SYLLABUS
Computer Graphics and Geometric Modeling
ME/CprE/ComS 557 – Fall 2018

Course Description
The course covers the principles of computer graphics. This incorporates the representation of 3D models, materials, lighting and shading, transformations and animations, as well as interaction and collision detection. The students will learn how to represent and prepare a 3D object for rendering, how to render an image on screen, and how to work with graphics parameters to generate the expected output. The goal is to create a 3D graphics application that utilizes the taught techniques.

Course Outcomes
- Demonstrate a command of the basic principles underlying 2D and 3D computer graphics.
- Develop programs in OpenGL to display objects, view them in scenes, navigate and interact with them.
- Create programs to model 2D and 3D shapes in a variety of ways, using geometric primitives, meshes, etc.
- Encounter and assimilate new graphics techniques more quickly based on the background developed.

Grading:
Assignments: 60%
Final Project: 40%

Individual Homework:
The homework assignments incorporate the writing of algorithms and math problem solving for topics that have been addressed in class. The outcomes prepare the students for the final project and can be reused for it. All homework tasks must be individually solved.

Final Project
The final project is a programing exercise: students have to define, to plan, and to implement a computer graphics application. The applications must address the topics of class. Every student has to propose an application and functionality one their own. A grading schema will be offered that will help to define a project sufficient to pass this course. If the proposed program is accepted, the project must be realized and presented until the end of term.

Prerequisites: basic programming experience in C, C++, basic knowledge in Linear Algebra.

Instructor: Rafael Radkowski
1620 Howe Hall (VRAC),
email: rafael@iastate.edu

Meeting times and venue: Tuesday/Thursday 2:10 – 3:30PM, 1324 Howe Hall

Office hours: Mo, 1:00 pm - 2:00 pm, Tu, 1:00 -2:00 pm, in 1620 Howe Hall.

Course Outline (tentative)

Week 1	• Introduction into Computer Graphics • Software introduction • OpenGL, glfw, and glm
Week 2	• C++ and • GLSL Introduction
Week 3	• OpenGL Primitives • Model representation
Week 4	• Homogenous coordinate system • Transformations: translation, rotations, and scaling • Quaternion and Rodriguez Rotation
Week 5	• Virtual camera: orthogonal and perspective projection • Virtual camera: 3D world to 2D image transformations • Rendering pipeline
Week 6	• Light and Light models (Ambient, spot, direct, and parallel light) • Color and material • Blend Function and Blend Equations • Shading (Flat, Goraud, and Phong Shading Model)
Week 7	• Textures and texture mapping, • Texture Coordinates • Texture filter: magnification and minifying filter
Week 8	• Texture filter (point sampling, linear sampling / bilinear, trilinear, and anisotropic filters) • Texture blending modes • Textures: MidMaps • Anti-aliasing
Week 9	• Animations • Virtual Trackball, Navigation
Week 10	• Keyframe animation • Blend Shape Morphing
Week 11	• 2D/3D Picking • Ray-intersection test
Week 12	• Ray-box intersection, • Ray-sphere intersection
Week 13	• Global Illumination • Environment Mapping • Bump Mapping
Week 14	• Parametric surfaces
Week 15	• Project presentations
Week 16	• Project presentations

Grading scale: the final grade will be determined as follows

A	100.0-93.0
A-	92.0-90.0
B+	87.0-89.9
B	83.0-86.9
B-	80.0-82.9
C+	77.0-79.9
C	73-76.9
C-	70.0-72.9
D+	67.0-69.9
D	63.0-66.9
D-	60.0-62.9
F	0-59.9

Recommended Textbook

Graham Sellers, Richard S Wright Jr., Nicholas Haemel**, OpenGL Superbible: Comprehensive Tutorial and Reference** (7th Edition), Addison-Wesley Professional

Hughes et al. **Computer Graphics: Principles and Practice (3rd Edition)**, Addison-Wesley (The textbook is not required. Nevertheless, the course is structured according to this textbook and it can help to understand the content.)

Special Needs:

Please discuss any special needs or special accommodations with me at the beginning of the semester or as soon as you become aware of your needs. Those seeking accommodations based on disabilities should obtain a Student Academic Accommodation Request (SAAR) form from the Disability Resources (DR) office (515-294-7220). The DR office is located on the main floor of the Student Services Building, Room 1076.

Disabilities Syllabus statement:

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. All students requesting accommodations are required to meet with staff in Student Disability Resources (SDR) to establish eligibility. A Student Academic Accommodation Request (SAAR) form will be provided to eligible students. The provision of reasonable accommodations in this course will be arranged after timely delivery of the SAAR form to the instructor. Students are encouraged to deliver completed SAAR forms as early in the semester as possible. SDR, a unit in the Dean of Students Office, is located in room 1076, Student Services Building or online at www.dso.iastate.edu/dr/. Contact SDR by e-mail at disabilityresources@iastate.edu or by phone at 515-294-7220 for additional information.

Disagreement: protest of grades must be submitted in hardcopy format to the instructor. The protest has to explain what part of the assignment has been incorrectly graded and refer to the score metric for this particular assignment. The entire homework will be re-graded if the protest is valid. Protest can only be submitted once per assignment