Course Title: Introduction to Computer Graphics

Course No: CS360

Instructor's Name: Soumya Dutta

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Credits: 3-0-0-0 (9)

Prerequisites: Linear Algebra, excellent programming skills (JavaScript, HTML)

Who can take the course: UG Students

Departments that may be interested: CSE, EE, ME

Class Timing: MTh 2 pm-3:15 pm

Venue: Rajeev Motwani Building, Room-101 (RM-101)

Course Objective:

Computer graphics is one of the fundamental topics in computer science that deals with generation of images or any kind of visualization in a digital device. The goal of learning computer graphics is to develop a comprehensive understanding of the principles, techniques, and applications of computer-generated imagery in various disciplines. Through this course, the students will learn the fundamental concepts and theories of 2D and 3D graphics algorithms and through several programming assignments they will gain hands-on experience on 2D/3D interactive graphics programming. Students will also learn about various rendering paradigms that are used to generate realistic and real-time images. To generate real-time graphics, we will cover GPU shader programming. We will also discuss Ray Tracing techniques that are used to produce realistic graphics by simulating the light transport phenomena. Through this course, students will gain proficiency in graphics programming, enabling them to create and manipulate visual content for a wide range of disciplines, including gaming, animations, visualization, and design.

Course Contents:

Index	Topics
1	Introduction, Math Basics, Raster Images, JavaScript
2	Graphics API, WebGL
3	Transformations 2D and 3D
4	Viewing & Projections
5	GPU Pipeline, GPU Shaders, and Shader Programming, GLSL
6	Basic Shape Generation and Polygonal Meshes
7	Illumination and Shading, Shading Transformations

8	Textures, Textures on GPU, Cube Environment Mapping, Bump mapping and Normal Mapping
9	Frame Buffer Objects (FBO), Rendering to FBO, Planer Reflections
10	Multi-pass rendering: Advanced Graphics Effects
11	Texture/Image Texture Post processing in Shader
12	Rendering Equation, Rendering Algorithms
13	Ray Tracing, Distributed Ray Tracing: Reflection, Shadow Mapping, and other advanced topics

Policies:

- Please be on time for the lectures.
- You are expected to submit your assignments in time.
- **Students caught cheating or plagiarizing will automatically fail the course and will be reported to the institute. No exceptions. Please cite your sources properly in your work. Your assignments should be your own original work.**
- If you are unwell, please follow the standard IITK procedure.

Noteworthy points:

1. We might add new, drop existing, or reorder topics depending on the progress and class feedback. Things may be changed by mutual consent after discussion in class.
2. Grading will be relative.
3. The recommended reading material is part of the course material.
4. If required, extra classes will also be conducted at weekends.

Evaluation:

Category	Split
Attendance*	5%
Quiz	15%
Programming Assignments	40%
Mid-Sem Examination	20%
Final-Sem Examination	20%

*Attendance will be collected in class and based on that the grade for attendance will be assigned.

Books, References, and Resources:

There is no dedicated textbook for this course. Lectures and slides and any other material provided in the class should be treated as main resources. However, here is a list of books and references that can be used to learn some topics covered in the class.

1. Fundamentals of Computer Graphics, Steve Marschner and Peter Shirley, 4th Ed, CRC Press.

2. Interactive Computer Graphics, A Top-Down Approach with WebGL, Edward Angle and Dave Shreiner, 7th Ed, Pearson.

3. Realistic Ray Tracing, Peter Shirley and R. Keith Morley, AK Peters.

4. Computer Graphics: Principle and Practice, James D. Foley, Andries van Dam, Steven K. Feiner, John Hughes, Morgan McGuire, David F. Sklar, and Kurt Akeley.

5. WebGL 2.0 Specification at khronos.org.

6. The OpenGL® Shading Language Manual, John Kessenich, Dave Baldwin, and Randi Rost.