Course Title: Computer Graphics and Multimedia

A Program Elective for CSE

L-T-P-C: 2-1-0-3

Prerequisite: Vector calculus, Linear Algebra and Computer Programming.

1. Course Objectives: The objective of the course is to introduce principles of computer graphics from the mathematical foundation to graphics visualization. This will cover the stages in rendering digital information to human understandable graphics including object representation, transformation, viewing, and projection.

2. Course Syllabus: This course is divided in six units given below.

Unit – 1 [6 Hours]: Computer Graphics Basics - Applications, Random and Raster scan systems; Graphics software and standards - OpenGL introduction; Graphics Primitives - Points, lines, circles and ellipses.

Unit – 2 [6 Hours]: Area Fill - scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation; Attributes of output primitives - line attributes, area-fill attributes, character attributers; OpenGL primitives - Functions, pipeline, drawing output primitives with OpenGL, event handling and view manipulation.

Unit – 3 [8 Hours]: 2D Transformations - Basic transformations, matrix representations, homogeneous coordinates, composite transformations, reflection and shearing; Viewing - viewing pipeline and coordinates system, window-to-viewport transformation, point clipping, line clipping, polygon clipping.

Unit – 4 [5 Hours]: 3D concepts - Parallel and perspective projection, Depth cueing, Visible line and surface identification; 3D representation - Polygon surfaces, tables, equations, meshes, curved lines and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods, Bezier curves and surfaces, B-spline curves and surfaces.

Unit – 5 [6 Hours]: 3D transformations - Translation, rotation, scaling, reflection, shear, composite transformations; 3D viewing - viewing pipeline and coordinates, parallel and perspective transformation, view volume and general parallel and perspective projection transformations.

Unit – 6 [5 Hours]: Visible surface detection - back face detection, Depth buffer, Abuffer,

Scan-line detection; Illumination models - light sources, basic illumination models, ambient, diffuse and specular reflection; Color models - properties of light, chromacity diagram, XYZ, RGB, YIQ, CMY, HSV models.

3. Books:

1. **Text Book:** Donald D. Hearn, M. Pauline Baker, Warren Carithers, Computer Graphics withOpenGL, 4th edition, 2013, Pearson Education India, ISBN: 978-9332518711

Reference Books:

1. Peter Shirley et al., Fundamentals of Computer Graphics, 3rd edition, CRC Press,
2. ISBN:978-1568814698
3. James D. Foley et al., Computer Graphics: Principles and Practice, 3rd edition, 2013,
4. Pearson Education India, ISBN: 978-0321399526
5. Dave Shreiner, OpenGL Programming Guide: The Official Guide to Learning
6. OpenGL, version 4.3, 2013, ISBN: 978-0321773036
7. Donald D. Hearn, M. Pauline Baker, Computer Graphics C Version, 2nd edition,2002, Pearson Education India, ISBN: 978-8177587654

4. Pre-Requisites: The following skills are necessary for this course.

Vector Calculus: The students should have basic concepts of differentiation and integration of vector fields.

Linear Algebra: The student must know the following linear algebra topics: matrices, matrix operations, determinants, system of linear equations, Eigen values, Eigen vectors.

Computer Programming: The students should also have programming skills to complete assignments and projects. It would help the students to solve real world problems. Matlab, Python or C/C++ could be considered for implementing the algorithms.

5. Grading Policy: The grade of the students would be decided based on the written examinations, assignments and class participation.

15% Mid-Exam
25% End-Exam
30% Assignments
15% Project
15% Class Participation

6. Resources:

I. Computer Graphics (CMU 15-462/662, Spring 2021)
by Prof. Nancy Pollard

Carnegie Mellon University
Link: http://15462.courses.cs.cmu.edu/spring2021/courseinfo

7. Course Ethics: Please note down the following activities leading to a fair academic honesty:

- All class work is to be done independently.
- It is best to try to solve problems on your own, since problem solving is an important component of the course, and exam problems are often based on the outcome of the assignment problems.
- You are allowed to discuss class material, assignment problems, and general solution strategies with your classmates. But, when it comes to formulating or writing solutions you must work alone.
- You may use free and publicly available sources, such as books, journal and conference publications, and web pages, as research material for your answers. (You will not lose marks for using external sources.)
- You may not use any paid service and you must clearly and explicitly cite all outside sources and materials that you made use of.
- I consider the use of uncited external sources as portraying someone else's work as your own, and as such it is a violation of the University's policies on academic dishonesty.
- Instances will be dealt with harshly and typically result in a failing course grade.

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