SJSU SAN JOSÉ STATE UNIVERSITY

College of Science · Computer Science

Introduction to Computer Graphics

CS 116A

Fall 2026 Section 01 In Person 3 Unit(s) 08/19/2026 to 12/07/2026 Modified 08/19/2026

Contact Information

Instructor: Kevin M. Smith
Office Location: DH282
Email: kevin.smith@sjsu.edu
Office Hours: Wednesdays 1:00-2:00 DH282
Class Days/Time: MW 9:00AM-10:15AM
Classroom: DH 250
Prerequisites: Math 31 or 31X, Math 39, CS146

Course Overview
In this course, you will learn the basic elements of computer image generation using a computer. This will include the fundamentals of 2D and 3D viewing, the graphics pipeline and the generation of 3D objects in the scene, including geometric constructions, shading, texturing, lighting and ray tracing. The course is both theoretical and project based so you will learn how to create images by writing your own code in C++. This course is designed to provide you with the basic knowledge to prepare you for more advanced study in animation, visual effects and real-time computer graphics.

The course description below is from the catalog...

Course Description and Requisites

Vector geometry, geometric transformations and the graphics pipeline. Basic raster graphics algorithms for drawing discrete lines, clipping, visible surface determination and shading. Display of curves and surfaces. Graphics data structures.

Prerequisite(s): MATH 31 or MATH 31X, MATH 39, CS 146 (with a grade of "C-" or better in each) and previous programming experience in C/C++; Allowed Majors: Computer Science, Data Science, Software Engineering or Applied/Computational Math or instructor's consent.

Letter Graded

Classroom Protocols

Laptops are permitted in class only for notetaking, viewing lecture slides and labs only.

Cellphones are not permitted to be used in class unless for SJSU system authentication.

If you come late or are required to leave during the lecture, please enter at rear of classoom and use the seats in back.

Program Information

Diversity Statement - At SJSU, it is important to create a safe learning environment where we can explore, learn, and grow together. We strive to build a diverse, equitable, inclusive culture that values, encourages, and supports students from all backgrounds and experiences.

Course Learning Outcomes (CLOs)

Upon successful completion of this course, students will be able to:
1: Describe how 3D computer graphics images are generated both in principle and practice.
2: Be able to implement computer graphics agorithims for rendering and basic animation.
3: Implement a working ray tracer.
4: Have an in in-depth understanding of the field of Computer Graphics in order to pursue further study or industry experience in modeling, animation, visual effects or games development

Course Materials

Required Texts/Readings

Textbook
The following textbook is required for the class:
Steve Marschner and Peter Shirley, Fundamentals of Computer Graphics (Fourth Edition).

Computer
Students will be required to have access to a modern capable laptop or desktop computer running recent version of Windows or macOS. In addition to a computer, a three-button mouse is required for the programming assignments.

The class materials (including any lecture slides, notes, videos and PDF files) are protected by copyright. It is illegal to copy or distribute the class materials without permission from the instructor There is no photography allowed (including mobile phone cameras) or recording of the lectures permitted.

Course Requirements and Assignments

This is a project-oriented class. The final grade is weighted based on these percentages:

1. Development Projects (50%)

Students will complete a series of development projects involving the use of C++ and/or production tools covered in the class. The projects will be specified on Canvas.

2. Presentations (5%)

Students will be required to give two (2) in-class presentations on one of their homework projects.

3. Mid-Term Exam (20%)

The mid-term exam with theoretical closed-book exam on paper given in class.

4. Final Project (25%)

The student final project will be comprehensive prototype that will leverage concepts learned and components from pervious assignments. A final presentation will be given on final exam day.

Projects

For “Development Projects”” specified in (1) above, students will complete a series of sequential programming projects that will be assigned during the semester. Most of the projects will be dependent on the previous and the final project will be the culmination of the previous projects, therefore, it is required that all projects be completed to be successful in the course. Students will post either a still frame or video of the project on the Google Class Community Page. Instructions for posting will be provided on Canvas.

Final Project

There is no final exam. The student will be required to submit a final project which demonstrates comprehensive knowledge learned in the class. This will included a recorded presentation and prototype.

Gallery

A Google Gallery will be provided for the course where students will be required post a movie of their assignments (or still images, depending on the assignment) in a web Gallery.

AI Policy

LLM-assisted programming will be used for most of the software projects. In these cases, students will be required to provide citations fon generated-code, an export of the prompts used and a specification written by the student on how the code works. Assignments may differ in how AI is used.

Grading Information

Criteria

The grading criteria for development projects is based on:

1) completion of required functionality

2) robustness of required functionality

3) quality of deliverables which includes quality of code any an required documentation or assets that to be included with the project.

Breakdown

94% or above A

90% A-

87% B+

83% B

80% B-

77% C+

73% C

70% C-

67% D+

63% D

60% D-

< 60% F

Note: there is no "rounding" of numercial grades to letter grades. For example, if your final grade in Canvas is 93.9%, you will receive an A-.

Late Work

Take-home exams and labs will not be accepted late after the deadline. Projects will be accepted late with a 10% reduction in grade per day late up to a maximum of three days. After three days, it will not be accepted.

University Policies

Per University Policy S16-9 (PDF) (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on the Syllabus Information (https://www.sjsu.edu/curriculum/courses/syllabus-info.php) web page. Make sure to visit this page to review and be aware of these university policies and resources.

Course Schedule

The following schedule is tentative and subject to change

When	Topic	Notes
Lecture Week 1 08/19/2026 10:30 AM - 11:45 AM	Introduction	We will be covering the syllabus an introduction to the topic and development systems used.
Lecture Week 2 08/24/2026 10:30 AM - 11:45 AM	Vector and Matrix Operations	We will be covering the basics of 2D and 3D vectors, rays and matrix operations required for 2D and 3D graphics with code examples
Lecture Week 3 08/31/2026 10:30 AM - 11:45 AM	2D and 3D Transformations, the 3D Camera and Viewing	Basic 2D and 3D matrix transformations and how a 3D camera works.
Lecture Week 4 09/07/2026 10:30 AM - 11:45 AM	Basic Ray Tracing	**No Class September 7 (Labor Day)**. September 9 - We will be covering the basic idea of ray tracing simple shapes. Contrast ray tracing with rasterization.

When	Topic	Notes
Lecture Week 5 09/14/2026 10:30 AM - 11:45 AM	Canonical Shapes and Intersections	Defining the canonical plane, sphere, box, cylinder and cone and their intersections.
Lecture Week 6 09/21/2026 10:30 AM - 11:45 AM	Shading and Lighting	Basic interaction of light with materials on a surface including shadows. Lambert and Blinn-Phong given as examples.
Lecture Week 7 09/28/2026 10:30 AM - 11:45 AM	Triangle Meshes	The construction of triangle polygon meshes, data structures and storage formats. Examples given.
Lecture Week 8 10/05/2026 10:30 AM - 11:45 AM	Rendering Triangles and Smooth Surfaces	Study of triangle intersection, normals, barycentric coordinates and shading.
Lecture Week 9 10/12/2026 10:30 AM - 11:45 AM	Review and Midterm Exam	Catchup and review of topics (October 12), **Midterm Day (October 14)**
Lecture Week 10 10/19/2026 10:30 AM - 11:45 AM	Acceleration Data Structures	How do we make rendering algorithms faster ? Bounding Volume Hierarchies, BVH, Octree, Surface Area Hueristic.
Lecture Week 11 10/26/2026 10:30 AM - 11:45 AM	Supersampling, Area Lights and Soft Shadows	Anti-aliasing rendered images with sampling techniques. Simulating area lights which generate soft shadows.

When	Topic	Notes
Lecture Week 12 11/02/2026 10:30 AM - 11:45 AM	Graphics Systems Architectures	Multi-threading, tiling and scene description. Progressive rendering techniques. (Demo of instructor's renderer).
Lecture Week 13 11/09/2026 10:30 AM - 11:45 AM	Image- Based Lighting	Nov 9 - Discussion of image-based lighting techniques and high dynamic range imaging with examples. **Nov 11 - No class (Veterans Day).**
Lecture Week 14 11/16/2026 10:30 AM - 11:45 AM	Physically Based Rendering	PBR materials simulate how light reacts with real materials like metal, wood glass etc.
Lecture Week 15 11/23/2026 10:30 AM - 11:45 AM	Transformation Hierarchies and Animation	Discuss basic computer animation techniques including hierarchical scene graph and key frame animation. **No class Nov 25.**
Lecture Week 16 11/30/2026 10:30 AM - 11:45 AM	Generative design and AI - assisted modeling/scene generation	Algorithms for generative computer graphics such as L-systems and using AI to build models and scenes.
Lecture Week 17 12/07/2026 10:30 AM - 11:45 AM	Open Topic or Make-up	Dec 7 - Last Day of Instruction