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# Course Descriptions

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**compsci.appstate.edu/advising**

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# Spring 2027 Computer Science courses

- Every required course is offered every fall and spring semester
- Elective courses loosely follow the schedule indicated in the bulletin
  - To see what is actually offered, you need to check the registrar's site: [Registration](#)
  - DON'T ASSUME A COURSE WILL BE OFFERED BECAUSE OF WHAT THE BULLETIN SAYS, CHECK THE REGISTRAR'S SITE
- The next set of slides describes each of the CS **elective** courses offered in the Spring 2027 semester

# CS 2531: Computational Reasoning

From the most elementary hardware to the most sophisticated software, all of computer science is based in discrete mathematics. This course covers a range of topics in discrete mathematics that are particularly important in computer science, emphasizing relationships between certain mathematical structures on the one hand, and their applications in computer science on the other. But since it treats mathematical knowledge as primary rather than as something to be picked up “on the fly”, this course provides an opportunity to focus on building a solid mathematical foundation for computer science. This is important --- after all, no computer scientist has ever said that they wished they had less mathematical background or understood mathematics less well! Specific topics to be covered include propositional logic, predicate logic, proof techniques, basic set theory, functions, relations, counting principles, inductively defined sets, inductive proof, and recursive definitions.

**Prerequisite:** Prerequisite: CS 1100 with a C (2.0) or better.

**Professor:** Patricia Johann

# CS 3532: Competitive Programming

Competitive programming is all about solving mathematical and computational problems. In this course, we look at various problem solving paradigms to tackle a wide variety of fun and interesting problems. The skills developed in this course reinforce skills such as problem solving, rapid prototyping, and programming proficiency. We meet for three hours, one hour for a lecture on a topic related to competitive programming, then one hour to work on a handful of problems alone or in small groups, and then an hour to go over solutions to proposed problems. This covers topics such as advanced data structures, graph algorithms, string matching, and programming paradigms such as complete search, divide and conquer, and dynamic programming.

**Prerequisite:** CS 3460: Data Structures with C- or higher.

**Professor:** Chad Waters

# CS 3534: Introduction to Robotics

Introduction to Robotics (CS 3534) provides a practical foundation in robotics through hands-on experience with a Smart Robot Car platform and the Arduino IDE. Students learn the principles of robot motion control, sensing, and embedded programming by building, wiring, and coding their own autonomous vehicle. Core topics include microcontroller operation, pulse-width modulation, DC motor control, infrared and ultrasonic sensing, line tracking, Bluetooth communication, and camera interfacing with the ESP32-S3 module. This course also emphasizes programming logic, circuit integration, and real-time system behavior, progressing from simple motion sketches to interactive, sensor-driven autonomy and wireless control. By the end of the course, students will understand how mechanical, electrical, and computational components integrate to create intelligent robotic systems and will be prepared for more advanced work in robotics modeling, control, and AI applications.

**Prerequisite:** CS 2450 with a C- (1.7) or better.

**Professor:** Yeganeh Madadi

# CS 3541: Penetration Testing

In this course students will learn the tools, techniques, and reporting skills required for ethical hacking and penetration testing. They will learn the following:

- Information Gathering & Vulnerability Scanning
- Exploitation & Pivoting: Conduct targeted exploits on networks, apps, hosts & explore the world of pivoting, lateral movements, & persistence techniques.
- Social Engineering & Physical Security: Exploit the social vulnerabilities, such as phishing & impersonation & test out the physical access control weaknesses.
- Scripting For Penetration Testing: Automate tasks with Python, bash as well and PowerShell. Utilize the power flow control, I/O operations, error handling & reusable code.

**Prerequisite:** Computer Science I preferred; basic programming skills are also acceptable if CS I has not been taken

**Professor:** Nazia Sharmin

# CS 3549: Understanding AI Intelligence

This is a special topics course covering advances in artificial intelligence, potentially including discussions of the relationship with natural/biological intelligence, neural networks, LLMs and agentic AI, and current issues in AI ethics.

**Prerequisite:** Prerequisite: CS 2440 with a C (2.0) or better, and ENG 3695.

**Professor:** Mohammad Ali Javidian

# CS 3750: Applied Neural Networks

This project-oriented course provides an opportunity for students to learn and apply neural networks techniques to solve a variety of problems from different disciplines, applying such techniques in pattern recognition, time series prediction, data mining, and optimization problems. Focus is on some applications of artificial neural networks in the real world.

**Prerequisite:** CS 3460 with a minimum grade of "C-" (1.7) or CS 3435; MAT 2240.

**Professor:** Mitch Parry

# CS 4435: Server-Side Web Programming

This course introduces the technologies for implementing secure, high performance, and sophisticated web sites. Topics may include: installation and configuration of a web server, client/server web applications with database backends, web development frameworks, web services, web data formats, and content management systems.

**Prerequisites:** CS 3430 and CS 3440.

**Professor:** Joel Swanson

# CS 4521: Operating Systems

An in-depth study of the design and implementation of operating systems including process management, memory management, file systems, and input/output. Lecture three hours, laboratory three hours.

**Prerequisite:** CS 3482. This course is cross-listed with **CS 5521: Operating Systems**. Only seniors will be able to register for this course.

**Professor:** Yeganeh Madadi

# CS 4532: Reinforcement Learning

This course offers a comprehensive deep dive into building intelligent agents. It starts with foundational Markov Decision Processes (MDPs) and Dynamic Programming (Policy and Value Iteration). The core focuses on model-free learning, covering classic algorithms like Monte Carlo, SARSA (On-Policy), and Q-Learning (Off-Policy), and mastering the exploration-exploitation dilemma. Finally, the course explores Deep Reinforcement Learning methods, studying the architecture and theory behind DQN, Policy Gradient methods (REINFORCE, Actor-Critic), and the Asynchronous Advantage Actor-Critic (A3C), ensuring both theoretical mastery and practical application.

**Prerequisite:** CS 4755 or CS 4440

**Professor:** Tinghao Feng

# Spring 2027 Data Science courses

- Data Science courses can help you earn the Data Science certificate
- In addition to other courses required by the CS major, you will need to take:
  - **CS 3435: Data Collection and Visualization**
    - This course does not count as a CS elective
  - **One of these courses:**
    - **CS 4440 Artificial Intelligence**
    - **CS 3750 Applied Neural Networks (offered in Spring 2027)**
    - **CS 4755: Applied Machine Learning**
      - Each of these courses count as a CS elective as well as meeting a Data Science certificate requirement

# CS 2435: Introduction to Scientific Programming

When Offered: Fall; Spring. GEN ED: Quantitative Literacy. This course provides an introduction to problem solving and computer programming using tools such as MATLAB or Python. The course material is motivated by interdisciplinary applications focusing on computational approaches to solving problems using data. Fundamental topics in computer programming will be covered in the course. Lecture three hours, laboratory two hours.

**Corequisite:** MAT 1020 or MAT 1025 or equivalent with a minimum grade of "C-" (1.7) or MAT 1110, or satisfactory Calculus Readiness Test score.

**Professors:** Courtney Dixon, Danielle Lapensee-Rankine

This course counts for the Data Science certificate but CS students can substitute CS 2440 for this requirement. CS 2440 is required for the CS major. This course is not required for the CS major.

# CS 3750: Applied Neural Networks

This project-oriented course provides an opportunity for students to learn and apply neural networks techniques to solve a variety of problems from different disciplines, applying such techniques in pattern recognition, time series prediction, data mining, and optimization problems. Focus is on some applications of artificial neural networks in the real world.

**Prerequisite:** CS 3460 with a minimum grade of "C-" (1.7) or CS 3435; MAT 2240.

**Professor:** Mitch Parry

# Spring 2027 Graduate/Honors Courses

- Senior (90 hours) with a minimum 3.0 GPA can take grad courses
- Graduate courses **count as CS electives** for the undergraduate CS degree
- Graduate courses count as **honors credits**
- If you are in the Accelerated Master's Program then graduate courses count toward both the undergraduate degree and the graduate degree:
- Unless you are in the Accelerated Master's Program, you will need to complete the Request for Special Permission Form to register for a graduate course
  - [Forms | Cratis D. Williams School of Graduate Studies](#)

# CS 5100: Seminar in Computer Science

Discussion and presentation of current topics in computer science. Each student will make oral and written reports on the results of research conducted on an instructor approved topic. Professional development aspects are also covered, including resume writing and interviewing skills.

**Prerequisite:** graduate status in computer science.

**Professor:** Abdelbaset Hamza

# CS 5460: Deep Learning

Deep learning is a subset of machine learning where the model is a deep neural network. This course uses computer programming and linear algebra to understand deep neural networks in their various forms, such as multilayer perceptrons, convolutional neural networks, generative adversarial networks, deep reinforcement learning, and large language models.

**Prerequisite:** CS 3460 (Data Structures) and MAT 2240 (Linear Algebra) or equivalents. Offered odd-numbered years

**Professor:** Mitch Parry

# CS 5470: Causal Inference for Computer Science

Causality is a fundamental concept, which plays a critical role in several areas today including machine learning, AI, and data science. This course covers the tools for modeling probabilistic causality. Topics include causal graphs, and how they can be used for estimating interventional queries; parameter and structure learning of causal models from observational data; and the notion of counterfactuals. The course culminates with a research project.

**Prerequisite:** CS 3460 (Data Structures) and MAT 2240 (Linear Algebra).

Offered odd-numbered years

**Professor:** Mohammad Ali Javidian

# CS 5521: Operating Systems

An in-depth study of the design and implementation of operating systems including process management, memory management, file systems, and input/output. Lecture two hours, laboratory three hours.

**Prerequisite:** equivalent of CS 3482. [Dual-listed with CS 4521.]

**Professor:** Yeganeh Madadi

# CS 5760: Topics in Computer Systems

This course examines advanced topics in computer systems, such as parallel computing, distributed computing, grid computing, internet of things, and GPU programming.

May be repeated for a maximum of 6 hours when content does not duplicate.

**Prerequisite:** CS 3481 (Computer Systems I) or by permission of graduate program director. Offered odd-numbered years.

**Professor:** Abdelbaset Hamza

# CS 5780: Topics in Web & Mobile Computing

This course examines advanced topics in web & mobile computing, such as server-side web programming, front-end web development, cloud computing, visual analytics, and scrum techniques.

May be repeated for a maximum of 6 hours when content does not duplicate.

**Prerequisite:** CS 3460 (Data Structures) and CS 3667 (Software Engineering), or by permission of graduate program director. Offered odd-numbered years.

**Professor:** Jay Fenwick