Dr. Angelos Barmpoutis
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Office: E109, CSE building
Hours: Thursdays 10:40am-12:35pm

DIG4930 Special Topics in DAS
Game Engine Development

Spring 2026

Course Meetings: NRG0120, Tuesdays 5-6th period (11:45am-1:40pm) & Thursdays 6th period (12:50pm-1:40pm)
Course Modality: Face-to-Face (F2F) Live and Online Live (online section)

Course Description

In this course the students will learn how to develop their own 3D game engine from scratch and use it to deploy a game in various gaming environments such as phones, tablets, and extended reality headsets. The topics that will be covered include 3D object encoding, 3D transformations, hierarchical scene structuring, animation loop, physics engines, rendering with shaders, input controller event handling, output vibration triggering, game resource management and deployment.

Course Prerequisites

Digital Arts and Sciences BA major (DAR_BA) & (DIG 3873(C) or COP 3502(C))

Learning Outcomes

By the end of this course, students will be able to:

- Understand the core components of a 3D game engine.
- Develop custom game engines.
- Deploy fully functional games in mobile and extended reality devices using the engines they created.

Materials & Books

Required

- NONE

Supplemental

- Frank Pouhela (2024). "3D Game Engine Development", Publisher: Independently published; 1 edition, ISBN: 9798878081344

Technology Requirements
- Android Studio (free software).
- Unity (free for education).
- Meta OpenXR SDK (free): https://github.com/meta-quest/Meta-OpenXR-SDK
- Laptop to run Android Studio and Unity

Course Schedule

This schedule is only a guide and is subject to change. Unless otherwise indicated, assignments and readings are due the day they are listed on the syllabus, not the following day.

Week	Subject	Assignment Quizzes	Assignments Due
1	**Course Overview.** **Required Software Overview.** **Homework Assignment:** Install required software.	**Install Required Software**	**Sunday Midnight**
2	**What are the core components of a 3D Game Engine?** Explore professional 3D game engines, identify requirements, parts, protocols, and systems. **Homework Assignment:** Create a component map of a game engine.	**Homework Assignment**	**Sunday Midnight**
3	**3D Data Encoding:** Geometric representations, polygonal meshes, vertices, faces, textures. **Homework Assignment**: Create a Mesh class and primitive shapes.	**Homework Assignment**	**Sunday Midnight**
4	**3D File Formats:** Text vs Binary, OBJ encoding, syntax, file parts, other file formats. **Homework Assignment:** Create an OBJ parser.	**Homework Assignment**	**Sunday Midnight**
5	**3D Transformations:** Linear algebra (matrices), translations, rotations, Scale, projection, local transform, global transform, model view and projection matrices. **Homework Assignment:** Make a Transformation class.	**Homework Assignment**	**Sunday Midnight**
6	**Shaders:** GPU rendering, vertex shader, fragment shader, GLSL shader language, Phong shading model **Homework Assignment:** Create a basic shader.	**Homework Assignment**	**Sunday Midnight**
7	**Shaders cont.:** Normal maps shaders, mat-cap shaders, animation shaders **Homework Assignment:** Create an animation shader.	**Homework Assignment**	**Sunday Midnight**
8	**Scene Hierarchy**: Component Tree, Root, children components, local transformations.	**Homework Assignment**	**Sunday Midnight**

	Homework Assignment: Create a class structure to implement scene hierarchy.		
9	**Animation loop**: Start method, update method, draw method, frame statistics, FPS independent animations **Homework Assignment:** Implement a full animation loop	**Homework Assignment**	**Sunday Midnight**
10	**Input Devices**: Touch event handling, OpenXR controller mapping, pressure triggers and joystick events. **Homework Assignment:** Create methods for multi-finger touch events.	**Homework Assignment**	**Sunday Midnight**
11	**Colliders**: Geometry simplification, spherical colliders, box colliders **Homework Assignment:** Create a spherical collider	**Homework Assignment**	**Sunday Midnight**
12	**Physics simulation**: Force based simulation model, physics-based animation, gravity and other forces. **Homework**: Implement a sling shot interaction	**Homework Assignment**	**Sunday Midnight**
13	**Physics engines**: Rigid body, mass, properties, Bullet API **Homework**: Implement a scene with a stack of spheres.	**Homework Assignment**	**Sunday Midnight**
14	**Adding everything together**: Audio, full game scene, level making, interactive elements, animations **Homework**: Implement a simple game part 1	**Homework Assignment**	**Sunday Midnight**
15	**Use cases**: Endless runner development, randomly generated levels, deployment across devices **Homework**: Implement a simple game part 2	**Homework Assignment**	**Sunday Midnight**

Grading Criteria

Assignment / Assessment	Total Points	% of Grade
Attendance and Participation: Students are expected to actively participate in the live sessions and respond to in class discussions.	10	10%
Homeworks: Student are expected to submit completed homework assignments in canvas and follow the posted instructions. The homework assignments will be graded using the corresponding rubric in canvas.	90	90%

Grading Scale

Letter Grade	% Equivalency
A	94 – 100%
A-	90 – 93%

B+	87 – 89%
B	84 – 86%
B-	80 – 83%
C+	77 – 79%
C	74 – 76%
C-	70 – 73%
D+	67 – 69%
D	64 – 66%
D-	60 – 63%
E, I, NG, S-U, WF	0 – 59%

More information on grades and grading policies is here: https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

Materials and Supply Fees

Material and supply and equipment use fee information are available from the academic departments or from the schedule of courses (Florida Statutes 1009.24). The total course fee for this class is $29.00. The total course fee for each course is listed on the UF Schedule of Courses. (https://registrar.ufl.edu/soc/)

Course Policies

Attendance Policy, Class Expectations, and Make-Up Policy

The instructor is responsible for communicating the specific details of what percentage of your grade (if any) will be assigned to participation, and how class participation will be measured and graded. The UF Digital Worlds Institute is committed to the idea that regular student engagement is essential to successful scholastic achievement. No matter if the class is held in a traditional classroom, an online classroom, or a combination of the two, interaction with your peers and the instructor will empower you to greater achievement.

In our course, attendance is mandatory. Students are allowed **three unexcused absences**. If you miss more than **three classes** during the semester, each additional absence will lower your overall grade by **10 points**. If you miss more than **six classes**, you will fail the course. Exempt from this policy are those absences outlined in the Excused and Unexcused Abscesses policy linked below.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Course Technology

The students will be required to have access to and use a personal computer with access to the Internet. Word editing software will be required for written assignments.

The University of Florida and Digital Worlds requires that students have access to and ongoing use of a laptop/mobile computer for DIG courses in order to be able to function in the current learning environment. Digital Worlds requires each DAS major's laptop computer to meet certain minimum specs for heavy graphics use, the requirements documented below must be met. https://digitalworlds.ufl.edu/programs/ba-in-digital-arts-sciences/technology-requirements/.

Course Communications

Students can communicate directly with the instructor regarding the course material through the course management system (CANVAS) using "Canvas E-Mail".

Course Technology Support

UF Computing Help Desk

For support related to account services, technical consulting, mobile device services, software services, administrative support, application support center, and learning support services, please contact the UF Computing Help Desk available 24 hours a day, 7 days a week at 352-392-4357 or helpdesk@ufl.edu.

University Policies

Information about university-wide policies and resources can be found here: https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/

Disclaimer: This syllabus represents the instructor's current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.