San José State University
Department of Computer Science
CS116A, Introduction to Computer Graphics Section 1

Fall Semester, 2020

Course and Contact Information

Instructor:	Kevin M. Smith
Office Location:	DH 282 (Online for Fall 2020)
Email:	kevin.smith@sjsu.edu
Office Hours:	Mondays 4-5 PM (or by appointment)
Class Days/Time:	MW 1:30-2:45
Classroom:	Online for Fall 2020
Prerequisites:	Math 31, Math 129A, CS146 and previous C or C++ experience (or permission from the instructor)

Catalogue Description

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.

Course Description

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.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1: Understand how 3D computer graphics images are generated both in principle and practice.

2: Understand how to implement computer graphics algorithms in C++.

3: Have a basic understanding of the field of Computer Graphics to pursue further study or industry experience in modeling, animation, visual effects or games development.

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. It is preferable to have a machine with a GPU. 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 0.10.1 C++ Library (Open Source)

Camtasia or SnagIt will be used for creating videos of your assignments and projects.

Course Requirements and Assignments

It is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf.

1. Development Projects (60%)
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. Engagement (5%)
Students are expected to attend every class and be engaged. This component of the grade will be determined by quiz results and graded short in-class exercises or labs.

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 (25%)
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.   Some of the projects may be a "team" project where students can work together and present their results. 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

In lieu of a final exam, the student will be required to submit a final project which demonstrates comprehensive knowledge learned in the class.

Gallery

A Google Community will be provided for the course where students will be required post a movie of their assignments in a Gallery.

Academic Honesty

Students are required to produce their own work either individually or with a team member if the assignment is a team-based assignment. Each code source file, whether you work in a team or individually, must contain a header comment at the top of the file that includes the author's (the student's) name. It is recommended that when teams work together, the work is divided so that each team member works on different non-conflicting source files. If a source file is shared, then each team member must create signed comment block for the section of the code within that source file (ex: method or class) identifying their own work.

If you have to use any code or algorithms from sources outside of the class, you must include a citation for it in your work. It is expected that the vast majority of the work is your own original work and you will be graded on your contribution to the project not on cited code from external sources.

Grading Policy

No **make-up tests will be given and** *no* **late homework (or other work) will be accepted. If you are in doubt about the submission time for an assignment, it is better to submit it early.**

At least	Grade
97%	A+
93%	A
90%	A-
87%	B+
83%	B
80%	B-
77%	C+
72%	C
70%	C-
67%	D+
62%	D
60%	D-
<60%	F

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

Classroom Protocol

Class attendance is required to gain maximum benefit from the presented materials, presentations and discussion and it part of the *engagement* component of the grade.

Laptop are used for the in-class assignment/exercises and not permitted (including tablets) during the lecture part of the class.

Cell phones are generally not permitted to be used in class (including text messaging).

Since the material presented in class is copyrighted, there is no photography allowed (including mobile phone cameras). Copy of any of the course materials, including slides, images, data files and code is not permitted without permission from the instructor.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' **Syllabus Information web page** at http://www.sjsu.edu/gup/syllabusinfo/

CS116A, Computer Graphics, Course Schedule

This schedule is tentative and is subject to change. Due dates for assignments will be posted in Canvas and are generally due the following week after are assigned.

Course Schedule

Week	Date	Topics
1	8/19	Introduction
2	8/24, 8/26	Polygonal Geometry I (Triangle Meshes)
3	*8/31, 9/2	**Last Day to Drop** Polygonal Geometry II (Demo and Applications)
4	9/7, 9/9	**Labor Day (no Class)** Ray Tracing - Intersection
5	9/14. 9/16	Perspective Ray Tracing - Shading
6	9/21, 9/23	Ray Tracing - Interpolation Ray Tracing - Textures
7	9/28. 9/30	Transformations
8	10/5, 10/7	3D Viewing Graphics Pipeline
9	10/12 10/14	**Review** **Midterm Exam (Wednesday, October 16)**
10	10/19, 10/21	Graphics Pipeline
11	10/26, 10/28	Graphics Pipeline (OpenGL)
12	11/2,11/4	Basic Animation
13	11/9, 11/11	Hierarchical Animation **Veteran's Day (no Class)**
14	11/16. 11/18	Physics-Based Animation
15	11/23, 11/25	Case Studies – Visual Effects Development (Film)
16	11/30,12/7	Open Topic/Review
17	12/7	**Final Project Due (Last Day of Class)**