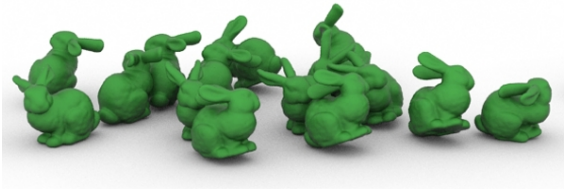


CSCI 480 Computer Graphics, Spring 2013



Source: USC, Cornell, Georgia Tech



Introduction and Purpose

Spring 2013, Monday and Wednesday,
10:30-11:50, MHP 106

Instructor: [Jernej Barbic](#)

Office: SAL 230

Office hours: Monday
3:35 - 5:00

Email: jnb@usc.edu

TA: TBA

Office:

SAL 211

Office
hours: TBA
Email: TBA

This course is an introduction to three-dimensional computer graphics. Students will learn both the theory of 3D computer graphics, and how to program it efficiently using [OpenGL](#). Topics include 2D and 3D transformations, Bézier and B-Spline curves for geometric modeling, interactive 3D graphics programming, computer animation and kinematics, and computer graphics rendering including ray tracing, shading and lighting. There will be an emphasis on the mathematical and geometric aspects of computer graphics. This course is regularly offered every semester (the instructor may vary from offering to offering, as may the content somewhat).

[Schedule](#) | [Prerequisites](#) | [Textbooks](#) | [Assignments](#) | [Grading](#) | [Resources and Supplementary Reading](#) | [Academic Integrity](#)

Date	Topic	Reading	Reference	Assignments
Mon Jan 14 2013	What is Computer Graphics	Ch 1		
Wed Jan 16	Basic Graphics Programming	Ch 2		
Mon Jan 21	No class (Martin Luther King Day)			
Wed Jan 23	Input and Interaction	Ch 3		Assignment 1 out
Mon Jan 28	Transformations	Ch 4		
Wed Jan 30	Viewing and Projection	Ch 5		
Mon Feb 4	Hierarchical Modeling	Ch 5.10, 10.1-10.6		
Wed Feb 6	Polygonal Meshes, Curves and Surfaces	Ch 12.1-12.3		
Mon Feb 11	Splines	Ch 12.4-12.12		Assignment 1 due
Wed Feb 13	Lighting and Shading	Ch 6.1-6.4		Assignment 2 out

Mon Feb 18	No class (President's Day)		
Wed Feb 20	Shading in OpenGL	Ch 6.5-6.9	
Mon Feb 25	Texture Mapping	Ch 8.7-8.8	
Wed Feb 27	Clipping	Ch 7.1-7.7	
Mon Mar 4	Rasterization	Ch 7.8-7.11, 8.9-8.12	
Wed Mar 6	Programmable Graphics Hardware	Ch 9	Assignment 2 due
Mon Mar 11	Review for midterm		
Wed Mar 13	Midterm exam		
Mon Mar 18	No class (spring break)		
Wed Mar 20	No class (spring break)		
Mon Mar 25	Ray Tracing	Ch 13.2-13.3	
Wed Mar 27	Ray Tracing: Geometric Queries	Ch 13.2-13.3	Assignment 3 out
Mon Apr 1	Spatial Data Structures	Ch 10.12	
Wed Apr 3	Global Illumination	Ch 13.4-13.5	
Mon Apr 8	Keyframe Animation	Ch 10.6	
Wed Apr 10	Quaternions and Rotations	Ch 4.12	
Mon Apr 15	Physically Based Simulation	Ch 11.2-11.6	
Wed Apr 17	Image Processing	Ch 7.13, 8.11-8.12	Assignment 3 due
Mon Apr 22	Guest lecture: TBA		
Wed Apr 24	Non-Photorealistic Rendering		
Mon Apr 29	Virtual Environments		
Wed May 1	Visualization	Ch 2.11	
Mon May 13	Final exam	8a.m.-10 p.m.	

Prerequisites

- CSCI 102
- Familiarity with calculus and linear algebra
- C/C++ programming skills

Textbooks (both strongly recommended)

- Edward Angel: **Interactive Computer Graphics: A Top-Down Approach Using OpenGL**, Fifth edition, Publisher: Addison Wesley, ISBN: 9780321535863
 - Dave Shreiner: **OpenGL Programming Guide: The Official Guide to Learning OpenGL, Versions 3.0 and 3.1**, Seventh edition, Publisher: Addison-Wesley Professional, ISBN: 9780321552624
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Assignments

There will be three programming homework assignments, teaching students OpenGL and how to program 3D computer graphics. Please see the schedule for links to assignments and due dates. All assignments must be done **individually**.

Grading

- Assignments: 17% each (51% total)
- Mid-term exam: 19%
- Final exam: 30%

All assignments must be completed to pass the course. The assignments will have a small amount of extra credit.

Late policy: Programming assignments should be turned in by midnight on the day they are due. A total of **three late days** may be taken during the semester on programming assignments. For example, you can use one late day on the second assignment, and two on the third assignment. All days are counted, including any weekends and holidays, as follows:

Less than 24 hours late = 1 late day, 24-48 hours late = 2 late days, 48-72 hours late = 3 late days, and so on. The flexibility provided by the late days is intended to get you through the time where all your classes just happen to have assignments due on the same day. Beyond the three late days, there will be a penalty of 10% of the value of the assignment / day. Exceptions will be granted only under most dire circumstances and must be discussed with and approved by the instructor at least one week in advance.

Resources and Supplementary Readings

- [Textbook support](#) by the author, [Edward Angel](#)
- [Real-Time Rendering Resources](#)
- www.opengl.org, the OpenGL home page
- [OpenGL Red Book](#) on-line, Version 1.1
- [OpenGL tutors](#) for windows by Nate Robins

Computer Graphics References

- **Real-Time Rendering.**
Tomas Akenine-Möller and Eric Haines.
2nd edition, AK Peters, 2002.
ISBN 1-56881-182-9.
- **Computer Graphics: Principles and Practice.**
James D. Foley, Andries van Dam, Steven K. Feiner, and John F. Hughes.
2nd edition in C, Addison-Wesley, 1996.
ISBN 0201848406.
- **Fundamentals of Computer Graphics.**
Peter Shirley, Steve Marschner.
3rd edition, A K Peters, 2009.
ISBN 1568814690.
- **An Introduction to Ray Tracing.**
Andrew S. Glassner, editor, Academic Press, 1989.
ISBN 0-12-286160-4.
- **Advanced Animation and Rendering Techniques, Theory and Practice.**
Alan Watt and Mark Watt, ACM Press and Addison-Wesley, 1992.
ISBN 0-201-54412-1.

Prerequisite-related Resources

- **(Math for graphics) Appendices B and C of the course textbook (Angel)**
- **(Math for graphics) Chapter 2, "Miscellaneous Math" of Shirley and Marschner, Fundamentals of Computer Graphics**
- **Introduction to Linear Algebra.**
Gilbert Strang.
Wellesley-Cambridge Press, 1998.
ISBN 0-9614088-5-5.
- **Calculus: Early Transcendentals.**
James Stewart.
Fourth edition, Brooks/Cole Publishing Company, 1999.
ISBN 0-534-36298-2.
- **[Khan Academy, free math instructional videos](#)**
- **The C Programming Language.**
Brian W. Kernighan and Dennis M. Ritchie.
Second edition, Prentice Hall, 1988.
ISBN 0-13-110362-8 (paperback).

Academic integrity

All students are expected to maintain the utmost level of academic integrity. Do not copy any parts of any of the assignments from anyone. Do not look at other students' code, papers, assignments or exams. The university policies on academic conduct will be applied rigorously, and the USC Office of Student Judicial

Affairs and Community Standards will be notified.

Please consult the USC [Student Guidebook](#) (for example, Section 11.00 in the University Governance chapter) for details on what is and is not appropriate, and for the [possible consequences of violating the rules](#). USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in [Appendix A](#). Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Credits

I wish to thank Prof. Frank Pfenning and Prof. Jessica Hodgins from Carnegie Mellon University for generously providing materials from their computer graphics courses at CMU. This course has also been influenced by computer graphics courses at Cornell, MIT and UC Berkeley.