CIS 536: Introduction to Computer Graphics
CIS 636: Interactive Computer Graphics
Spring 2012

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. (2012). *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 2012*) 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 18 Jan 2012	Course Overview	Chapter 1, Eberly 2e
1	**Fri 20 Jan 2012**	**CG Basics: Transformation Matrices; Lab 0**	**Sections (§) 2.1, 2.2**
2	Mon 23 Jan 2012	Viewing 1: Overview, Projections	§ 2.2.3 – 2.2.4, 2.8
3	Wed 25 Jan 2012	Viewing 2: Viewing Transformation	§ 2.3 esp. 2.3.4; FVFH slides
4	**Fri 27 Jan 2012**	**Lab 1a: Flash & OpenGL Basics**	**Ch. 2, 16[1], Angel *Primer***
5	Mon 30 Jan 2012	Viewing 3: Graphics Pipeline	§ 2.3 esp. 2.3.7; 2.6, 2.7
6	Wed 01 Feb 2012	Scan Conversion 1: Lines, Midpoint Algorithm	§ 2.5.1, 3.1; FVFH slides
7	**Fri 03 Feb 2012**	**Viewing 4: Clipping & Culling; Lab 1b**	**§ 2.3.5, 2.4, 3.1.3**
8	Mon 06 Feb 2012	Scan Conversion 2: Polygons, Clipping Intro	§ 2.4, 2.5 esp. 2.5.4, 3.1.6
9	Wed 08 Feb 2012	Surface Detail 1: Illumination & Shading	§ 2.5, 2.6.1 – 2.6.2, 4.3.2, 20.2
10	**Fri 11 Feb 2012**	**Lab 2a: Direct3D / DirectX Intro**	**§ 2.7, Direct3D handout**
11	Mon 13 Feb 2012	Surface Detail 2: Textures; OpenGL Shading	§ 2.6.3, 20.3 – 20.4, *Primer*
12	Wed 15 Feb 2012	Surface Detail 3: Mappings; OpenGL Textures	§ 20.5 – 20.13
13	**Fri 17 Feb 2012**	**Surface Detail 4: Pixel/Vertex Shad.; Lab 2b**	**§ 3.1**
14	Mon 20 Feb 2012	Surface Detail 5: Direct3D Shading; OGLSL	§ 3.2 – 3.4, Direct3D handout
15	Wed 22 Feb 2012	Demos 1: CGA, Fun; Scene Graphs: State	§ 4.1 – 4.3, **CGA handout**
16	**Fri 24 Feb 2012**	**Lab 3a: Shading & Transparency**	**§ 2.6, 20.1, *Primer***
17	**Mon 27 Feb 2012**	**Animation 1: Basics, Keyframes; HW/Exam**	**§ 5.1 – 5.2**
	Wed 29 Feb 2012	**Exam 1 review; Hour Exam 1 (evening)**	**Chapters 1 – 4, 20**
18	**Fri 02 Mar 2012**	**Scene Graphs: Rendering; Lab 3b: Shader**	**§ 4.4 – 4.7**
19	**Mon 04 Mar 2012**	**Demos 2: SFX; Skinning, Morphing**	**§ 5.3 – 5.5, CGA handout**
20	Wed 07 Mar 2012	Demos 3: Surfaces; B-reps/Volume Graphics	§ 10.4, 12.7, **Mesh handout**
21	**Fri 09 Mar 2012**	**Lab 4a: Animation Basics**	**Flash animation handout**
22	Mon 12 Mar 2012	Animation 2: Rotations; Dynamics, Kinematics	Chapter 17, esp. §17.1 – 17.2
23	Wed 14 Mar 2012	Demos 4: Modeling & Simulation; Rotations	Chapter 10[1], 13[2], §17.3 – 17.5
24	**Fri 16 Mar 2012**	**Collisions 1: axes, OBBs, Lab 4b**	**§2.4.3, 8.1, GL handout**
25	Mon 26 Mar 2012	Spatial Sorting: Binary Space Partitioning	Chapter 6, esp. §6.1
26	**Wed 28 Mar 2012**	**Demos 5: More CGA; Picking; HW/Exam**	**Chapter 7[2]; § 8.4**
27	**Fri 30 Mar 2012**	**Lab 5a: Interaction Handling**	**§ 8.3 – 8.4; 4.2, 5.0, 5.6, 9.1**
28	Mon 02 Apr 2012	Collisions 2: Dynamic, Particle Systems	§ 9.1, particle system handout
	Wed 04 Apr 2012	**Exam 2 review; Hour Exam 2 (evening)**	**Chapters 5 – 6, 7[2] – 8, 12, 17**
29	**Fri 06 Apr 2012**	**Lab 5b: Particle Systems**	**Particle system handout**
30	**Mon 09 Apr 2012**	**Animation 3: Control & IK**	**§ 5.3, CGA handout**
31	Wed 11 Apr 2012	Ray Tracing 1: intersections, ray trees	Chapter 14
32	Fri 13 Apr 2012	Lab 6a: Ray Tracing Basics with POV-Ray	RT handout
33	Mon 16 Apr 2012	Ray Tracing 2: advanced topic survey	Chapter 15, **RT handout**
34	Wed 18 Apr 2012	Visualization 1: Data (Quantities & Evidence)	Tufte handout (1)
35	**Fri 20 Apr 2012**	**Lab 6b: More Ray Tracing**	**RT handout**
36	Mon 23 Apr 2012	Visualization 2: Objects	Tufte handout (2 & 4)
37	Wed 25 Apr 2012	Color Basics; Term Project Prep	**Color handout**
38	Fri 27 Apr 2012	Lab 7: Fractals & Terrain Generation	**Fractals/Terrain handout**
39	Mon 30 Apr 2012	Visualization 3: Processes	Tufte handout (3)
40	**Wed 02 May 2012**	**Final Review; Project presentations 1**	**–**
41	Fri 04 May 2012	Project presentations 2	–
		Final Exam 11:50 Tue 11 May 2012	**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.