CS3451-A Syllabus

Computer Graphics, Section A, 3 Credits

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Instructor Information

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General Course Information

Description

CS3451 offers a comprehensive introduction to the mathematical and programmatic foundations of computer graphics. The course covers mathematical foundations, the GPU pipeline, shape representation, procedural modeling, physically based simulation, character animation, shading, lighting, texturing, and realistic ray-tracing rendering. Coursework includes programming assignments, in-class quizzes, and a final project in which students build interactive applications and create visually impressive images and animations using OpenGL and a modern GPU rendering pipeline.

Course Learning Outcomes

By the end of the course, students will be able to:

Explain the mathematical and programmatic foundations of modern computer graphics.

Implement interactive graphics applications using OpenGL, GLSL, and the modern GPU rendering pipeline.

Apply core concepts including mesh representation, geometric transformations, shading, texturing, noise, ray tracing, and animation.

Develop visually compelling and technically correct graphics assignments and projects with both creativity and implementation quality.

Communicate and demonstrate graphics work clearly in quizzes, project milestones, demos, and class sharing activities.

Required Course Materials

The required textbook is "Fundamentals of Computer Graphics" by Shirley and Marschner, 3rd edition or newer. Students will also use course-provided starter code, Canvas materials, the course GitHub repository at https://github.com/cg-gatech/cs3451, and Ed Discussion for course communication.

Grading Policy

Grades are based on the following tentative breakdown:

Assignments: 64% (eight programming assignments, 8% each)

Quizzes: 16% (two quizzes, 8% each)

Final Project: 16%

Presentation participation / creative sharing: 4%

Description of Graded Components

Programming assignments emphasize implementation using OpenGL, GLSL, and modern graphics pipelines. Quizzes assess conceptual and mathematical understanding. The final project gives students an opportunity to build a more substantial graphics system or visual experience. Presentation participation recognizes in-class sharing, demo participation, and engagement with course creative activities.

Attendance and Participation

Regular attendance and participation are strongly encouraged. Because the course builds progressively across technical and visual topics, students are responsible for keeping up with lectures, course announcements, and deadlines whether or not they are present in class.

Course Topics and Tentative Schedule

The course progresses from graphics foundations to rendering, appearance, geometry processing, animation, and advanced topics. The tentative schedule is:

Week 1: Introduction; GPU Rendering Pipeline; HW1 (A Story-telling Canvas) released.

Week 2: GLSL Programming; Mesh foundations.

Week 3: Mesh data structures; Loop subdivision; HW1 due; HW2 released.

Week 4: Homogeneous coordinates; composite transformations.

Week 5: 3D transformations and camera; HW2 due; HW3 released; Lambertian shading.

Week 6: Phong shading; texture introduction; HW4 released; HW3 due.

Week 7: UV coordinates and displacement mapping; Noise I; practice problems posted; HW5 released.

Week 8: Review session; HW4 due.

Week 9: Quiz I; Noise II.

Week 10: Noise III; HW5 due; HW6 released; Ray Tracing I.

Week 11: Ray Tracing II and III; HW6 due; HW7 released.

Week 12: Animation I and II; practice problems posted; HW8 released.

Week 13: Review session; Quiz II.

Week 14: Animation III; HW7 due; Final Project released; Advanced Topics I.

Week 15: Advanced Topics II; Thanksgiving break.

Week 16: Graphics in the Era of AI; HW8 due.

Final Week: Final Project due.

Office hours and TA support are provided through regularly scheduled sessions announced on Canvas.

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USG Required Course Policies

Attendance and/or Participation

Regular attendance and participation are strongly encouraged. Because the course builds progressively across technical and visual topics, students are responsible for keeping up with lectures, course announcements, and deadlines whether or not they are present in class.

Academic Integrity

You are expected to follow Georgia Tech's Academic Honor Code and Student Code of Conduct. It is fine to discuss high-level project ideas with other students, but you must write all submitted code yourself. You must not use code from the web, GitHub, AI models such as ChatGPT or Copilot, tutorials, videos, or other students, except for starter code explicitly provided by the instructor. Do not share your code with other students or post course code publicly.

Core IMPACTS

Not applicable.

Additional Georgia Tech Required Policies

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to discuss your needs and obtain an accommodations letter. Please also email the instructor as early as possible so appropriate support can be arranged.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations Agreement articulates some basic expectations that you can have of me and that I have of you. Respect for knowledge, hard work, and cordial interactions will help build the learning environment we seek in this class.

Course Expectations, Policies, and Resources

Pre- and/or Co-Requisites

This course assumes an understanding of multivariable calculus and linear algebra. Experience with programming is expected. Familiarity with graphics is helpful but not required.

Collaboration, Group Work, and Use of Generative AI

Students may discuss high-level concepts with classmates, but submitted work must be completed independently unless the instructor explicitly authorizes collaboration for a specific activity.

Generative AI tools may be used only for up to two Creative Expression assignments. For those permitted uses, students must demonstrate their own creative contribution, comment code sections generated with AI, submit the prompts used, and share a short reflection describing how AI was used as a creative partner. Outside of those designated Creative Expression assignments, AI tools may be used only as study aids and may not be used to generate code for programming assignments, quizzes, or projects.

Extensions, Late Assignments, and Missed Work

Each student is allotted seven late days for assignments. Late days do not apply to quizzes or the final project. Students should indicate in the Canvas submission comments when a late day is being used. Requests beyond the allotted late days require instructor approval. Submissions only a few minutes after midnight will generally not be treated as late if they fall within a reasonable grace period.

Course Websites and Resources

Course materials are distributed through Canvas. Starter code is available through the course GitHub repository at https://github.com/cg-gatech/cs3451. Ed Discussion is used for class discussion and sharing of work.