

School of Computer Science

Course Title: Principles of Computer Graphics

Date: 3/10/04

Course Number: CAP-4710

Number of Credits: 3

Subject Area: Computer Systems	Subject Area Coordinator: S. Masoud Sadjadi email: sadjadi@cs.fiu.edu
Catalog Description: A first course in algorithms/techniques for image generation devices, geometric transformations/matrices, algorithms for hidden surfaces, ray tracing, advanced rendering. Programming with standard graphics interface. This course will have additional fees.	
Textbook: Computer Graphics with OpenGL, 3 rd Edition Hearn and Baker Prentice Hall (ISBN: 0130153907)	
References: Computer Graphics: Principles and Practice in C, 2 nd Edition Foley, van Dam, Feiner, and Hughes Addison-Wesley (ISBN: 0201848406)	
Prerequisites Courses: COP 3337 and MAC 2312	
Corequisites Courses: None	

UUType: Elective

Prerequisites Topics:

- Array, stack, and queue data structures
- Recursive functions
- Differentiation and integration

Course Outcomes:

1. Be familiar with drawing primitive objects (lines, circles, polygons) on a display
2. Be exposed to graphical input and output devices
3. Master two dimensional modeling and 2-D transformations
4. Be familiar with master-instance structure
5. Master three dimensional modeling and 3-D transformations
6. Be familiar with projection of 3-D objects on a 2-D plane
7. Master clipping, fill, and rendering techniques
8. Be exposed to color and shading models

School of Computer Science
CAP-4710
Principles of Computer Graphics

Outline

Topic	Number of Lecture Hours	Outcome
<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ Raster and vector graphics systems ○ Video display devices ○ Physical and logical input devices ○ Issues in graphical systems development ○ Coordinate representation 	6	2,4
<ul style="list-style-type: none"> • Drawing primitives <ul style="list-style-type: none"> ○ Line drawing algorithms ○ Circle and ellipse generation ○ Fill-area primitives, scan-line polygon-fill ○ OpenGL API ○ Character font outline & bitmap 	6	1
<ul style="list-style-type: none"> • Geometric transformations <ul style="list-style-type: none"> ○ Two dimensional transformations ○ Inverse transformations ○ Three dimensional transformations ○ Object-relational model 	6	3,5
<ul style="list-style-type: none"> • Viewing <ul style="list-style-type: none"> ○ Viewing pipeline ○ Normalization and viewing transformation ○ 2-D clipping algorithms ○ Projections: parallel and perspective ○ 3-D object representations ○ 3-D clipping techniques 	9	6,7
<ul style="list-style-type: none"> • Advanced graphics <ul style="list-style-type: none"> ○ Hidden-surface removal methods ○ Ray-tracing algorithm ○ Texture mapping ○ Color models: RGB, YIQ, CMY, HSV,HLS 	9	8

**School of Computer Science
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Course Outcomes Emphasized in Laboratory Projects / Assignments

	Outcome	Number of Weeks
1	Drawing primitive graphical objects Outcome: 1	2
2	Two dimensional transformations Outcomes: 3	3
3	Design of a 2-D graphical system with master-instance Outcomes: 3,4,7	4

Oral and Written Communication:
No significant coverage

Social and Ethical Implications of Computing Topics
No significant coverage

**School of Computer Science
CAP-4710
Principles of Computer Graphics**

Approximate number of credit hours devoted to fundamental CS topics

Topic	Core Hours	Advanced Hours
Algorithms:		1.5
Software Design:		
Computer Organization and Architecture:		0.5
Data Structures:	0.5	
Concepts of Programming Languages		

Theoretical Contents

Topic	Class time
Matrix theory	0.5

Problem Analysis Experiences

1. Mapping among several coordinate systems

Solution Design Experiences

1. Graphical transformations
2. Design of a simple graphical system

School of Computer Science
CAP-4710
Principles of Computer Graphics

The Coverage of Knowledge Units within Computer Science Body of Knowledge¹

Knowledge Unit	Topic	Lecture Hours
<u>GV1</u>	Hierarchy of graphics software, using OpenGL API, simple color models (RGB, HSB, CMYK), homogeneous coordinates, affine transformations (scaling, rotation, translation), viewing transformation, clipping	6
<u>GV2</u>	Raster and vector graphics systems, video display devices, physical and logical input devices, issues in graphical systems development	3
<u>GV5</u>	Line generation algorithms (Bresenham), font generation: outline vs. bitmap, light-source and material properties, rendering of a polygonal surface, introduction to ray tracing, sampling techniques & anti-aliasing	9
<u>GV7</u>	Scan conversion of 2D primitive, hidden surface removal methods, Z-buffer and frame buffer, advanced geometric modeling techniques	6

¹See <http://www.computer.org/education/cc2001/final/chapter05.htm> for a description of Computer Science Knowledge units