The University of Jordan
King Abdullah II School for Information Technology
Computer Science Department

Computer Graphics Syllabus (1901359) – Fall 2016

Instructor: Dr. Jamal Alsakran
Office location: KASIT 1st floor (Computer Science Department)
Office hours: 12 – 11 (Sun, Tues, Thurs)

Prerequisite: Data Structures I (1901231)

Course website: jamalalsakran.me/ComGraph/ComGraph.html

Course Description

This course offers an in-depth exploration of fundamental concepts in 2D and 3D computer graphics. After introducing 2D raster graphics techniques, the course focuses on 3D modeling, geometric transformations, 3D viewing and rendering. The course uses OpenGL as the basis for learning graphics programming. Example applications will be developed in lectures using C++ and OpenGL to demonstrate the techniques being presented.

The Goal:

The main goal of this course is to teach students the foundation of computer graphics and how images are generated on the computer. The course aims to provide you with sufficient background to write computer graphics applications.

Objectives

Enable students to:

1. Learn about computer graphics and its broad applications in various aspects of our day to day life.
2. Understand the algorithms used in computer graphics to build 2D/3D complex models from basic output primitives.
3. Understand the techniques used in computer graphics for illumination models and renderings
4. Understand the viewing pipeline and what goes behind the scene for images to look the way they do and how to manipulate parameters to control the model view.
5. Write computer graphics applications and implement the various techniques discussed throughout the course.

Intended Learning Outcomes:

The intended learning outcomes of this course are:

A- Knowledge and Understanding: Students should …

A1) Learn the concepts of computer graphics, including graphics primitives, and geometric transformations
A2) Know the important principles of computer graphics

B- Intellectual skills: with the ability to …

B1) Compare and analyze algorithms used in computer graphics.
B2) Apply mathematical tools to algorithm design.

C- Subject specific skills – with ability to …

C1) Work on case studies to show how all the tools are used together to build a complete program.

C2) Develop methods to reduce program errors, verify used algorithms, and efficiently debug programs.
C3) Translate abstract ideas into practice.
C4) Implement and handle large projects.

D- Transferable skills – with ability to

D1) Possess good programming style and computer graphics concepts.
D2) Develop advanced structures and algorithms into complete projects.
D3) Choose the appropriate algorithm structure for a certain project.

Weekly Course Contents and Teaching/Learning and Assessment with ILOs

Week	Topic Details	T/L and A Methods	ILOs
1	**Introduction:** computer graphics history, domain, and applications	**T**: Lecture and presentation **L**: Reading lecture notes and Ch.1 **A**: in class questions	A1, A2
2	**Graphics Systems:** video display devices, CRT, raster-scan systems, input devices, graphics software	**T**: Lecture and presentation **L**: Reading lecture notes and Ch. 2 **A**: in class questions	A1, A2
3	**OpenGL Basics:** basic GL library, GLU, GLUT	**T**: Lecture and presentation **L**: Reading lecture notes **A**: in class questions	A2, C3
4 + 5	**Graphics Primitives:** RGB color, point, line drawing algorithms, circle drawing algorithms, polygons, OpenGL attributes	**T**: Lecture and OpenGL examples **L**: Reading lecture notes and Ch. 3+4 **A: Homework 1**: **use OpenGL to draw and animate some basic shapes**	A2, B1, C1, D1, D2, D3
6	**2D Geometric Transformation:** 2D translation, rotation, scaling, and some other transformations, homogeneous coordinates, composite transformations	**T:** Lectures and presentation **L**: Reading lecture notes and Ch. 5 A: in class questions	A1, B2, C2
7	**3D Geometric Transformation:** 3D vector calculus, 3D translation, rotation, scaling, and some other transformations, homogeneous coordinates, composite transformations	**T:** Lectures OpenGL examples **L**: Reading lecture notes and Ch. 5 A: **Homework 2**: **use OpenGL to simulate the sun, earth, and moon orbiting in space**	C3, D2
8	**2D Viewing:** 2D viewing pipeline, different coordinate representations, clipping algorithms, OpenGL 2D viewing	T: Lectures and presentation **L**: Reading lecture notes and Ch. 6 A: in class questions A: Quiz 1 – vectors operations	A1, A2, B3, C4
	Midterm exam	**A**: Written exam - Chs. 1- 6	
9 + 10	**3D Viewing:** 3D viewing pipeline, world to viewing coordinates, orthogonal projection, perspective projection, 3D clipping, OpenGL 3D viewing	T: Lectures OpenGL examples **L**: Reading lecture notes and Ch. 7 A: in class questions	A2, B3, C4, D1, D2
11	**3D Object Representations:** polyhedral, curved surfaces, Bezier Splice curves and surfaces	**T**: Lectures OpenGL examples **L**: Reading lecture notes and Ch. 8 **A**: **Homework 3**: **OpenGL 3D viewing and representations**	A2, B4, C5, D1
12	**Visible Surface Detection:** visible surface detection algorithms, depth buffer, area subdivision method	T: Lectures and presentation **L**: Reading lecture notes and Ch. 9 A: in class questions	A2, B4, C5

13 + 14	**Illumination Models:** light sources, illumination models, shadows, camera, texture mapping, OpenGL illumination, OpenGL texture	T: Lectures and presentation **L**: Reading lecture notes and Ch. 10 **A**: **Homework 4**: **an extension to Homework 3 by adding shading and textures**	A2, B4, C5
15	**Review**	**T**: Summary and Review **L**: Demo **A**: Sample of exams	
16	**Final Exam**	Written exam - Chs. 1- 10	

Teaching (T) Strategies: The class contact is 3 hours per week. The course will be delivered using different means like lectures, presentations, demonstration examples, and discussions.

Learning (L) Methods: Students attend classes, ask questions and participate in discussions, do the homework, present and demo their work. Students will use the lab to implement the homework. Students will access the e-learning platform for more instructions and supported learning materials.

Assessment (A) Methods: There will be several assessment methods of evaluating the performance of the students such as attending and class participation, grading the homework, quizzes and assignments; conducting the Midterm and the Final Exams. Every student is expected to completely adhere to the assignments and project strict deadlines, absolutely no exceptions will be given.

Evaluation:

Mid-Term Exam	25%
Homework and Assignments	25%
Final Exam	50%

Satisfactory completion of this subject requires a 50% pass in the end-of-semester examination.
Grading Scale:

F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A
0 -35	36-49	50-55	56-61	62-66	67-71	72-76	77-81	82-86	87-89	90-93	94-100

Text Book:
Computer Graphics with OpenGL, Hearn and Baker, Prentice Hall, 3rd Edition 2004

References:
1. Interactive Computer Graphics - A Top-Down Approach using OpenGL, Angel and Shreiner, Addison-Wisely, 5th or 6th Edition
2. OpenGL(R) Programming Guide: The Official Guide to Learning OpenGL(R), Version 1.4 (4th Edition), Architecture Review Board, Dave Shreiner, Mason Woo and Jackie Neider (Nov 13, 2003)

Ethics: The honor code applies to all work turned in for this course including exams and assignments. It is important that you understand the solutions to all problems, and the best way to gain an understanding is to work them out and write them up by yourself. Hence the policy is that you must submit your own work and clearly list your references. You may not share your work with other students, unless it is allowed as group. Violating the policy will be taken as a no submission state for the assignment. University regulations will be preserved at all times.