



Florida State University

ISC 5305 0001

Scientific Programming
2026 Fall

Course Information

Credit Hours: 3

Course Delivery Method: In Person/Traditional

Meeting Location: DSL0499

Meeting Days and Times: 01:20 PM 02:35 PM T|R

Instructor Information

Gordon Erlebacher

Email: gerlebacher@fsu.edu

Department/Office Location

Dept. Scientific Computing, room 464

Office Hours

By appointment.

Course Teaching Assistant(s)

Name: Kunal Kunawade

Email: kk21p@fsu.edu

Office Hours
400 DSL: By appointment

Prerequisites or Co-requisites

Prerequisite: Working knowledge of one programming language (C++, Fortran, Java) or instructor permission.

Course Description

This course provides an advanced exploration of modern, object-oriented C++ within the context of contemporary AI-assisted engineering and autonomous agent architectures. Designed for students with prior introductory C/C++ programming experience, the curriculum establishes deep competency in core C++ paradigms—including robust class hierarchies, strict memory management (RAII), template programming, and the Standard Template Library (STL)—applied directly to scientific data structures. Distinct from traditional syntax-driven instruction, this course treats Generative AI and Large Language Models as primary, interactive engineering components. Students will transition from using AI as an autocomplete tool to architecting production-grade, closed-loop agentic workflows incorporating code generation, automated compilation, unit testing, and benchmarking harnesses to empirically evaluate AI-generated code for computational correctness and performance.

Course Objectives

- Architect autonomous agentic workflows that leverage generative AI to automate C++ code generation, compilation, testing, and performance optimization.
- Apply core C++ paradigms—including class design, encapsulation, and template programming—to build robust scientific software.

- Manage object lifecycles and memory using RAII and smart pointers to ensure resource safety.
- Construct reusable software components by leveraging C++ Standard Template Library (STL) containers and algorithms.
- Design automated testing harnesses to empirically evaluate code for correctness, safety, and execution performance.
- Critique and refactor code—whether legacy or AI-generated—for algorithmic efficiency, memory locality, and modern idioms.

Required Textbooks and Readings

No textbook required.

Topical Outline /Course Schedule

1. Basic C++ Concepts -- AI as a Co-programmer
2. Basic Object-Oriented Programming (OOP) -- Critiquing AI-Generated Classes
3. Memory Management -- AI-Driven Ownership Verification
4. Advanced OOP -- Enforcing Value Semantics Policies
5. Templates and Generic Programming -- Automated Component Engineering
6. Standard Template Library (STL) -- Prompting for Idiomatic Container and Algorithm Choices
7. Algorithms & Data Structures -- Agentic Pipelines
8. Modern C++ -- Modernization Agents
9. Agent Architecture -- Building Autonomous Coding Agents in C++
10. Empirical Validation -- Automated Benchmarking, Testing, and Guardrails

Assignments and Evaluations

Students will be given homework problems weekly to help master the material learned in class. The assignments will be executed using the tools on classroom machines or students' laptops or PCs. Using the Linux operating system will be easiest. Assignment deliverables are documented programs, sometimes with unit test codes to check their validity and an assortment of analyses. The homework will often be intensive. Students should expect to program 15 hours a week

outside course time. The web is a bountiful resource of program examples and tutorials.

Several in-class quizzes to test your knowledge, to break dependence on AI tools. These will consist of multiple-choice questions and simple problems to test you on the content taught in class. Weekly homework will be assigned each Tuesday (visible on Canvas one day earlier) and will be due the following Tuesday at midnight. You can only submit a homework to Canvas once, so check your answers before submitting. Homework will be submitted as a zip file (PDF report, including tables and figures) and as code in a GitHub repository. There is no final project, midterm, or final exam. Every quiz, article summary homework, and programming assignment has equal weight. Plus or minus grades will be assigned consistent with standard University practice. A grade of I will not be given to avoid a grade of F or to give additional study time. Failure to process a course drop will result in a course grade of F. If the scores are curved, the letter grades will be assigned after curving the numerical score. Homework must be received on time and uploaded to Canvas.

Grading Scale and Grading Policies

Quizzes will count for 40% of the grade. Homework will count for the remaining 60%. All quizzes will be taken in class and will be unannounced. Therefore, it is to your advantage to how up at every lesson. There will be no opportunity to catch up on a quiz, unless you have a doctor or faculty note justifying your absence. Each quiz will have 23 questions that are either True/False, multiple choice, or might require you to answer a question about what a short code snippet is accomplishing. The reason for these quizzes is to evaluate knowledge and to ensure that AI is used to learn and not simply to copy.

Letter Grade	Percentage
A	95% to 100%
A-	90% to < 95%
B+	87% to < 90%
B	84% to < 87%
B-	80% to <84%
C+	75% to <80%

Letter Grade	Percentage
C	70% to <75%
C-	65% to <70%
D	60% to < 65%
F	0% to < 60%

University Policies

University Attendance Policy

Excused absences include documented illness, deaths in the family, and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid written excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of student's academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to ". . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/academic-resources/academic-integrity-and-grievances/academic-honor-policy>)

Americans With Disabilities Act

FSU is committed to providing reasonable accommodation for all persons with disabilities in a manner that is consistent with the academic standards of the course while empowering the student to meet the integral requirements of the course. Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Office of Accessibility Services; and (2) request a letter from the Office of Accessibility Services to be sent to the

instructor indicating the need for accommodation and what type; and (3) meet (in person, via phone, email, zoom, etc...) with each instructor to whom a letter of accommodation was sent to review approved accommodations. Please note that instructors are not allowed to provide classroom accommodations to a student until appropriate verification from the Office of Accessibility Services has been provided. This syllabus and other class materials are available in an alternative format upon request. For the latest version of this statement and more information about services available to FSU students with disabilities, contact the:

Office of Accessibility Services
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
oas@fsu.edu
<https://dsst.fsu.edu/oas>

Academic Success

Your academic success is a top priority for Florida State University. University resources to help you succeed include tutoring centers, computer labs, counseling and health services, and services for designated groups, such as veterans and students with disabilities. The following information is not exhaustive, so please check with your advisor or the Department of Student Support and Transitions to learn more.

CONFIDENTIAL CAMPUS RESOURCES:

Various centers and programs are available to assist students with navigating stressors that might impact academic success. These include the following:

Victim Advocate Program

University Center A, Rm. 4100

(850) 644-7161

Available 24/7/365

Office Hours: M-F 8-5

<https://dsst.fsu.edu/vap>

Counseling and Psychological Services (CAPS)

Florida State University's Counseling and Psychological Services (CAPS) primary mission is to address psychological needs and personal concerns, which may interfere with students' academic progress, social development, and emotional well-being. The following in-person and virtual (tele-mental health) services are available to all enrolled students residing in the state of Florida:

1. Individual therapy
2. Group therapy
3. Crisis Intervention
4. Psychoeducational and outreach programming
5. After hours crisis-hotline
6. Access to community providers for specialized treatment

Call 850-644-TALK (8255) for more information on how to initiate services.

Counseling and Psychological Services

250 Askew Student Life Center

942 Learning Way

(850) 644-TALK (8255)

Walk-in and Appointment Hours:

M-F 8 am – 4 pm

<https://counseling.fsu.edu/>

University Health Services

The mission of University Health Services (UHS) is to promote and improve the overall health and well-being of FSU students. UHS provides a coordinated continuum of care through prevention, intervention, and treatment. Services include general medical care, priority care, gynecological services, physicals, allergy injection clinic, immunizations, diagnostic imaging, physical therapy, and

a medical response unit. The Center for Health Advocacy and Wellness (CHAW) assists students in their academic success through individual, group, and population-based health and wellness initiatives. Topics include wellness, alcohol and other drugs, hazing prevention, nutrition and body image, sexual health, and power based personal violence prevention. For more information, go to uhs.fsu.edu.

University Health Services

Health and Wellness Center

960 Learning Way

Tallahassee, FL 32306

Hours: M-F, 8 am – 4 pm

(850) 644-6230

<https://uhs.fsu.edu/>

Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation statement, this syllabus is a guide for the course and is subject to change with advance notice.

Free Tutoring from FSU

On-campus tutoring and writing assistance is available for many courses at Florida State University. A comprehensive list of on-campus tutoring options is available at **tutoring.fsu.edu** (<https://tutoring.fsu.edu>). High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

Canvas Support Statement

Canvas works best with Chrome or Firefox browsers. If you use Safari and notice issues on either your mobile or desktop devices, please switch to Chrome or Firefox.

Need help with Canvas?

FSU Canvas Support

Office of Digital Learning and Academic Technology

Email: canvas@fsu.edu

Phone: (850) 644-8004

Website: support.canvas.fsu.edu

Hours: 8am to 5pm, Monday - Friday