CIS 536: Introduction to Computer Graphics
CIS 636: Interactive Computer Graphics
Spring 2013

Hours: 3 hours; 3 hour extended course project option (CIS 597/598, 690, 798, 890) available
Prerequisite: CIS 300 and knowledge of C/C++ programming. Background in **precalculus (trigonometry and analytic geometry) and basic matrix algebra (Math 551)** recommended. A first course in computer graphics is *not* required for CIS 536 or 636, but is recommended for CIS 736.
Textbook: Angel, E. & Shreiner, D. (2013). *Interactive Computer Graphics A Top-Down Approach with Shader-Based OpenGL, 6th edition.* Reading, MA: Addison-Wesley. ISBN: 0132545233
Venue: MWF 10:30 – 11:20, Room 236 Nichols Hall (Lecture) and Room 126 Nichols Hall (Lab)
Instructor: William H. Hsu, Department of Computing and Information Sciences
Office: 213 Nichols Hall URL: http://www.cis.ksu.edu/~bhsu E-mail: bhsu@ksu.edu
Phone (Google Voice: office/home/cell): +1 785 236 8247 TA: Ming Yang, 218 Nichols Hall
Instructional e-mail alias (use for instructor and TA): CIS536TA-L@listserv.ksu.edu
Office hours: 12:30 – 13:30 Monday, Friday; 09:00 – 10:00 Wednesday; 09:30 – 10:30 Tuesday; by appointment
K-State Online (KSOL) page: http://bit.ly/ksu-IntroCG **Public mirror**: http://bit.ly/CG-class
Camtasia lectures: Linked from course web page (http://bit.ly/ksu-IntroCG-Lectures) and KSOL

Course Description

This course provides introductory background in computer graphics for graduate and advanced undergraduate students. It will introduce mathematical foundations such as linear, affine, and projective transformations, and will then cover fundamental topics in realistic rendering: view normalization, clipping and culling, scan conversion of lines and polygons, shading and illumination, texture mapping, particle systems, basics of animation, user interfaces, picking, and collision handling. The last part of the course will focus on a few intermediate topics of interest, including shaders, procedural textures, fractals, color theory, and ray tracing.

Course Requirements

Homework: 8 of 10 programming and written assignments – 5 written, 5 programming (**16**%)
Paper reviews: 2 written reviews (1-2 pages) of short (10-15 page) research papers (**4%**)
Labs and class participation: attendance (**2**%), in-class discussion (**4**%), peer review (**2**%), labs (**7%**)
Examinations: two hour exams (10% each, **20%** total), 1 final exam (**25**%)
Computer language(s): C/C++, C#, and Java (any of these permitted for term programming project); *OpenGL*, other graphics libraries and packages (e.g., *Ogre3D*, *Maya 9 aka Maya 2013*) to be taught and used
Project: term programming project for all students (**20**%); additional term paper or project extension option for graduate students and advanced undergraduates

References (to be placed on reserve in K-State CIS Library)

- **(Recommended text)** Eberly, D. H. (2006). *3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, 2nd edition.* San Francisco, CA: Morgan Kaufmann. ISBN: 0122290631
- OpenGL Architecture Review Board, Shreiner, D. & The Khronos OpenGL ARB Working Group (2009). *OpenGL® Programming Guide: The Official Guide to Learning OpenGL®, Versions 3.0 and 3.1, 7th edition.* Reading, MA: Addison-Wesley. ISBN: 0321552628
- Angel, E. (2007). *OpenGL: A Primer, 3rd edition*. Reading, MA: Addison-Wesley. ISBN: 0321398114
- Hearn, D. O. & Baker, M. P. (2003). *Computer Graphics with OpenGL, 3rd edition.* Englewood Cliffs, NJ: Prentice-Hall. ISBN: 0130153907.
- Foley, J. D., VanDam, A., Feiner, S. K., & Hughes, J. F. (1991). *Computer Graphics: Principles and Practice, 2nd Edition in C .* Reading, MA: Addison-Wesley. ISBN: 0201848406
- Orange Book 3e (ISBN: 0321637631), SuperBible *aka* Blue Book 5e (ISBN: 0321712617), formerly Cyan Book

Additional bibliography (excerpted in course notes and handouts)

- Tufte, E. R. (2006). *Beautiful Evidence.* Cheshire, CT: Graphics Press.
- Tufte, E. R. (1997). *Visual Explanations: Images and Quantities, Evidence and Narrative*. Cheshire, CT: Graphics Press.
- Card, S. K., MacKinlay, J. D., & Schneiderman, B. (1999). *Readings in Information Visualization: Using Vision to Think*. San Francisco, CA: Morgan Kaufmann.
- Barnsley, M. F. (1993). *Fractals Everywhere, 2nd Edition*. Burlington, MA: Academic Press.
- Books on Maya and Ogre 3D – to be announced

Course Calendar and Syllabus

Lecture	Date	Topic	Primary Source(s)
0	Wed 23 Jan 2013	Course Overview	Chapter 1, Eberly 2e
1	**Fri 25 Jan 2013**	**CG Basics: Transformation Matrices; Lab 0**	**Sections (§) 2.1, 2.2**
2	Mon 28 Jan 2013	Viewing 1: Overview, Projections	§ 2.2.3 – 2.2.4, 2.8
3	Wed 30 Jan 2013	Viewing 2: Viewing Transformation	§ 2.3 esp. 2.3.4; FVFH slides
4	**Fri 01 Feb 2013**	**Lab 1a: Flash & OpenGL Basics**	**Ch. 2, 16[1], Angel *Primer***
5	Mon 04 Feb 2013	Viewing 3: Graphics Pipeline	§ 2.3 esp. 2.3.7; 2.6, 2.7
6	Wed 06 Feb 2013	Scan Conversion 1: Lines, Midpoint Algorithm	§ 2.5.1, 3.1; FVFH slides
7	**Fri 08 Feb 2013**	**Viewing 4: Clipping & Culling; Lab 1b**	**§ 2.3.5, 2.4, 3.1.3**
8	Mon 11 Feb 2013	Scan Conversion 2: Polygons, Clipping Intro	§ 2.4, 2.5 esp. 2.5.4, 3.1.6
9	Wed 13 Feb 2013	Surface Detail 1: Illumination & Shading	§ 2.5, 2.6.1 – 2.6.2, 4.3.2, 20.2
10	**Fri 15 Feb 2013**	**Lab 2a: Direct3D / DirectX Intro**	**§ 2.7, Direct3D handout**
11	Mon 18 Feb 2013	Surface Detail 2: Textures; OpenGL Shading	§ 2.6.3, 20.3 – 20.4, *Primer*
12	Wed 20 Feb 2013	Surface Detail 3: Mappings; OpenGL Textures	§ 20.5 – 20.13
13	**Fri 22 Feb 2013**	**Surface Detail 4: Pixel/Vertex Shad.; Lab 2b**	**§ 3.1**
14	Mon 25 Feb 2013	Surface Detail 5: Direct3D Shading; OGLSL	§ 3.2 – 3.4, Direct3D handout
15	Wed 27 Feb 2013	Demos 1: CGA, Fun; Scene Graphs: State	§ 4.1 – 4.3, **CGA handout**
16	**Fri 01 Mar 2013**	**Lab 3a: Shading & Transparency**	**§ 2.6, 20.1, *Primer***
17	**Mon 04 Mar 2013**	**Animation 1: Basics, Keyframes; HW/Exam**	**§ 5.1 – 5.2**
	Wed 06 Mar 2013	**Exam 1 review; Hour Exam 1 (evening)**	**Chapters 1 – 4, 20**
18	**Fri 08 Mar 2013**	**Scene Graphs: Rendering; Lab 3b: Shader**	**§ 4.4 – 4.7**
19	**Mon 11 Mar 2013**	**Demos 2: SFX; Skinning, Morphing**	**§ 5.3 – 5.5, CGA handout**
20	Wed 13 Mar 2013	Demos 3: Surfaces; B-reps/Volume Graphics	§ 10.4, 12.7, **Mesh handout**
21	**Fri 15 Mar 2013**	**Lab 4a: Animation Basics**	**Flash animation handout**
22	Mon 25 Mar 2013	Animation 2: Rotations; Dynamics, Kinematics	Chapter 17, esp. §17.1 – 17.2
23	Wed 27 Mar 2013	Demos 4: Modeling & Simulation; Rotations	Chapter 10[1], 13[2], §17.3 – 17.5
24	**Fri 29 Mar 2013**	**Collisions 1: axes, OBBs, Lab 4b**	**§2.4.3, 8.1, GL handout**
25	Mon 01 Apr 2013	Spatial Sorting: Binary Space Partitioning	Chapter 6, esp. §6.1
26	**Wed 03 Apr 2013**	**Demos 5: More CGA; Picking; HW/Exam**	**Chapter 7[2]; § 8.4**
27	**Fri 05 Apr 2013**	**Lab 5a: Interaction Handling**	**§ 8.3 – 8.4; 4.2, 5.0, 5.6, 9.1**
28	Mon 08 Apr 2013	Collisions 2: Dynamic, Particle Systems	§ 9.1, particle system handout
	Wed 10 Apr 2013	**Exam 2 review; Hour Exam 2 (evening)**	**Chapters 5 – 6, 7[2] – 8, 12, 17**
29	**Fri 12 Apr 2013**	**Lab 5b: Particle Systems**	**Particle system handout**
30	**Mon 15 Apr 2013**	**Animation 3: Control & IK**	**§ 5.3, CGA handout**
31	Wed 17 Apr 2013	Ray Tracing 1: intersections, ray trees	Chapter 14
32	Fri 19 Apr 2013	Lab 6a: Ray Tracing Basics with POV-Ray	RT handout
33	Mon 22 Apr 2013	Ray Tracing 2: advanced topic survey	Chapter 15, **RT handout**
34	Wed 24 Apr 2013	Visualization 1: Data (Quantities & Evidence)	Tufte handout (1)
35	**Fri 26 Apr 2013**	**Lab 6b: More Ray Tracing**	**RT handout**
36	Mon 29 Apr 2013	Visualization 2: Objects	Tufte handout (2 & 4)
37	Wed 01 May 2013	Color Basics; Term Project Prep	**Color handout**
38	Fri 03 May 2013	Lab 7: Fractals & Terrain Generation	**Fractals/Terrain handout**
39	Mon 06 May 2013	Visualization 3: Processes	Tufte handout (3)
40	**Wed 08 May 2013**	**Final Review; Project presentations 1**	**–**
41	Fri 10 May 2013	Project presentations 2	–
		Final Exam 11:50 Thu 16 May 2013	**Ch. 1 – 8, 10 – 15, 17, 20**

Lightly-shaded entries denote the due date of a written problem set; heavily-shaded entries, that of a machine problem (programming assignment); blue-shaded entries, that of a paper review; and the green-shaded entry, that of the term project.

Lab exercises are always due on the day before the next lab.

Green, **blue** and **red** letters denote **exam review**, **exam**, and **exam solution review** dates.

[1] Required for CIS 536 / 636 students; optional (refresher as needed) for CIS 736 students.

[2] Required only for CIS 736 students.