

# CSc 165 - Computer Game Architecture and Implementation - Spring 2024

## Syllabus

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|---|--|
| <b><u>Instructor</u></b><br>V. Scott Gordon<br><a href="http://athena.ecs.csus.edu/~gordonvs">http://athena.ecs.csus.edu/~gordonvs</a><br>gordonvs@csus.edu | <b><u>Office Hours</u></b><br>(RVR-5040)<br>Mon 1-2<br>Fri 12-2                  |
| <b>Section 1</b><br><b>MWF</b> 2:00-2:50pm<br>Game Demos: Wed May 15, 12:45-2:45pm  | <b>Section 2</b><br><b>MW</b> 3:00-4:15pm<br>Game Demos: Mon May 13, 3:00-5:00pm |

### Course Overview:

Architecture and implementation of computer game systems. Topics include: game engine architecture; real-time interactive 3D graphics; input handling; screen and rendering management; lighting; camera control; modeling and model animation; scenegraph organization and processing; AI for non-player characters; physics engines; spatial sound; multi-player games and related networking protocols; texture mapping; scripting; skybox and terrain modeling.

The main objectives of the course are for students to learn about the architecture of modern computer video games and the game engines on which they are built. Along the way, students will also learn some of the fundamentals of 3D graphics, and will build some game engine components and a simple 3D game of their own choosing using a simple game engine.

For programming we will be using Java, TAGE, OpenGL, JOGL, JOML, JBullet, JInput, and JOAL.

### Required Textbook:

There is no required textbook in this course. However, there will be a substantial amount of material disseminated in class that students will need to study thoroughly.

### Prerequisites:

CSc-130, CSc-133, Math-30 or Math-26A, and Physics-11A or Physics-5A, each with a grade of C- or better. Students without prior Java experience should see the instructor.

The instructor will review every student's course history to ensure that prerequisites have been met. It is the students' responsibility to discuss any questions or unusual situations regarding prerequisites with the instructor during the first week of class, or face being administratively dropped from the course.

### Important Dates:

|                |                                       |              |
|----------------|---------------------------------------|--------------|
| Wed March 13   | Midterm Exam                          |              |
| March 18-22    | Spring Break (no classes)             |              |
| Monday April 1 | Cesar Chavez Day (no classes)         |              |
| Wed May 8      | Final Exams                           |              |
| Mon May 13     | Game demos (section 2) 03:00 - 5:00pm | } Game Demos |
| Wed May 15     | Game demos (section 1) 12:45 - 2:45pm |              |

### Course Modality – IN PERSON:

- All class meetings will be held in RVR-5029.
- Some supplemental videos will be posted in Canvas. Students will be expected to watch them as directed.
- The instructor is having a surgical procedure during week #1, on Tuesday January 23. Therefore, class on January 24, and possibly January 26, may be conducted online or via offline video.

## Coursework:

- Lecture:** ✓ The proposed outline of material to be covered appears in the course schedule below.  
✓ Students are expected to attend all class meetings, and watch all supplemental videos.
- Labs:** ✓ There will be three programming assignments, which will be turned in, and will be graded.  
✓ The first two assignments will be individual, and then the third may be done in groups of two.  
✓ The third assignment is the final game project, and will require at least two milestone demos.  
✓ Students will demonstrate their final game projects during the regularly-scheduled final exam slot.
- Exams:** ✓ There will be a *midterm* during week 8 and a *comprehensive final exam* during the last week of instruction.  
✓ Each exam will include material covered in lecture and related material in the homework assignments.

## Grading:

Coursework and exams will all factor into a student's grade, weighted as follows:

|               |                |
|---------------|----------------|
| Lab #1 and #2 | 20% (10% each) |
| Game Project  | 50%            |
| Midterm       | 10%            |
| Final Exam    | 20%            |

A final percentage will be calculated according to the above criteria. It will then be rounded to the nearest integer value. Then, two grades will be assigned: first, a straight percentage grade according to the following scale:

|        |    |          |    |
|--------|----|----------|----|
| 93-100 | A  | 73-76    | C  |
| 90-92  | A- | 70-72    | C- |
| 87-89  | B+ | 67-69    | D+ |
| 83-86  | B  | 63-66    | D  |
| 80-82  | B- | 60-62    | D- |
| 77-79  | C+ | below 60 | F  |

The second grade assigned will be based on a curve of the final point scores of all students.

The final grade will be the higher of the two assigned grades.

That is, the percentage scale listed above is the *minimum* grade that a student will receive based on his/her percentage.

## Health & Safety Information:

If you are sick, notify your instructor. If you are experiencing any COVID- like symptoms (fever, cough, sore throat, muscle aches, loss of smell or taste, nausea, diarrhea, or headache) or have had exposure to someone who has tested positive for COVID contact Student Health & Counseling Services (SHCS) at 916-278-6461 to receive guidance and/or medical care.

Sacramento State University maintains an information portal with COVID-19 related resources for students at: <https://www.csus.edu/student-affairs/emergency-student-information/>. The CDC provides a good source of information regarding COVID-19 at: <https://www.cdc.gov/coronavirus/2019-ncov/index.html>

If you are experiencing challenges with food, housing, financial or other unique circumstances that are impacting your education, the CARES office provides case management support for any enrolled student. Email the CARES office at [cares@csus.edu](mailto:cares@csus.edu) to speak with a case manager about the resources available to you. Check out the CARES website at <https://www.csus.edu/student-affairs/crisis-assistance-resource-education-support/>

## Student Conduct:

The use of externally produced 3D graphics source material is a part of this course. Therefore, it is every student's obligation to do so ETHICALLY and LEGALLY. Therefore, there are special requirements in this course with respect to the use of models, images, and code that go beyond most other Computer Science courses.

CSc-165 requires students to write computer programs of large size and complexity. Students will also be required to do some original research, create and/or use stored 3D models, texture image files, sound files, and height map images. Many such files are posted on the web, most of which are copyrighted, some posted legally and some posted illegally. The illegal distribution of copyrighted material is a problem in the graphics industry, and this topic forms an important ethical component of CSc-165.

When submitting solutions to assigned homework projects, unless stated clearly on the assignment specifications, you must only submit code modules, images, sounds, and/or models that were created by you. In those instances where the posted specifications allow for the use of code, images, sounds, and/or models that were created by someone else, you **MUST** provide evidence in your submission – in the manner required in the assignment specifications – that permission to use each such item has in fact been obtained. Or, you must provide clear evidence that the item is in the public domain.

Submitting any project that fails to meet the above requirement, such as including an image, sound, or model that you did not create, or that you didn't provide evidence of permission to use, will be required to be resubmitted, correcting this error without any other modification to the original submission, and incurring a late penalty. Egregious cases, such as fraudulently claiming that an item is in the public domain when it is not, or claiming that you created a model, sound, or image that in fact was created by someone else, will be reported to the campus ethics officer.

In addition to the above, students are expected to behave ethically as expected in all programming courses and university courses in general. You need to know that I have in the past, and will in the future, strongly penalize anyone caught cheating or inappropriately obtaining or sharing work, whether on an exam or in a project.

When a few students cheat, it hurts (and frustrates) the majority of hard-working honest students. Not only can it skew grades, it can affect the reputation of your hard-earned degree. Thus, I hope that you understand that any efforts to reduce and/or penalize cheating is done **entirely for your benefit**.

Inappropriately sharing work includes, in addition to the scenarios already described above, copying files (electronically or manually) or code used in the solution of an assigned exercise (completely or partially), or copying written solutions to other exercises or problems assigned in projects, homeworks, quizzes, or exams. The penalty for inappropriate sharing or copying can vary depending on the severity, but generally includes a reduction in score (or zero) on the assignment, and/or reduction in course grade, and/or a failing grade in the course. In every case, however minor, the incident is reported to the campus student ethics officer for review. This is required by University student conduct procedures, Article IVa:

<https://www.csus.edu/student-affairs/internal/documents/vp-student-conduct-procedures.pdf>

Severe or repeat offenses may also result in administrative sanction beyond the instructor's control.

*Your instructor reported **six** such cases in Spring 2023.*

*All of them resulted in students failing the course.*

The University has a comprehensive website containing university policies regarding student conduct:

<https://www.csus.edu/student-affairs/student-conduct/>

All students are expected to read, understand, and abide by all university conduct expectations.

I have and will continue to follow its procedures exactly.

NOTE: If at any time you are unsure whether or not you might be "crossing the line" and working too closely with someone, or if you think you may have appropriated too much information from the web or other sources, please ask your instructor. Such thoughtful action on your part will be greatly appreciated and is likely to result in more lenient consideration. Taking charge of one's own academic integrity is part of becoming a professional, so **come see me before I come to see you**.

## Attendance:

Attendance is taken during the first two weeks, to assess availability and priority for students wishing to add the class. Attendance is also taken during exams and game demos. It is only during game demos that attendance may count towards the course grade. However, active participation in the class meetings is always important for success in the course.

During finals week, we will use our regularly-scheduled final exam slot for students to demonstrate their game projects. This is traditionally called the “game party”.

Your instructor asks that you keep in mind that these are trying times, and this is a hard class. Everyone is facing hardships and challenges. Try to bring a positive, respectful, encouraging, empathetic, and inclusive attitude and together we can create an engaging, challenging, and exciting experience for everyone! I look forward to working with all of you.

## Course Schedule

| Week | Dates             | Chapter | Topics   | Notes                        |
|------|-------------------|---------|--|------------------------------|
| 1    | Jan 22, 24, 26    | 0, 1    | overview, 2D transform/matrices, Game elements/engines<br>(videos provided for January 24 – modality for January 26 TBA) | Jan 24 & 26<br>may be remote |
| 2    | Jan 29, 31, Feb 2 | 2       | Input Handling, Input Controllers, Event Processing, HUDs  |                              |
| 3    | Feb 5, 7, 9       | 3       | 3D Coordinates, Models, Transforms, Projections, Lighting  |                              |
| 4    | Feb 12, 14, 16    | 4       | Camera Control, 1P vs. 3P, Chase/Orbit, Viewports  | HW#1 due                     |
| 5    | Feb 19, 21, 23    | 5       | Display Modes, FSEM, Rendering   |                              |
| 6    | Feb 26, 28, Mar 1 | 6, 7    | Scenegraphs, Node Controllers, Scripting   |                              |
| 7    | Mar 4, 6, 8       | 8       | Networked multi-Player games, Application Protocols  | HW#2 due                     |
| 8    | Mar 11, 13, 15    | 9       | Game World (textures, skyboxes, visibility, etc.)  | Midterm Exam<br>Wed. Mar 13  |
|      | Mar 18-22         |         | Spring Break (no classes)  |                              |
| 9    | Mar 25, 27, 29    | 10      | Terrain algorithms and tools   |                              |
| 10   | Apr 3, 5          | 11      | Modeling and Modeling Tools  | Cesar Chavez Day<br>Apr 1    |
| 11   | Apr 8, 10, 12     | 12      | Animated Models, Skeletons, Keyframes  | milestone #1                 |
| 12   | Apr 15, 17, 19    | 13      | Physics Engines, Collisions  |                              |
| 13   | Apr 22, 24, 26    | 14      | NPCs, AI, Behavior Trees   |                              |
| 14   | Apr 29, May 1, 3  | 15      | 3D Sound, OpenAL, JOAL, final exam prep  | milestone #2                 |
| 15   | May 6, 8, 10      |         | presentation prep, final exam, early game demos  | Final Exam                   |
|      | May 13, 15        |         | Finals Week -- sec.1: Wed 12:45pm, sec.2: Mon 3:00pm   | Game Party!                  |