

## Course Outline

### Fundamentals of Computer Graphics

COMP 557

(Fall 2008; TJ 1:05:-2:25 ENGTR 070)

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## Course Description from McGill Calender

*Note that this official course description is slightly outdated. For the topics covered this semester, see "Topics" on the following page.*

The study of fundamental mathematical, algorithmic and representational issues in computer graphics. The topics to be covered are: an overview of the graphics process, projective geometry, homogeneous coordinates, projective transformations, quadrics and tensors, line-drawing, surface modeling and object modeling reflectance models and rendering texture mapping, polyhedral representations, procedural modeling and animation.

## Lecture Notes

All material covered in the lectures will be made available on-line on the course web page.

## Reference Textbooks

The following book is strongly recommended for the assignments. It is available at the McGill Book store, as well as at the Schulich library on two hour loan.

- Angel, E. "OpenGL : a primer". Either the 2nd (T385 A5135 2005) or 3rd Edition is fine.

Other excellent books are also available at the Schulich library:

- Hearn, D. "Computer graphics with OpenGL" (T385 H395 2004)
- Hearn D. and Baker, P. "Computer graphics, C version" (T385 H385 1997)
- Foley, J.D. et al "Computer graphics : principles and practice" (T385 C587 1996)
- Angel, E. "Interactive computer graphics : a top-down approach with OpenGL" (T385 A514 2000)

## Topics covered in Fall 2008

### Geometry

- drawing a line
- rotations, scaling, translations
- homogeneous coordinates, viewing transformations
- projections
- normalized view coordinates, clipping, viewports
- texture mapping and homographies
- visible surface algorithms
  - hidden surface removal
  - ray casting
- focus and the accumulation buffer
- cubic curves and surfaces
- meshes, fractal curves and surfaces
- plant modelling

### Rendering

- illumination and reflectance
- shading models for polygons (Gouraud and Phong)
- bump mapping, environment mapping
- transparency and volume rendering
- shadows

### Image capture and display

- color
- gamma correction
- histograms, tone mapping, computational photography
- high dynamic range imaging

## Prerequisites

There are three official prerequisites for the course:

- COMP 206 *Introduction to Software Systems*

The assignments will require you to program in C (not C++) and to use the unix utility `make`.

- MATH 223 *Linear Algebra*

This course will build upon your basic understanding of vector and matrices. If should have at least a B grade in your linear algebra course, or be prepared for a serious review.

- COMP 251 *Data Structures and Algorithms*

This prerequisite is mostly there to ensure you have a sufficiently high level of mathematical maturity. A high grade in COMP 250 is probably sufficient though.

Although it is not a prerequisite, it is strongly recommended that you have taken MATH 222 (*Calculus 3*) which is required for CS Majors, or the equivalent. In particular, you need to know what a parametric representation of a smooth surface is, and what a partial derivative is.

## Evaluation

There will be two exams, worth a total of 60 % of the final grade. The first will be a midterm exam which will take place in class during the week of Oct. 13-17. It is worth a 20% of your grade. The second exam will take place during the Final Exam Period and is worth 40 % of the final grade. The first exams covers the material of approximately lectures 1-9. The second covers the material from lectures 10-24.

There will be three assignments, worth a total of 40 % of your final grade. Each will involve some graphics programming in OpenGL, which is a standard applications programmer interface (API). The best way to begin learning OpenGL is to read Angel's book, "OpenGL: a primer".

Students with grades of D, F or J will *not* be given the opportunity to complete additional work to upgrade their grade. There will be a Supplemental Exam, however.<sup>1</sup> It will cover the same material as the Final Exam, is worth (i.e. replaces) the 40% component of that exam. For information on Supplemental Exams, see <http://www.mcgill.ca/artscisao/general/exams/supplemental/>.

## Other related courses

- COMP 558: Fundamentals of Computer Vision (Fall 2008). There is long history of interactions between the fields of computer vision and computer graphics. The two courses complement each other very well.
- COMP 559: Topics in Computer Science – Computer Animation (Winter 2009) This course will be offered by Prof. Paul Kry.

## Academic Integrity

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offenses under the Code of Student Conduct and Disciplinary Procedures. See [www.mcgill.ca/integrity](http://www.mcgill.ca/integrity) for more information, as well as the Student Guide to Avoid Plagiarism, [www.mcgill.ca/integrity/studentguide/](http://www.mcgill.ca/integrity/studentguide/).

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<sup>1</sup>McGill requires that any course with an exam during the Final Exam Period must have a Supplemental Exam.