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:** Masoud Sadjadi **email:** sadjadi@cis.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, 3rd Edition Hearn and Baker Prentice Hall (ISBN: 0130153907)	
References: Computer Graphics: Principles and Practice in C, 2nd Edition Foley, van Dam, Feiner, and Hughes Addison-Wesley (ISBN: 0201848406)	
Prerequisites Courses: COP 3337 and MAC 2312	
Corequisites Courses: None	

Type: 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

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Outline

Topic	Number of Lecture Hours	Outcome
• Introduction o Raster and vector graphics systems o Video display devices o Physical and logical input devices o Issues in graphical systems development o Coordinate representation	6	2,4
• Drawing primitives o Line drawing algorithms o Circle and ellipse generation o Fill-area primitives, scan-line polygon-fill o OpenGL API o Character font outline & bitmap	6	1
• Geometric transformations o Two dimensional transformations o Inverse transformations o Three dimensional transformations o Object-relational model	6	3,5
• Viewing o Viewing pipeline o Normalization and viewing transformation o 2-D clipping algorithms o Projections: parallel and perspective o 3-D object representations o 3-D clipping techniques	9	6,7
• Advanced graphics o Hidden-surface removal methods o Ray-tracing algorithm o Texture mapping o Color models: RGB, YIQ, CMY, HSV,HLS	9	8

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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

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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

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The Coverage of Knowledge Units within Computer Science Body of Knowledge[1]

Knowledge Unit	Topic	Lecture Hours
GV1	Hierarchy of graphics software, using OpenGL API, simple color models (RGB, HSB, CMYK), homogeneous coordinates, affine transformations (scaling, rotation, translation), viewing transformation, clipping	6
GV2	Raster and vector graphics systems, video display devices, physical and logical input devices, issues in graphical systems development	3
GV5	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
GV7	Scan conversion of 2D primitive, hidden surface removal methods, Z-buffer and frame buffer, advanced geometric modeling techniques	6

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