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Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person **SOUNDARARAJAN EZEKIEL**	Email Address **EZEKIEL**
Proposing Department/Unit **COMPUTER SCIENCE**	Phone **7-6102**

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

_____New Course _____Course Prefix Change _____Course Deletion

__X__Course Revision _____Course Number and/or Title Change __X__Catalog Description Change

***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**
COSC 355 Computer Graphics	

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____Catalog Description Change _____Program Revision

_____New Degree Program _____Program Title Change _____Other

_____New Minor Program _____New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Department Curriculum Committee Chair(s)		5 Dec 06
Department Chair(s)	Wm. Oglesby	12/7/06
College Curriculum Committee Chair		05/17/07
College Dean	Gerard Buckley	9/24/07
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail S Scherrer	10/30/07

* where applicable

Received
NOV 06 2007
Liberal Studies

Received
SEP 25 2007
Liberal Studies

Part-II Description of the Curriculum Change

1. New Syllabus of Record

I. Catalog Description

COSC 355 Computer Graphics 3c-0l-3cr

Prerequisites: COSC 310 and junior status
The use of computer graphics hardware and software. An overview of current applications and experience with representative software will introduce current practice. Foundations in primitives, geometry, and algorithms of passive computer graphics are the principal focus. A brief introduction to interactive computer graphics is included.

II. Course Objectives

Upon successful completion of this course, the student should be able to

- Discuss computer graphics terminology, progress and issues.
- Describe different kinds of graphics display system.
- Write 2-D and 3-D computer graphics application.
- Model geometric objects into computer graphics.
- Create digital images using vector tools and parametric forms.
- Create images using affine transformation in both 2-D and 3-D cases.
- Develop tools for modeling, shaded objects and 2-D and 3-D viewing.
- Model shapes with polygonal meshes, surfaces and Bezier curves.
- Render texture and hidden surface removal
- Apply advanced techniques such as ray tracing, color theory, and fractals

III. Course Outline

A. Introduction 3 hours
   a. Where computer generated picture are used
   b. Primitives
   c. Input and output devices
   d. Graphics architectures

B. Drawing figures 4 hours
   a. Device independent programming
   b. Window based programming
   c. Graphics primitives
   d. Line drawing
   e. Interaction with input devices

C. Drawing tools 3 hours
   a. Viewports
   b. Figures based on regular polygons
   c. Drawing circles and arcs
   d. Parametric curves

D. Vector tools for graphics 3 hours
   a. vectors
   b. Dot product
   c. Cross product
   d. Representation of geometric objects
   e. Tweening
   f. Clipping

E. Transformation of objects 5 hours
   a. Introduction to transformation

b. 2-D , 3-D and inverse affine transformation
c. Changing coordinate systems
d. Drawing 3-D objects
e. Translation, scaling and rotation
f. Tiling

F. Modeling shapes with polygonal meshes — 4 hours
a. Polygonal meshes
b. Finding normal vectors
c. Properties of meshes
d. Polyhedra and Prism
e. Extruded shapes
f. Smooth objects

G. Three dimensional viewing — 4 hours
a. Positioning and pointing camera
b. Projection of 3-D objects point, line
c. Graphics pipeline
d. Taxonomy of projections

H. Rendering — 5 hours
a. Shading models
b. Flat and smooth shading
c. Texture
d. Shadows

I. Approaches to Infinity — 3 hours
a. Fractals, random fractals and self-similarity
b. String production
c. Peano curves
d. Creating images by iterated functions systems
e. Mandelbrot and Julia sets

J. Raster Display, curves and surface — 3 hours
a. Pixmaps
b. Aliasing
c. Polynomials
d. Bernstein polynomial
e. B-splines
f. Color theory

K. Hidden surface removal and ray tracing — 3 hours
a. Hidden surface removal methods
b. Hidden line removal methods
c. Overview of Ray-tracing process

Midterm exam — 2 hours

Total = **42 hours**

Final Exam **During Final Exam Week**

IV. Evaluation Methods

The final grade for the course is determined as follows:

Midterm exam	20%
Programming Assignments	30%
Final Exam	30%
Homework	10%
Quizzes	10%

V. Grading Scale: 90-100% A, 80-89% B, 70-79% C, 60-69% D, 0-59% F

VI. Attendance

The attendance policy will conform to the University wide attendance criteria.

VII. Required Textbook

Computer Graphics using Open GL., Second Edition, F.S.Hill, Jr., Prentice Hall, Upper Saddle River, NJ, 2001. ISBN 0-02-354856-8

VIII. Special Resource Requirements

None.

IX. Bibliography

Angel Edward, Interactive Computer Graphics, a Top Down Approach with Open GL, Reading, MA, Addison Wesley 2003.

Benny Raphael, Ian F.C. Smith, Fundamentals of Computer-aided Engineering, John Wiley and Sons, 2003.

Eric Lengyel, Mathematics for 3d Game Programming and Computer Graphics, Charles River Media, 2003.

Farin, Gerald, *NURB Curves and Surfaces From Projective Geometry To Practical Use,* A.K. Peters, Wellesley, MA, 1995.

Foley, J., A. van Dam, S. Feiner, and J. Hughes, *Computer Graphics: Principles and Practice,* second edition, Addison-Wesley, Reading, MA, 1990.

Foley, J., A. van Dam, S. Feiner, J. Hughes, and R. Phillips, *Introduction to Computer Graphics,* Addison-Wesley, Reading, MA, 1994.

Gonzalez, Woods, and Eddins, *Digital Image Processing Using MATLAB* Prentice Hall, 2004.

Govil-Pai, Shalini Principles of Computer Graphics Theory and Practice Using OpenGL and Maya®, Springer, 2005

Hartman, J. and J. Werneckle, The VRML 2.0 Handbook, Addison-Wesley, Reading, MA, 1996.

Hart, John C., G. Francis, and L. Kaufman, "Visualizing Quaternion Rotation," *ACM Transactions on Computer Graphics,* vol. 13, no. 3, July 1994, 256-276.

Jeff. Lander, Graphics Programming Methods, Charles River Media 2003.

John DiMarco Computer graphics and multimedia: Applications, Problems and Solutions Idea Group Inc, 2004

Peter Comninos, Mathematical and Computer Programming Techniques for Computer Graphics, Springer, 2006

Samuel R. Buss, 3D Computer Graphics: A Mathematical Introduction With Opengl, Cambridge University Press, 2003

Swoizral, H., K. Rushforth, and M.Deering, The Java 3D API Specification, Second Edition, Addison-Wesley, 2000.

Wendy Jones, Beginning DirectX 9, Thomson Course Technology 2004.

Watt, Alan, *3D Computer Graphics,* third edition, Addison-Wesley, Reading, MA, 2000.

Watt, Alan, and M. Watt, *Advanced Animation and Rendering Techniques,* Addison-Wesley, Wokingham, England, 1992.

2. Summary of the proposed revisions

For the past twelve years, the computer graphics field has been experiencing enormous growth with many applications. The syllabus is revised based on Application Programming Interfaces (API) as opposed to Integrated Development Environment such as Turbo Pascal Graphics.

The change from 2c-1l-3cr to 3c-0l-3cr brings this course in line with our other offerings. The current facilities do not require a designated "lab time" as when the course was developed (see rationale).

3. Justification/rationale for the revision

With the new advances in technology, our syllabus of record is outdated. Hence, it is necessary that we revise our old syllabus of record because it is a required course for Language and System track (LAS) to meet the ABET criteria.

When COSC 355 was created, the department had limited facilities for accommodating graphics programming. To assure students in the class an opportunity to use these facilities, the course was designed with a lab so that the few facilities could be used by small groups of students – much like a large science lecture has its students divided into smaller groups for labs. For some time, the department has had sufficient facilities to accommodate the entire class working on graphics programming both as a part of class time and in open labs for homework assignments. There is no longer a need to have the course with a different offering mode from our other courses; hence, we are changing to 3c-0l-3cr.

4. The old syllabus of record

I. Catalog Description

CO 355 Computer Graphics 2c-1l-3sh

Prerequisites: CO 310 and Junior status.

The use of computer graphics hardware and software. A broad overview of current applications and experience with representative software will introduce current practice. Foundations in basic programming concepts, passive computer graphics and human-computer interaction will be followed by experiences in the analysis and design of interactive computer graphics systems.

Procedural Notes: This course meets two times a week for 60-minute lectures, and once a week for a 60-minute small group laboratory session. The lab sessions are conducted in small groups to allow for hands-on activities and demonstrations. The size of lab groups is limited by the number of workstations which are available, and the need to give individual attention. The laboratory arrangement is especially helpful in orienting students to computing environments and functions with are novel to computer graphics or their experience, and in allowing students to complete many computing projects.

The course works best with a stable computing environment with adequate availability of that environment for student work outside of class. Hardcopy, high resolution displays, variable intensity pixel illumination, a bit-

mapped raster display, color, and programmable devices for interactive graphics are helpful. The course must be supported by a minimum level of these capabilities in its computing environment.

II. Course Purpose

This course is designed as a 300 level first course in computer graphics for computer science students. It is intended as an elective. Students should learn about advanced topics or study a particular topic in depth as an Independent Study project. Students should detail work with specific applications which make use of computer graphics in course work which makes use of those applications. For example, the study of interactive computer graphics for computer-aided design (CAD) is an advanced topic. The use of CAD may be an integral part of an engineering course or a course in Interior Design.

III. Course Content

The course includes experiences with existing computer graphics hardware and software at IUP; software packages (e.g., SLIDES and PLOT79); instruction in and programming of fundamental concepts, including data presentation graphics, standards (especially GKS on the Microvax II), analytic geometry for two and three-dimensional graphics, and algorithms for computer graphics; and an orientation to interactive graphics.

Since this is an introductory course which must be integrated within the total university context and each student's lifetime opportunities, and also because time is limited in a 3-credit course, certain topics are not covered. For example, the Geography Department has coursework which specifically addresses concerns of the use of computer graphics in cartography and image processing. The Art Department teaches the creation of fine art with the use of computer graphics. The Interior Design program includes the use of Computer-Aided Design (CAD). Journalism and Communications Media also make use of computer graphics. Other departments are working in this direction, particularly Chemistry. Within the Computer Science Department, the implementation of device drivers and the study of computer architecture concerns are left to other courses. Time limits generally prevent the study of ray-tracing, lighting, shading, and advanced techniques of animation and interaction. Students in COSC 355 are made aware of these applications and specialized topics, but they generally do not receive classroom instruction about them in depth.

IV. Course Outline

The following topics and emphasis are designed into the schedule. Advanced study and additional topics may be studied by means of a following Independent Study.

> Definition of Computer Graphics and broad overview	1 week
> Graphics software primitives	1 week
> Graphics standards	2 weeks
> Programming language concerns in IUP Graphics (C)	1 week
> Two-Dimensional Concepts and Algorithms	1 week
> Three-Dimensional Concepts and Algorithms	2 weeks
> Perspective	2 weeks
> Hidden-Line Problems and Algorithms	2 weeks
> Interactive Graphics	2 weeks
(> Discretion of instructor: Remove hidden-lines or interactive graphics to allow greater intensity in another topics, or the study of alternative topics.)	
* Total *	14 weeks

V. Course Requirements

The following items indicate the general requirements and grading policy. Point scores will be used to determine grade cutoffs for all COSC 355 students. The grade cutoffs will reflect the instructor's best judgment of what level

of achievement a particular point total represents. A course grade will then be determined by each student's point total, plus the personal judgment of the instructor for students who are at a borderline score.

Mid-term	100 points
Final	100 points
Computing projects	200-250 points
Quizzes	30-50 points
* Total *	430-500 points

VI. Bibliography of Appropriate Textbooks

Ammeraal, Leendert. (1986). New York: John Wiley & Sons.

Foley, J.D., and Van Dam, A. (1982). Fundamentals of Interactive Computer Graphics. Reading, MA: Addison-Wesley.

Harrington, Steven. (1987). Computer Graphics, A Programming Approach (Second Edition). New York: McGraw Hill.

Hearn, Donald, and Baker, Pauline. (1986). Computer Graphics. Englewood Cliffs, NJ: Prentice-Hall.

Park, Chan S. (1985). Interactive Computer Graphics. Reading, MA: Addison-Wesley.

Part-III Letters of Support or Acknowledgement

Not applicable