CSc 155 – Advanced Compter Graphics - Spring 2024
Syllabus

Instructor	**Office Hours**
V. Scott Gordon http://athena.ecs.csus.edu/~gordonvs gordonvs@csus.edu	*(RVR-5040)* Mon 1-2 Fri 12-2

Section 1	**Section 2**
MWF 10:00-10:50am	MWF 11:00-11:50pm

Course Overview:

Real-time rendering techniques for modern 3D computer graphics systems. Topics include mathematical foundations of 3D graphics such as parametric surface representation and 3D transformations, the synthetic camera paradigm, hidden surface removal, managing 3D graphics data, building and using 3D models, 2D and 3D texture mapping, lighting and materials, shadows, cube maps and skydomes, techniques for terrain generation, normal mapping, bump mapping, height mapping, tessellation and geometry shaders, atmospheric effects such as fog and clouds, simulating water, compositing, generating and applying 3D noise, 3D animation, ray tracing, anaglyph and side-by-side stereoscopy, and performance issues such as controlling level of detail. Emphasis on hardware support and shader pipeline programming.

We will be doing our work in OpenGL 4.3+ and GLSL. Students may use Java or C++, but lectures will all be in Java.

Apple support for OpenGL is poor. The latest version available for Mac is still 4.1, which will probably work for most of our assignments, but is missing a few features that we may use. Consult the textbook for more information about using a Mac.

Required Textbook:

Computer Graphics Programming in OpenGL with Java, 3rd Edition, by Gordon and Clevenger. Mercury Learning, 2021.
We will also make heavy use of the ancillary materials provided with the textbook on the accompanying CD. If you purchased an electronic copy of the book, obtain the ancillary materials by emailing the publisher (Mercury Learning).

This textbook is REQUIRED, and we will be making HEAVY use of it, as well as its accompanying ancillary materials. Also, make sure and get the 3rd EDITION - earlier editions won't be adequate.

Although lectures will be in Java, students who wish to work in C++ may instead purchase the equivalent C++ textbook:
Computer Graphics Programming in OpenGL with C++, 2nd Edition, by Gordon and Clevenger. Mercury Learning, 2020.
(if using the C++ edition, make sure and get the 2nd Edition – earlier editions won't be adequate).

Recommended Supplementary Textbook:

OpenGL SuperBible (6th or 7th Edition) by Sellers, Wright, Haemel, Addison-Wesley, 2013/2015.
(if you get this book, make sure you obtain the SIXTH or SEVENTH edition, as earlier editions will not be helpful)

Prerequisites:

The usual prerequisite is CSc-133, but that has been waived this semester. CSc-130 and CSc-131 are now required.
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.

Course Modality – IN PERSON:

- All class meetings will be held in RVR-5029.
- Supplemental lecture videos will be posted most weeks, on Canvas.
- 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.

Important Dates:

Wed March 13	Midterm Exam
March 18-22	Spring Break (no classes)
Monday April 1	Cesar Chavez Day (no classes)
Monday May 13	Final Exam (section 2) 10:15am
Tuesday May 14	Final Exam (section 1) 08:00am

Coursework:

Lecture: ✓ Students are expected to attend all class meetings, and watch all assigned lecture videos.
✓ There may be important material that is covered in the videos that is not covered in lecture.

Labs: ✓ There will be four (4) programming assignments ("labs"), which will be turned in, and will be graded.
✓ Labs can be turned in up to 24 hours after the deadline (w/10% penalty). After that, they are not accepted.

Exams: ✓ There will be a *midterm* during week 8 and a *comprehensive final exam* during finals week.
✓ Each exam will include material covered in lecture, videos, and in the homework assignments.

Grading:

Labs	60% (15% each)
Midterm	20%
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 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-155 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, 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-155.

When submitting solutions to assigned homework projects, unless stated clearly on the assignment specifications, you must only submit code modules, images, and/or models that were created by you. In those instances where the posted specifications allow for the use of code, images, 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 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 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 will never count towards the course grade. However, active participation in the class meetings is always important for success in the course.

Course Schedule

Week	Dates	Chapter	Topics	Notes
1	Jan 22, 24, 26	1	overview, 2D coord. systems, 2D affine transforms *(videos provided for January 24 – modality for January 26 TBA)*	*Jan 24 & 26 may be remote*
2	Jan 29, 31, Feb 2	2	OpenGL/JOGL pipeline, GLSL language, error handling	
3	Feb 5, 7, 9	2,3	animation, 3D coord. systems, 3D matrix transforms	
4	Feb 12, 14, 16	3,4	model / view / perspective (MVP) matrices	Lab#1 due
5	Feb 19, 21, 23	4	buffers, vertex attributes, uniform variables, instancing	
6	Feb 26, 28, Mar 1	5, D	texture mapping, camera control	
7	Mar 4, 6, 8	6	procedural and external models, indexing	
8	Mar 11, 13, 15	7	ADS lighting (Gouraud, Phong, Blinn-Phong)	Midterm Exam Lab #2 due
	Mar 18-22		*Spring Break (no classes)*	
9	Mar 25, 27, 29	4,9	cube maps, skydomes, environment mapping, matrix stacks	
10	Apr 3, 5	8	shadows, percentage closer filtering (PCF)	**Cesar Chavez Day** Apr 1
11	Apr 8, 10, 12	10	bump mapping, normal mapping, height mapping	Lab #3 due
12	Apr 15, 17, 19	11,14	bezier surfaces, transparency	
13	Apr 22, 24, 26	12/13	TBA – tessellation and/or geometry shaders	
14	Apr 29, May 1, 3	16	ray tracing	
15	May 6, 8, 10		TBA – (e.g., noise, fog, water, stereoscopy)	Lab #4 due
	May 13, 14	Finals Week -- sec.1: Tues 8am, sec.2: Mon 10:15am		Final Exam