SJSU SAN JOSÉ STATE UNIVERSITY

College of Science · Computer Science

Introduction to Computer Graphics Section 01

CS 116A

Fall 2023   3 Unit(s)   08/21/2023 to 12/06/2023   Modified 08/22/2023

👤 Contact Information

Instructor: Kevin M. Smith
Office Location: DH282
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Office Hours: Tuesdays 10:30-11:30 (CS116A) Thursdays 10:30-11:30 (CS134)
Class Days/Time: Tues/Thurs 12:00-1:15
Classroom: Duncan Hall 450
Prerequisites: Math 31, Math 129A, CS146 and previous C or C++ experience recommended

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++. Computer Science or Software Engineering majors only, or instructor 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 animimation in C++
3: Implement a working ray tracer in C++.
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).

Software and 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 development projects for this class will be done in C++. Students will be required to download and install a development framework for their particular operating system including Visual Studio (Windows) or Xcode (macOS) and a C++ graphics development library (instructions will be provided on first day of class).

Software Packages
Students are required to use the following software packages for this course:
1. Visual Studio 2017 Free Community Version (PC) or Xcode (MAC)
2. Camtasia or SnagIt Video Capture Software (or equivalent)
3. Autodesk Maya (for creating your own 3D content) (free student version available)
4. SideFX Houdni (if time permits, for creating 3D content) (free Apprentice version available)
5. OpenFrameworks 0.11.X C++ Library (Open Source)
Camtasia or SnagIt will be used for creating videos of your assignments and projects.

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. Labs (10%)
There will be 4-5 labs which are designed to be completed in class that you will be assigned

3. Mid-Term Exam (10%)

The mid-term exam with be either a closed-book exam and/or a take-home problem.

4. Final Project (30%)
The student project will be comprehensive prototype that will leverage concepts learned and components from pervious assignments.

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.

✔ 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 numerical grades to letter grades. For example, if your final grade in Canvas is 93.9%, you will receive an A-.

🏛 University Policies

Per [University Policy S16-9 (PDF) (http://www.sjsu.edu/senate/docs/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)](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

Week Date Topics

1 8/22, 8/24 Introduction Polygonal Geometry and Meshes I
2 8/29, 8/31 Polygonal Geometry I (Cont'd)
3 9/5, 9/7 Polygonal Geometry II (Demo and Applications)
4 9/12. 9/14 Perspective Ray Tracing - Shading
5 9/19, 9/21 Ray Tracing - Interpolation Ray Tracing - Textures
6 9/26. 9/28 Transformations
7 10/3, 10/5 3D Viewing Graphics Pipeline
8 10/10 0/12 Review **Midterm Exam (Wednesday, October 12)**
9 10/16, 10/18 Graphics Pipeline
10 10/24, 10/25 Graphics Pipeline
11 11/7, 11/9 Hierarchical Animation
13 11/14, 11/16 Physics-Based Animation
14 11/21 Open Topic
    11/23 Non-instrunctional day (Thanksgiving Holiday)
15 11/28,11/30 **final project presentations**
16 12/5 **Final Project Due** (Last Day of Class)