Course Description

An overview of computer graphics covering rendering, modeling, and animation. Topics include geometric primitives and modeling; image formation algorithms such as ray tracing and the Z-buffer; lighting, shading, and texture; and introduction to physics-based animation and character animation.

Note: This is an elective course and used to have attendees from computer science students of any stream who are interested in learning about computer graphics.

Prerequisites/Corequisites

Prerequisite(s): COMP 2401, COMP 2402, MATH 1007, and MATH 1104. Basic linear algebra and calculus, programming in C/C++.

Course Delivery Method

At least one lecture in the week would be online (Blended delivery) and attendance is important in this course. Live lectures will occur at the designated times. Lectures might be recorded and posted to cuLearn. Tutorial participation will be graded, so students must be available to be online during their tutorial time.

Resources

- Course notes will be available on cuLearn.
• Text books: There is no mandatory textbook for the course, but a few textbooks which are available online will be announced for your interest. You would have some weekly reading, that would be posted on cuLearn.

Software

Visual Studio 2017 or later versions and OpenGL.

Topics Covered

We will try to cover the following topics, although some material may be omitted due to time constraints:

1. Computer graphics hardware
2. Graphics Pipeline
3. Transformation
4. Projections
5. Graphics primitives
6. Lighting models (Gouraud and Phong)
7. Shaders
8. Colour
9. Modelling (Object representation, hierarchical scenes/object)
10. Textures
11. Ray tracing
12. OpenGL Other topics such as Collision detection, curve modelling (Bezier curves), clipping, visibility, raster scan, line drawing and polygon fill may be included.

The environment is Visual C++ and OpenGL

Course Objectives

• Explain basic concepts of computer graphics
• Demonstrate computer graphics techniques used in generating graphics images
• Include mathematical background used in computer graphics
Learning Outcomes

At the end of this course, students will be able to:

- Describe and explain the graphics pipeline.
- Create computer graphics in C/C++ using OpenGL.
- Create computer graphics models.
- Use matrices and vector geometry to create computer graphics images.
- Acquire knowledge of lighting models.
- Understand the different coordinate system used in computer graphics (model, view, projection, and screen).
- Be able analyse a computer graphics image and determine components that were used in generating it.

Evaluation

Grading scheme: (Note: This section probably subjects to change)

- 30% Assignments (approximately every three weeks)
- 10% Tutorials (almost every week)
- 20% Midterm: around February
- 20% Final exam
- 20% Course project: due at the end of classes

Late assignments policy

Assignment deadlines are strict. The following scheme is applied to late submissions (which includes assignments and the final course project):

- 3 hours late: no penalty
- 3 to 12 hours late: -10%
- 12 to 24 hours late: -20%
- More than one day late: assignment receives a grade of zero
CS Undergraduate Academic Advisor

The undergraduate advisor for the School of Computer Science is available in Room 5302C HP, by telephone at 520-2600, ext. 4364 or by email at undergraduate advisor@scs.carleton.ca. The advisor can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisor will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and the Writing Tutorial Services.

Centre for Student Academic Support (CSAS)

The Centre for Student Academic Support (CSAS) is a centralized collection of learning support services designed to help students achieve their goals and improve their learning both inside and outside the classroom. CSAS offers academic assistance with course content, academic writing and skills development. Visit CSAS on the 4th floor of MacOdrum Library or online at: https://carleton.ca/csas/.

University Policies

Student Academic Integrity Policy

Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of F in the course or even being expelled from the program or University. Some examples of offences are: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found in the Undergraduate Calendar.

Plagiarism

As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one’s own". Such reported offences will be reviewed by the office of the Dean of Science. The Dean of Science now has the following minimum penalties:

- First offence, first-year students (< 4.0 cr): Final grade reduction of one full grade (e.g., A- becomes a B-, if that results in an F, so be it)
- First offence (everyone else): F in the course
- Second offence: One-year suspension from program
- Third offence: Expulsion from the University

Note: these are minimum penalties. More-severe penalties will be applied in cases of egregious offences (e.g., a first-year student accessing CULearn from their phone during an exam will be given an F in the course; bribing a faculty member for a better grade would be grounds for suspension, etc.)

Unauthorized Co-operation or Collaboration

Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis". Please refer to the course outline statement or the instructor concerning this issue.

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:
Pregnancy obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities
If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. https://carleton.ca PMC/

Survivors of Sexual Violence
As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/sexual-violence-support/

Accommodation for Student Activities
Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. https://carleton.ca senate/wp-content/uploads/ Accommodation-for-Student-Activities-1.pdf

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline