineering

At a time when technology in the modern world is rapidly evolving, the curriculum in the Department of Computer Science and Engineering fosters the technical proficiency that will enable our students to use and produce applications and solutions effectively. To this purpose, the sequence of courses is continuously adapted in accordance with current advances in technology, while building on historical best practices. The primary focus of the curriculum remains the development of skills and habits of thought that will enable our students to put forth theory and application in an effective, precise, and ethical manner. Students will be able to experience an introduction to the intellectual enterprises of computer science, the art of programming, and the processes of engineering. The Department of Computer Science and Engineering offers a range of introductory and advanced opportunities in the field of computer technology and methodical thinking. These courses cover topics including programming, robotics, and engineering.

Requirement:
One half-credit course

200-level courses:

CMPE 211 – Introduction to Computer Science
Half credit, meets five days in every ten-day cycle
Prerequisites: None
This course focuses on the fundamentals of computer hardware architecture, computer programming, as well as user interface (UI) design. Students will gain a historical understanding of the evolution of computers from their inception to the present. Students will work individually to create personalized programs emphasizing core programming concepts, using Java within the Processing Integrated Development Environment (IDE). Students will also explore the global impact of technology and associated ethical implications. The skills developed in this course will prepare students to take more advanced courses, such as intermediate programming, during their tenure at Horace Mann.

CMPE 215 - Introduction to Engineering

Half credit, meets five days in every ten-day cycle
Prerequisites: None
This course encourages creativity and celebrates ingenious solutions to engineering and mechanical problems through the design and construction of purpose-built devices and processes. Students in this course will learn the Engineering Design Process through project-based lessons and will use the facilities in our Robotics Innovations Lab to design, construct, and improve upon new and existing physical objects. Students will gain foundational knowledge of engineering design concepts through the use of technical drawings and CAD (Computer Aided Design).

300-level courses:

CMPE 320 - Intermediate Computer Science

Half credit, meets five days in every ten-day cycle
Prerequisites: Introduction to Computer Science (CMPE 211) or departmental approval
This course explores the theory and practice of object-oriented programming, the integration of software components into a large-scale software architecture. Software development in this way represents the next logical step after learning programming fundamentals, allowing for the creation of sprawling programs. Students will work individually, as well as in groups, to create unique programs written in Java. Through the use of an Integrated Development Environment (IDE), students will gain a foundational knowledge of programming concepts such as object/class relationships, modularization, abstraction, parameter passing, recursion, method calling and declaration. By the end of the course, students will have a solid foundation in Java and object-oriented design, as well as many software development concepts that can be applied to any language.

CMPE 321 – Ethical Hacking and Network Penetration

Half credit, meets five days in every ten-day cycle
Prerequisites: Introduction to Computer Science (CMPE 211) or departmental approval
This course explores the process of discovering and protecting against exploits that are present in various computer systems and networks. Ethical hacking is used as a common and favored process to analyze the security systems and programs of an organization. This unique learning experience will utilize Kali Linux to perform penetration testing. In addition to teaching students about the latest ethical hacking tools and techniques, students will apply these techniques to hardened computer systems on a closed, private network. Given the increased reliance on cloud-based storage systems, it is becoming increasingly important to proactively test and secure network vulnerabilities.

CMPE 322 – macOS and iOS Development

Half credit, meets five days in every ten-day cycle

Prerequisites: Introduction to Computer Science (CMPE 211) or departmental approval

macOS and iOS Development will explore the application design process through Xcode, Apple's professional integrated development environment (IDE). Students will gain a thorough understanding of Swift, the default programming language for Apple devices, and associated application frameworks. Students will learn how to build database-driven applications, create hybrid applications for iPhone and iPad, leverage remote data sources, and study the art of design to build visually appealing applications. They will learn how to incorporate third-party frameworks to build feature-rich applications of their design and choosing and will work individually and in teams to build various applications that can be deployed to devices in the Apple ecosystem.

CMPE 323 - Web Application Development

Half credit, meets five days in every ten-day cycle

Prerequisite: Introduction to Computer Science (CMPE 211) or departmental approval

This course will study the design and construction process of responsive web development. Students will explore front-end and back-end design, web application development, and deployment. To facilitate this, students will gain a foundational knowledge of HTML, CSS, PHP, and JavaScript. Further, students will incorporate MySQL databases into their dynamic web applications and explore common content management systems (CMS) such as Tumblr and WordPress. This course culminates with a portfolio of work that includes a fully-functioning, unique website.

CMPE 325 - Production Engineering Workshop

Half credit, meets five days in every ten-day cycle

Prerequisites: Introduction to Engineering (CMPE 215) or departmental approval

Students will learn how to bring a physical product to life. From the drawing board to the customer’s hands - how is a product successfully mass produced? In the Production Engineering Workshop, students will work together as a team to design a product to be manufactured entirely within our Robotics and Innovation Lab, using our advanced equipment. Students will learn and then apply the theories of production, procurement, and design engineering to fabricate a product of their own development. From the ideation of the product, through the purchasing of materials, to the design, build and running of the assembly line, to the storage and distribution of product, students will execute all aspects of the Production Engineering process in this student -run course. This course is designed to engage a variety of students with interests ranging from engineering, design, and fabrication to entrepreneurship, business management, budgeting, and more.

400-level half-credit courses:

CMPE 410 - Theoretical Computer Science

Half credit, meets five days in every ten-day cycle
Prerequisites: Intermediate Computer Science (CMPE 320) and departmental approval
Theoretical Computer Science provides students with an overview of the theoretical underpinnings of computer science, as well as the skills necessary to pursue further research on their own. Students in this class learn about and write code for several notable algorithms, but a large portion of the class time focuses on the mathematical underpinnings of computer science including pure logic, graph theory, and automata theory. Students also each take a turn leading a class session related to their own computer science interests with a goal of learning how to engage, challenge, and/or inspire an audience of peers. Students explore algorithmic correctness and efficiency and build toward understanding the core of the famous unsolved P vs. NP problem.

400-level full-credit courses

CMPE 411 - Art of Data

Full credit, meets 4 days/week
Prerequisites: Intermediate Computer Science (CMPE 320) and departmental approval
Art of Data prepares students to collect, evaluate, investigate, and present data. Students build their toolboxes of coding skills and apply those tools to address real-world problems. Students learn not only how to answer questions with data, but also how to ask good questions. Students also take turns leading class sessions related to their own computer science interests with a goal of learning how to engage, challenge, and/or inspire an audience of peers. Throughout this course, students create several original pieces of work culminating with a final project that can be a portfolio piece for them for the rest of their lives. This course runs much like a workshop, with student interest guiding the directions of exploration and much of class time being dedicated to original work.

CMPE 431 - Computer Science Seminar: Video Game Design and Development, Linux Operating System Development

Full credit, meets 4 days/week

Prerequisites: Intermediate Computer Science (CMPE 320) and departmental approval

Computer Science Seminar will focus on two topics for the 2024-2025 school year: video game development and Linux operating system development.

Semester 1

Narrative game design has become increasingly popular in recent years with an influx of sophisticated, graphically appealing game titles. This course will explore video game development through Unity (a cross-platform game design environment) and Blender (an open-source 3D modeling application). Students will gain an advanced understanding of JavaScript and C# as they build feature-rich gaming environments. User experience plays a major role in game development, and this course will explore how to create musical elements, appealing user interfaces, and graphical elements in tandem with programming.

Semester 2

Linux operating system development will explore the process of designing, developing, and packaging a custom Linux-based operating system based on the work of Linus Torvald. Students will gain an advanced knowledge of various shell scripting environments such as the Bourne Again Shell (BASH), KornShell (KSH), and Z Shell (ZSH). Through an open-source, package-based approach, students will build a custom operating system from the Kernel level and will add packages that include a networking stack, file system management, and graphical user environments (GUI) utilizing GNOME and KDE. Each operating system will be entirely unique to the student designer.

CMPE 435 - Challenges in Engineering

Full credit, meets 4 days/week

Prerequisites: Production Engineering Workshop (CMPE 325) and departmental approval

Challenges in Engineering is a survey-style course that focuses on solving real-world problems through the study of varied engineering disciplines. In this team-based course, students will use their knowledge of engineering principles to design and build a solution to a specific problem. For example, students might produce a working prototype of a basic water filtration system that can be made with readily available materials, design and build a mobile bridge, or research and propose various and implementable composting measures for Horace Mann. Students will work in small teams to tackle these challenges, with students taking on new and exciting roles within each project and team. Each project will involve learning subject-specific knowledge, which will inform and guide the eventual solution for each engineering challenge.