# CIS 636 & 736: Computer Graphics Spring 2008

Hours: 3 hours; 3 hour extended course project option (CIS 598, 690, 890, 798) available

Prerequisite: CIS 308 or CIS 300 and knowledge of C/C++ programming. Background in precalculus (trigonometry and analytic geometry) and basic matrix algebra (Math 551) recommended. Suggested additional background consists of: linear algebra, vector calculus. A first course in computer graphics is *not* required for CIS 636, but is recommended for CIS 736.

**Textbook:** Eberly, D. H. (2006). *3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, 2<sup>nd</sup> edition.* San Francisco, CA: Morgan Kaufmann. ISBN: 0122290631

Venue: MWF 11:30 - 12:20, Room 127 Nichols Hall

Instructor: William H. Hsu, Department of Computing and Information Sciences Office: 213 Nichols Hall URL: <u>http://www.cis.ksu.edu/~bhsu</u> E-mail: <u>bhsu@cis.ksu.edu</u> Office: +1 785 532 7905 Home: +1 785 539 7180 TA: <u>CIS736TA-L@listserv.ksu.edu</u> Office hours: 12:30 – 14:00 Monday, Wednesday, Friday; by appointment Tuesday, Friday mornings K-State Online (KSOL) pages: <u>http://snurl.com/1y5gc</u> (CIS 636), <u>http://snurl.com/1ybv6</u> (CIS 736) Course web page: <u>http://www.kddresearch.org/Courses/Spring-2008/CIS736/</u> Tegrity lectures: Linked from course web page and KSOL

#### Course Description

This course provides intermediate background in computer graphics for graduate and advanced undergraduate students. After a brief review basic principles of graphics display systems (clipping, view normalization, 3D graphics data structures, and shading and illumination), the course will cover fundamental topics in realistic rendering: ray tracing, radiosity, texture and bump mapping, and splines and cubic curves. The last part of the course will focus on several advanced topics of interest, including fractals, particle systems, physically-based modeling, and scientific and information visualization.

#### Course Requirements

Homework: 6 of 8 programming and written assignments – 4 written, 4 programming (18%) Paper reviews: 2 written reviews (1-2 pages) of short (10-15 page) research papers (4%) Labs and class participation: attendance, in-class discussion, peer review (6%), labs (7%) Examinations: two hour exams (10% each, 20% total), 1 final exam (25%)

**Computer language(s)**: C/C++ and Java (either permitted for term programming project); OpenGL, other graphics libraries and packages (e.g., Ogre, Maya 2008) 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 (on reserve in K-State CIS Library):

- Angel, E. (2006). Interactive Computer Graphics: A Top-Down Approach with OpenGL, 4<sup>th</sup> edition. Reading, MA: Addison-Wesley. ISBN: 0201773430. (with OpenGL: A Primer, 2<sup>nd</sup> ed.)
- Hearn, D. O. & Baker, M. P. (2003). Computer Graphics with OpenGL, 3<sup>rd</sup> 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, 2<sup>nd</sup> Edition in C. Reading, MA: Addison-Wesley. ISBN: 0201848406

## Additional bibliography (excerpted in course notes and handouts):

- Tufte, E. R. (2006). *Beautiful Evidence*. Cheshire, CT: Graphics Press.
- Tufte, E. R. (1997). Envisioning Information. Cheshire, CT: Graphics Press.
- Tufte, E. R. (1990). 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, 2<sup>nd</sup> Edition. Burlington, MA: Academic Press.

## **Course Calendar and Syllabus**

Lecture	Date	Торіс	Primary Source(s)
0	Fri 18 Jan 2008	Course Overview	Chapter 1, Eberly 2 <sup>e</sup>
1	Wed 23 Jan 2008	Viewing 1: Overview, Projections	Sections 2.1, 2.8
2	Fri 25 Jan 2008	Viewing 2: Viewing Transformation	Section 2.2
3	Mon 28 Jan 2008	Photorealism and Term Projects	Section 2.3
4	Wed 30 Jan 2008	Viewing 3: Graphics Pipeline	Sections 2.6 – 2.7
5	Fri 01 Feb 2008	Lab 1: OpenGL Exercises	Chapters 2, 16 <sup>†</sup> , Angel <i>Primer</i>
6	Mon 04 Feb 2008	Viewing 4: Culling and Clipping	Sections 2.4, 4.1, 4.5
7	Wed 06 Feb 2008	Surface Detail 1: Shading	Section 2.5
8	Fri 08 Feb 2008	Surface Detail 2: OpenGL SL	Section 4.1, Angel Primer
9	Mon 11 Feb 2008	Surface Detail 3: Textures	Sections 2.6, 20.3 – 20.4
10	Wed 13 Feb 2008	Surface Detail 4: Mappings	Sections 20.5 – 20.13
11	Fri 15 Feb 2008	Lab 2: Shading, Texturing in OpenGL	Sections 20.5 – 20.13, Primer
12	Mon 18 Feb 2008	Surface Detail 5: Pixel/Vertex	Section 3.1
13	Wed 20 Feb 2008	Surface Detail 6: More OpenGL SL	Sections 3.2 – 3.4
14	Fri 22 Feb 2008	Surface Detail 7: Render Farms	Chapter 3
15	Mon 25 Feb 2008	Demos 1: CGA, Animation Overview	Section 5.1
16	Wed 27 Feb 2008	Animation 1: Interpolation	Sections 4.2 – 4.6, 5.2
17	Fri 29 Feb 2008	Lab 3: Animation Basics	Sections 5.1 – 5.2, 5.3 – 5.5
18	Mon 03 Mar 2008	Demos 2: SFX, Scene Graphs	Sections 4.1 – 4.3, 4.7
	Wed 06 Mar 2008	Hour Exam 1	Chapters 1 – 4, 16 <sup><math>\dagger</math></sup>
19	Fri 07 Mar 2008	Scene Graphs: Rendering	Sections 4.4 – 4.6
20	Mon 10 Mar 2008	Demos 3: Surfaces	Sections 12.1, 20.3 – 20.13
21	Wed 12 Mar 2008	Animation 2: Intro to Quaternions	Sections 17.1 – 17.2
22	Fri 14 Mar 2008	Lab 4: Animation in Maya and Ogre	Sections 17.3 – 17.5
23	Mon 24 Mar 2008	Demos 4: Modeling and Simulation	Chapter 8
24	Wed 26 Mar 2008	Intersection Handling 1: Picking	Sections 8.1, 8.4
25	Fri 28 Mar 2008	Intersection Handling 2: Collisions	Chapter 7 <sup>‡</sup> , Sections 8.2 – 8.3
26	Mon 31 Mar 2008	Demos 5: More Animation, Fun Stuff	Sections 5.5 – 5.6, 9.1
27	Wed 02 Apr 2008	Intersection Handling 3: Dynamic	Sections 8.3 – 8.5
28	Fri 04 Apr 2008	Lab 5: Collision Detection	Chapter 8
29	Mon 07 Apr 2008	Curves 1: Bézier Curves and Splines	Sections 11.1 – 11.6
	Wed 09 Apr 2008	Hour Exam 2	Chapters 4 – 5, 7 <sup>+</sup> – 8, 17, 20
30	Fri 11 Apr 2008	Curves 2: Subdivision	Sections 11.8 – 11.9
31	Mon 14 Apr 2008	Surfaces 1: Implicit Surfaces	Sections 10.4, 12.1, 12.6, 15.6
32	Wed 16 Apr 2008	Surfaces 2: Patches, Subdivision	Sections 12.2 – 12.5, 12.7
33	Fri 18 Apr 2008	Lab 6: Curves and Surfaces	Chapters 11 – 12
34	Mon 21 Apr 2008	Spatial Sorting	Chapter 6
35	Wed 23 Apr 2008	Animation 3: Character Modeling, IK	Chapter 10, 13 <sup>+</sup>
36	Fri 25 Apr 2008	Visualization, Color Basics	Section 2.6, 20.1, handout
37	Mon 28 Apr 2008	Intro to Fractals and L-Systems	Handouts (4)
38	Wed 30 Apr 2008	Ray Tracing	Chapters 14 – 15, handouts
39	Fri 02 May 2008	Lab 7: Ray Tracing	Chapters 14 – 15, handouts
40	Mon 05 May 2008	Term project presentations	Chapter 10, 13 <sup>+</sup>
41	Wed 07 May 2008	I erm project presentations	-
42	Fri 09 May 2008	I erm project presentations	-
		Final Exam 09:40 Thu 15 May 2008	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 greenshaded entry, that of the term project.

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

 $<sup>^{\</sup>dagger}$  Required for CIS 636 students; optional (refresher as needed) for CIS 736 students.  $^{\ddagger}$  Required only for CIS 736 students.