San Jose State University
Department of Computer Science
CS116B, Advanced Computer Graphics

Spring Semester 2020

Course and Contact Information

Instructor:	Kevin Smith
Office Location:	DH 282
Email:	kevin.smith@sjsu.edu
Office Hours:	Wednesday 2:00-3:30 PM or by appointment
Class Days/Time:	MW 12:00-13:15
Classroom:	MH 223
Prerequisites:	CS 116A (with grade of C- or better) or instructor consent

Catalogue Description

In-depth discussion of algorithms and techniques used in computer graphics and their implementation. Topics include: animation, fractals, anti-aliasing, fill algorithms, visible surface algorithms, color and shading, ray tracing, radiosity and texture maps. Substantial programming required.

Course Description

In this course, you will learn the apply the foundations you learned in CS 116A towards learning and applying modern graphics techniques used today in the media and entertainment industry. Topics will include advanced rendering including global illumination, subdivision surfaces, physics-based animation such and particle and dynamics systems and advanced character animation including skin/muscle deformations. Course will focus on study of existing tools and custom software development.

Course Learning Outcomes (CLO)

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

1: Learn advanced rendering concepts using a commercial renderer as a case study.

2: Learn how to develop physics-based animation systems used in many films and games.

3: Learn theory and techniques for developing realistic computer-generated characters.

4: Gain some experience using industry standard tools used in production.

Required Texts/Readings

Textbooks

Matt Phar, Wenzel Jakob, Greg Humphries, *Physically Based Rendering – Third Edition* (available online)
Rick Parent, *Computer Animation – Third 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. Adobe Photoshop CC or equivalent open software package such as GIMP
3. Camtasia or SnagIt Video Capture Software (or equivalent)
4. Autodesk Maya or Maxon Cinema 4D (free student version available)
5. SideFX Houdini Apprentice (free version available)
6. OpenFrameworks 0.10.0 C++ Library (Open Source)
7. PBRT (open source companion rendered to the text book)

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 (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. Engagement (10%)
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.

3. Mid-Term Exam (15%)
The student will be required to take a closed book mid-term exam which will cover material presented in class and the reading material assigned and/or a take-home programming problem.

4. Final Project (25%)
The student project will be comprehensive game prototype that will leverage concepts learned and components from pervious assignments.

Projects

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 students 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 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 (exams and quizzes) will be given and *no* **late work will be accepted**. This includes: homework, projects, videos, in-class exercises or any other work related to the class. If an exam or work is missed or late, it will be graded as a "0". 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.

Laptops are permitted to be used in class only for activities pertaining to this class (this can include taking notes).

Cell phones are not permitted to be used in class.

Please be courteous and minimize any classroom distractions which may affect the learning environment including conversation, eating, taking unnecessary breaks and coming to class late.

Students with special requirements should notify the instructor or contact the Accessible Education Department.

Since the material presented in class is copyrighted, there is no photography allowed (including mobile phone cameras).

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/

CS116B, Advanced 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, Readings, Assignments, Deadlines
1	1/27, 1/29	Introduction and Rendering Environment
2	2/3, 2/5	Advanced Modeling and Rendering I
3	2/10, 2/12	Advanced Modeling and Rendering II
4	2/17, 2/19	Advanced Modeling and Rendering III
5	2/24, 2/26	Advanced Modeling and Rendering IV
6	3/2, 3/4	Advance Modeling and Rendering V
7	3/9, 3/11	Physics-based Animation
8	3/16, 3/18	Physics-based Animation
9	3/23 3/25	**Review** **Midterm Exam (Wednesday, March 25)**
10	3/30-4/3	**Spring Recess**
11	4/6, 4/8	Character Modeling and Animation I
12	4/13,4/15	Character Modeling and Animation II
13	4/20, 4/22	Character Modeling and Animation III
14	4/27, 4/29	Real-Time Rendering - Game Engine Case Study
15	5/4, 5/6	Open Topic
16	5/11	**Open Topic or Review**
17	5/18	**Final Project Due(Presentations Held on Day of Final)**