Concordia University
Department of Computer Science and Software Engineering

COMP371: Computer Graphics
TENTATIVE COURSE OUTLINE
(Revision 1.5)

COMP371		**Winter 2012**
Course instructor:	Serguei A. Mokhov	mokhov@cse.concordia.ca
Lab instructor:	Kaustubha Mendhurwar	k_mendhu@encs.concordia.ca
Lab instructor:	Sriram Srinivas Chandrasekhar	sr_cha@encs.concordia.ca
Coordinator:	Thomas Fevens	fevens@cse.concordia.ca

Instructors

Lectures

- S. Mokhov (Sec. R, Mondays and Wednesdays 13:15 - 14:30, H929)

Office Hours

- Office hours are by appointment. Contact me in class or by email mokhov@cse.concordia.ca to set one up.

Lab Sessions

- K. Mendhurwar (Wednesdays, 16:15-18:05, H817)
- S. Chandrasekhar (Thursdays, 14:45-16:35, H849)

Official labs start the week of Monday January 9, 2012. Both lab days are expected to cover the same material, so you are not required to attend both sessions; though if you would like to or ask additional questions you may attend both as long as there is enough space for the regular attendees.

Course Coordinator

Dr. T. Fevens is the coordinator for this term. He can be contacted at his office (room EV3.157) by phone (848-2424 ext. 3038) or by e-mail at fevens@cse.concordia.ca.

Course

Description Quoted from the Academic Calendar

Introduction to computer graphics and graphics hardware. Introduction to graphics API and graphics systems architecture. Mathematics of 2D and 3D transformations, and 2D and 3D viewing. Colour and basic rendering algorithms. Visual realism and visibility. Illumination and shading,

global illumination techniques, and textures. Introduction to curves and surfaces, and 3D object modelling. Introduction to computer animation. Project. Lectures: three hours per week. Laboratory: two hours per week.

Objectives

This course introduces basic techniques and concepts for 2D and 3D (non-stereoscopic) computer graphics (CG), including 2D and 3D transformations, modeling and representation, illumination and shading, rendering, texturing, animation, some game physics, and some related software tools. The students are expected to learn fundamental algorithms, methodologies, and techniques and gain experience in graphics programming; in particular, how to program in OpenGL, a powerful software library interface used to produce high-quality computer-generated images of 2D and 3D objects.

Concrete Topics (tentative)

- Historical perspective and some fundamental issues in hardware, software, and applications in relationship to CG.
- Overview of OpenGL programming.
- OpenGL 2D and 3D geometric primitives.
- Geometrical 2D and 3D transformations.
- Common graphics algorithms.
- Colors, including human color-vision system, various color-description systems, and rules for the effective use of color in OpenGL.
- Lighting: how to compute light intensity at surface points using different illumination models.
- Shading and shadows to increase realism.
- Blending, antialiasing, fog: discrete techniques to enhance the reality of the scene.
- Curve and surface representation: types of curves and surfaces representations.
- Texture mapping: how to fill object surface with 2D textures.
- Ray tracing, collision detection, animation, global illumination.

Drop Deadlines

- DNE: Monday, January 16, 2012
- DISC: Sunday, March 4, 2012

Tentative Schedule

Week	Dates	What (lecture time)	Deliverable	Due
1	Wed, January 4	Course Introduction and Outline OpenGL Overview Begin		
2	Mon, January 9 Wed, January 11	OpenGL Overview End; Object Modeling and Triangulation Vectors and Matrices	(labs begin); PA1 out; TA1 out	
3	Mon, January 16 Wed, January 18	2D Transformations 3D Transformations		
4	Mon, January 23 Wed, January 25	3D Viewing Graphics Algorithms		
5	Mon, January 30 Wed, February 1	Quiz 1 Color	TA1 due; **Quiz 1**: TA1+OpenGL; TA2 out	Mon Jan 30
6	Mon, February 6 Wed, February 8	Visibility	**PA1 due** + demos; PA2 out	Mon Feb 6 13:00
7	Mon, February 13 Wed, February 15	Quiz 2 Texture Mapping	TA2 due; **Quiz 2**: TA2+OpenGL **PA2 due**; PA3 out; Project out	Mon Feb 13 Sun Feb 19 23:59
8	Mon, February 20 Wed, February 22	**Midterm break**		
9	Mon, February 27 Wed, February 29	Illumination and Shading	PA2 demos	
10	Mon, March 5 Wed, March 7	Shadows, Radiosity, Ray Tracing/Casting	**Quiz 3 (lab)**: PA1 **Quiz 3 (lab)**: PA1	Wed Mar 7 16:15 Thu Mar 8 14:45
11	Mon, March 12 Wed, March 14	Curves and Surfaces	**PA3 due** + demos	Mon Mar 12 13:00
12	Mon, March 19 Wed, March 21	Curves and Surfaces (cont'd)	**Quiz 4 (lab)**: PA2+PA3 **Quiz 4 (lab)**: PA2+PA3	Wed Mar 21 16:15 Thu Mar 22 14:45
13	Mon, March 26 Wed, March 28	Animation Project Demos	**Project due** + demos	Tue Mar 27 23:59
14	Mon, April 2 Wed, April 4	T.B.D. T.B.D.		

Laboratory

For the most of our needs you will use the ENCS-managed labs located at H817 and H849 running Windows 7 and Scientific Linux 5.7, both 32-bit. The development takes place in Microsoft Visual Studio 2010 in the former and, `gcc` and `g++` [1] under Linux. OpenGL libraries and Nvidia drivers are installed under both OSes. The details will be presented during labs and lectures on some specific techniques and tricks to help you advance in your programming deliverables. In the lab, you will also have demos of your work and possibly programming quizzes.

Textbook

There is a great variety of references on the subject. The following particular textbook will be used for this course: [2]. This book is a great introduction to computer graphics and OpenGL. It includes sample OpenGL code and also the basic mathematical algorithms you need for computer graphics programming. Copies are available at Concordia University bookstore. While this is the newest edition, the older version [3] is still much the same, so if you have the older copy, you can still use it. The code for the exercises that comes with the book is freely available to download:

`http://esminfo.prenhall.com/computing/hearnbaker/Code.zip`

There are additional useful books on the subject that we may refer to for one concept or another throughout the class. They are listed under in the "References" section: [4, 5, 6, 7, 8, 9, 10, 11, 12,

13, 14]. [5] is freely available online and is generally sufficient for our course. Edition 8 [7] is slated to be released in March 2012 covering the latest features of OpenGL 4.x, among other things.

Administrative Policies

Evaluation

Grades will be based on the following tentative components:

1. Homework [0%]: 2-3 theory assignments. These concern with different math and linear algebra problems related to graphics. They are optional to solve, and you get no grades for them, but the material from the assignments is sure to appear on the quizzes.

2. Quizzes [$15\% \times 4$]: The quizzes would cover the theoretical and practical aspects of the course. Potentially 2 of the quizzes will be held in the lab and involve graphics programming tasks based on your project.

3. Project [40%]: a team graphics programming project and a report; tentatively broken down into the following deliverables:

   (a) 5% Programming Assignment 1 (PA1): Modeling

   (b) 10% Programming Assignment 2 (PA2): Lighting and Camera Control

   (c) 10% Programming Assignment 3 (PA3): Texture mapping

   (d) 15% Final: animation, demo, report with the software design and user manual

4. Failing grade: blatant plagiarism or/and lack of regular effort will result in the failing grade.

NOTE: There is no a priori rule for translation of a numerical grade to a letter grade. Electronic submission is expected via EAS (`https://fis.encs.concordia.ca/eas`). Additional details will be given in the class or via the mailing list. Students may discuss but must not copy or allow others to copy any part of their deliverables. Violators will lose all of their marks of the work and may be subject to other disciplinary actions. Students should be aware of the University's Code of Conduct (academic) as specified from the page 53 of the 2011-2012 Undergraduate Calendar, especially the parts concerning cheating, plagiarism, and the possible consequence of violating this code. Late submissions will be treated on a case-by-case basis.
NOTE: This course outline is tentative, i.e. subject to changes and adjustments as we go along.

Contribution

In usual circumstances, it is expected that all members of a group end up with the same mark. However, this must not be considered as a rule. For reasons of fairness, different evaluations will be considered to award those who provided outstanding input to the project, and to penalize those who provided minimal (below expectations) input to the project in case of disputes within the team. The team members would be expected to provide individual logs and timesheets of their contributions in the case of disputes.

Course Web Page and Mailing List

These are two more resources to be used frequently. The additional materials, grades, etc. will be published on the web page at:

`http://users.encs.concordia.ca/~comp371_4/`

A mailing list has been created for discussion of the course topics among students and the instructors; to ask and answer questions related to the course, etc. All the announcements will be directed to that list as well. All the students and instructors must be subscribed to the mailing list. URL (to change your subscription settings):

`https://mail.encs.concordia.ca:444/mailman/listinfo/comp371-w12`

To to post a message to the entire class for discussion or announcement, email:

`comp371-w12@encs.concordia.ca`

Additional Materials

Additional materials, such as lecture notes and slides, examples, etc. will be provided by the instructor whenever possible. The instructor will try his best to make the notes concise and complete as much as possible, but they cannot replace the entire set of the referenced material. Some material may be borrowed from previous instructors for this or related courses, such as from Drs. Sudhir P. Mudur, Peter Grogono, Thomas Fevens, Adam Krzyzak, Abdelssalem Ben Hamza, Clement Lam, Nizar Bouguila and others, whom the instructor Mokhov acknowledges with many thanks.

The Project

The project represents a significant component of the course. The project will be developed as a cooperative (group) project. Each group will be composed of about 3-5 students. The project requirements will be published and presented around the second or third lecture. The final deliverables of the project will have to be made with good quality.

Legal Statement

The final project is your property but it is also the property of everyone who shared a part of the realization of this project. You must notice that Concordia University has the full right to make whatsoever use of this project and without any restrictions. Please notice that previous projects may be made available to assist you with your project. In the same context, your project may be made available to help other students in the future.

Student Services

Need help? There are a variety student services available to you should you struggle through your studies and if the instructor for some reason is unable to help you. They are:

- One-stop information site on many questions:
  `http://www.concordia.ca/help4u/`

- Concordia Counseling and Development offers career services, psychological services, student learning services, etc.
  `http://cdev.concordia.ca`
- The Concordia Library Citation and Cycle Guides:
  `http://library.concordia.ca/help/howto/citations.html`
- Advocacy and Support Services:
  `http://supportservices.concordia.ca`
- Student Transition Centre:
  `http://stc.concordia.ca`
- New Student Program:
  `http://newstudent.concordia.ca`
- Office for Students with Disabilities:
  `http://supportservices.concordia.ca/disabilities/`
- The Academic Integrity Website:
  `http://provost.concordia.ca/academixintegrity/`
- Financial Aid & Awards:
  `http://web2.concordia.ca/financialaid/`
- Health Services:
  `http://www-health.concordia.ca/`

References

[1] Various Contributors and the GNU Project. GNU Compiler Collection (GCC). [online], 1988–2009. `http://gcc.gnu.org/onlinedocs/gcc/`.

[2] Donald Hearn, M. Pauline Baker, and Warren Carithers. *Computer Graphics with OpenGL*. Prentice Hall, 4 edition, November 2010. ISBN: 978-0136053583.

[3] Donald Hearn and M. Pauline Baker. *Computer Graphics with OpenGL*. Prentice Hall, 3 edition, August 2003. ISBN: 0-13-015390-7.

[4] OpenGL Architecture Review Board. OpenGL. [online], 1998–2011. `http://www.opengl.org`.

[5] Mason Woo, Jackie Neider, Tom Davis, Dave Shreiner, and OpenGL Architecture Review Board. *OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 1.2*. Addison-Wesley, 3 edition, October 1999. ISBN 0201604582, online ate `http://fly.cc.fer.hr/~unreal/theredbook/`, code samples: `http://www.opengl.org/resources/code/samples/redbook/`.

[6] Dave Shreiner and The Khronos OpenGL ARB Working Group. *OpenGL Programming Guide: The Official Guide to Learning OpenGL, Versions 3.0 and 3.1.* Addison-Wesley, 7 edition, July 2009. ISBN 978-0321552624.

[7] Dave Shreiner, The Khronos OpenGL ARB Working Group, Bill Licea-Kane, and Graham Sellers. *OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.1.* Addison-Wesley, 8 edition, March 2012. ISBN 978-0321773036.

[8] Peter Grogono. Getting started with OpenGL. [online], 2002. Department of Computer Science and Software Engineering, Concordia University, Montreal, Canada.

[9] Peter Grogono. Lecture notes of advanced computer graphics. [online], 2002. Department of Computer Science and Software Engineering, Concordia University, Montreal, Canada.

[10] Peter Grogono. Concordia University Graphics Library (CUGL). [online], December 2005. `http://users.encs.concordia.ca/~grogono/Graphics/cugl.html`.

[11] Randi J. Rost. *OpenGL Shading Language*. Pearson Education, Inc., February 2004. ISBN: 0-321-19789-5.

[12] Paul Rademacher, Nigel Stewart, and Bill Baxter. GLUI – A GLUT-based user interface library, version 2.35. [online], 1999–2006. `http://glui.sourceforge.net/`.

[13] CodeColony. OpenGL Colony tutorials and demos. [online], 2008. `http://www.codecolony.de/`.

[14] Jimmy Wales, Larry Sanger, and other authors from all over the world. Wikipedia: The free encyclopedia. [online], Wikimedia Foundation, Inc., 2001–2011. `http://wikipedia.org`.