

REFERENCE ONLY

****Syllabus is subject to change****

****Students currently enrolled in this course should reference NYU Classes syllabus only****

CS4533 Interactive Computer Graphics

Fall 2020

Lectures: Wednesdays 11am–1:30pm
Classroom: 2 MTC Room 9.009
Course Web sites: <http://cse.poly.edu/cs653/> & NYU Classes

Instructor: Professor Yi-Jen Chiang
Office: 370 Jay Street, 1103 (11F)
Office Hours: Wednesdays 5pm–6pm (via Zoom meetings)
Phone & Email: (646) 997-3395; chiang@nyu.edu

Description: This course introduces the fundamentals of Computer Graphics with hands-on graphics programming experiences. Topics include: graphics software and hardware, 2D line-segment scan conversion, 3D transformations, viewing and projection, programmable shaders, polygon scan-conversion, hidden-surface removal, illumination and shading, compositing, texture mapping, effects of shadow, decal, lattice, fog, firework, etc, ray tracing and radiosity, and so on.

Graphics programming projects will be assigned using the academics and industry graphics standard *OpenGL*, compiled with the Microsoft Visual C++ under Windows, or on Mac OS or Linux. The first homework is a warm-up exercise to get started with *OpenGL* programming, and the remaining three homeworks put pieces together to form one course project, which is an animation system with various graphics effects. You will work on the programming homeworks on your own (laptop) computer (it needs to have a programmable GPU to support shader-based OpenGL (OpenGL 3.1 and above), which is usually the case).

Course Objectives:

- Hands-on programming skills for 3D computer graphics using shader-based OpenGL.
- Ability to understand and derive advanced transformations such as sphere rolling and shadow projection.
- Understanding shading and illumination.
- Understanding texture mapping and related techniques.
- Understanding techniques for producing effects of decal, lattice, fog, firework, etc.
- Ability to understand and program shaders on programmable GPU.

Prerequisites: CS 5403 (Data Structures) or equivalents, and knowledge of C/C++ programming.

Required Textbook: S. Gortler, *Foundations of 3D Computer Graphics*, The MIT Press, 2012.

Optional Recommended Textbook: E. Angel and D. Shreiner, *Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL*, 6th Edition, Addison-Wesley, 2011.

Recommended Reference: J. Kessenich, G. Sellers, and D. Shreiner, *OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V*, 9th Edition, Addison-Wesley, 2016.

Grading Distribution: Midterm Exam: 25%, Final Exam: 25%, 4 Programming Assignments (last three put pieces together to form one course project): 50%. (The total score of the 4 Assignments is 600 points; the sum of the 4 Assignment scores will be **divided by 5** and then multiplied by 50% for the overall score). The full score of the overall score typically **exceeds 100 points**, and the **final grades** are based on the **distribution of the overall scores** of the class.

Midterm and Final Exams: remote (synchronous), closed-book, with limited notes.

General Instructions for Programming Assignments: Submit your write-up, your source code (with full comments and documentation), and include brief instructions on how to compile and run your programs. Submit everything to NYU Classes of this course (if your write-up is hand-written, scan it into a PDF file to submit).

Note: You may discuss the programming assignments with other students currently taking the course, but **each write-up and program must be done individually and independently**, and you should show that you **personally understand everything that you submit**.

Sharing code, e.g., copying from others or Internet, allowing others to copy your code, making your code publicly accessible on the web (such as on Github), is Cheating. (See also **Policy on Academic Dishonesty** below.)

Policy for Late Assignment Submissions: There will be 10% off for each week passed from the deadline, i.e., the actual score is 90% of the raw score if you miss the deadline but are less than one week late, 80% of the raw score if your time of delay is more than one week but less than two weeks, and so on. (But no assignments will be accepted after the deadline of HW4.)

Policy on Academic Dishonesty:

First time: 0 point for the whole homework; second time: F for the course.

NYU School of Engineering Policy on Academic Dishonesty

See **Student Code of Conduct**:

<https://engineering.nyu.edu/sites/default/files/2018-06/code-conduct2-2-16.pdf>

Instruction Mode and Contingency Plan:

The instruction mode of this course is **Blended**. All lectures will be given by the professor in-person in the classroom, with a Zoom meeting turned on to enable remote students to participate synchronously (where they can interact in class). All lectures will be video-recorded, and all course materials (including the lecture videos) will be posted on-line at the course web sites, so remote students can also participate asynchronously. The office hours of the professor and of the TA will be conducted via Zoom meetings.

In the event of a quarantine or stay-at-home order for which the course must be switched to fully remote, it will be announced on NYU Classes (with an email sent out), and the lectures will be given by the professor remotely via Zoom meetings. Students will then participate remotely either synchronously or asynchronously.

Tentative Schedule (subject to change):

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| 1 | 9/2 | Motivations, Overview, Graphics Software and Hardware [Lecture Notes] |
| 2 | 9/9 | No Class (Monday Classes Meet) |
| 3 | 9/16 | 2D Line-Segment Scan Conversion; OpenGL Standard [Lecture Notes, Ch 1]
Assgn 1 given |
| 4 | 9/23 | 3D Transformations [Ch 2, 3, 4, Appendix B] |
| 5 | 9/30 | 3D Transformations [Ch 2, 3, 4, Appendix B];
Viewing & Projection [Ch 5, Lecture Notes] |
| 6 | 10/7 | Viewing & Projection [Ch 5, 10, 11, 12.1, Lecture Notes];
Programmable Shaders & Shader-Based OpenGL [Lecture Notes, Ch 1, 6, Appendix A]
Assgn 1 due; Assgn 2 given |
| 7 | 10/14 | Programmable Shaders & Shader-Based OpenGL [Lecture Notes, Ch 1, 6, Appendix A];
[Additional Reading: Appendix B, Ch 12, 13]
Polygon Scan-Conversion [Lecture Notes, Sec 12.4] |
| 8 | 10/21 | Midterm Exam |
| 9 | 10/28 | Hidden Surface Removal [Lecture Notes, Ch 11]; BSP Trees [Lecture Notes] |
| 10 | 11/4 | Illumination and Shading [Lecture Notes, Ch 14]
Assgn 2 due; Assgn 3 given |
| 11 | 11/11 | Illumination and Shading [Lecture Notes, Ch 14] |
| 12 | 11/18 | Illumination and Shading [Lecture Notes, Ch 14]; Compositing [Lecture Notes] |
| 13 | 11/25 | Compositing [Lecture Notes]; Textures [Lecture Notes, Ch 15].
Assgn 4 given
Assgn 3 due (Sun. 11/29 at 11:55pm) |
| 14 | 12/2 | Textures [Lecture Notes, Ch 15] |
| 15 | 12/9 | Ray Tracing and Radiosity [Lecture Notes, Ch 20] |
| 16 | 12/16 | Final Exam
Assgn 4 due (Sat. 12/19 at 11:55pm) |

Note: If you have two exams at the same time, **report the conflict to your professors as soon as possible. Do not make any travel plans until the exam schedule is finalized.**

Also, please pay attention to notable dates such as Add/Drop, Withdrawal, etc. For confirmation of dates or further information, please contact Susana M. Garcia-Henriquez at sgarcia@nyu.edu.

NYU School of Engineering Policies and Procedures on Excused Absences

Complete policy is found here:

<https://engineering.nyu.edu/campus-and-community/student-life/office-student-affairs/policies>
with associated form:

<https://engineering.nyu.edu/sites/default/files/2018-09/Excused%20Absence%20Form%20DR.pdf>

Deanna Rayment, deanna.rayment@nyu.edu, is the *Coordinator of Student Advocacy, Compliance and Student Affairs* and handles excused absences. She is located in 5 MTC, LC240C and can assist you should it become necessary.

The Moses Center Statement for Student Accessibility

If you are student with a disability who is requesting accommodations, please contact New York University's Moses Center for Student Accessibility (CSA) at 212-998-4980 or mosescsa@nyu.edu. You must be registered with CSA to receive accommodations. Information about the Moses Center can be found at <https://www.nyu.edu/students/communities-and-groups/student-accessibility.html>. The Moses Center is located at 726 Broadway on the 2nd and 3rd floors. **Please do this at the start of the semester.**