COURSE DESCRIPTION

Dept., Number	CS411	Course Title	Computer Graphics
Semester hours	3	Course Coordinator	Dr. Gady Agam, Associate Professor

Current Catalog Description

Overview of display devices and applications. Vector graphics in two and three dimensions. Image generation, representation, and manipulation. Homogeneous coordinates. Modeling and hidden line elimination. Introduction to raster graphics. Perspective and parallel projections. Prerequisites: CS 331 or CS401 or CS403. (3-0-3) (T)

Textbook

Computer Graphics with OpenGL, 3rd ed., D. Hearn and M.P. Baker, Prentice-Hall, 2003.

References

OpenGL Programming Guide, 5th ed. M. Woo, J. Neider, et al. Addison - Wesley, 2005.

Computer Graphics: Principles and Practice, 2nd ed. J.D. Foley, A. Van Dam, et. al. Addison - Wesley, 1997.

Interactive Computer Graphics: A Top-Down Approach Using OpenGL, 3rd ed., E. Angel, 2003.

Course Outcomes

The following are the main objectives of the course:

- Provide overview of computer graphics.
- Provide understanding of basic concepts, mathematical models, techniques, and algorithms used in computer graphics in two and three dimensions.
- Provide graphics programming experience with OpenGL.

Students should be able to:

- Describe and understand the main areas of computer graphics, graphics software, and graphics hardware.
- Demonstrate an understanding of the basic concepts, mathematical models, techniques and algorithms relating to raster graphics. The students should be able to implement basic algorithms and modify them if necessary.
- Demonstrate an understanding of the basic concepts, syntax, and techniques behind the openGL graphics library. The students should be able to writh graphics programs by

using this software library.

- Demonstrate an understanding of the basic concepts, mathematical models, techniques and algorithms relating to 2D and 3D modeling and viewing. The students should be able to implement basic algorithms and modify them if necessary. They should be able to use openGL in this context.
- Demonstrate an understanding of the basic concepts, mathematical models, techniques and algorithms relating to 3D object representation. The students should be able to implement basic algorithms and modify them if necessary.
- Demonstrate an understanding of the basic concepts, mathematical models, techniques and algorithms relating to Color. The students should be able to implement basic algorithms and modify them if necessary.
- Demonstrate an understanding of the basic concepts, mathematical models, techniques and algorithms relating to Illumination models and surface rendering. The students should be able to implement basic algorithms and modify them if necessary. They should be able to use openGL in this context.

Relationship between Course Outcomes and Program Outcomes

The following Program Outcomes are supported by the above Course Outcomes:

- a. An ability to apply knowledge of computing and mathematics appropriate to the discipline
- c. An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs
- i. An ability to use current techniques, skills, and tools necessary for computing practices.
- j. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices

Prerequisites by Topic

Math - Calculus, Linear algebra

Programming - Data structures and algorithms, C/C++

Major Topics Covered in the Course

1. Introduction: overview of computer graphics, overview of graphics hardware and software	1.5 hours
2. Introduction to graphics programming with OpenGL: overview, concepts, syntax, libraries, basic drawing, state management	3 hours
3. Raster graphics: line and conic sections drawings, area filling, character generation, image operations, object attributes, antialiasing.	4.5 hours
4. 2D modeling and viewing: geometric transformations, homogeneous coordinates, affine transformation, line and polygon display	6 hours

5. Introduction to 3D Rendering with OpenGL: 3d rendering concepts, 3d modeling and viewing in OpenGL	6 hours
6. 3D modeling and viewing: 3D transformations, the 3D viewing pipeline, projections, clipping, visible surface detection, hierarchical modeling	7.5 hours
7. 3D object representation: polygonal surfaces, quadric surfaces, cubic splines, Bezier curves and surfaces, B-spline curves and surfaces, NURBS, CSG, octrees, BSP trees, other representations	7.5 hours
8. Color, illumination models, and surface rendering: basic illumination models, polygon rendering, ray tracing, texture and bump mapping, displaying light intensities, dithering, color models, LUTs, blending	7.5 hours
9. Midterm, Recap & Review	1.5 hours
Final Exam	-
	45 hours

Assessment Plan for the Course

End of every semester Course Objective Assessments by CS department. End of semester Course Evaluations by IIT. Reviewed every Spring semester by CS Undergraduate Studies Committee for possible updates in the following Fall. Once every 4-5 years a detailed review of all materials for the course is made by the CS Undergraduate Studies Committee.

How Data in the Course is Used to Assess Program Outcomes (unless adequately covered already in the assessment discussion under Criterion 4)

See the assessment discussion under Criterion 4

For a computer science program

Estimate Curriculum Category Content (Semester hours)

Area	Core	Advanced	Area	Core	Advanced
Algorithms		1.5	Software design		
Data structures		1.5	Concepts of programming languages		