Navrachana University

TEACHING PLAN

Computer Graphics
(CS240)

Faculty	Patel Tejaskumar R			Division	A
Contact	Tejaskumar.patel@nuv.ac.in	Office Hours	10:00 am - 6:00 pm		
School	School of engineering and Technology				
Program	Computer Science and engineering				
Semester	Spring			Credits	03
Academic Year	2022-2023				
Lecture time & Weekdays	Thursday 11.00 to 12.00 pm Friday 02.00 to 03.00 pm Tutorial:Monday 11.00 to 12.00 pm Friday 03.00 to 04.00 pm	Location	Room No: 502 Room No:501 Room No:504 Room No:-501		
Pre-requisites	Knowledge of C/C++ Programming, Free Hand Drawing				
Course Description	The purpose of this course is to study the process of creating graphics using computer programs.				
Course Abstract *	Computer graphics can be a powerful tool for supporting visual problem solving, and interactivity plays a central role in harnessing the users' creativity. This course will introduce various interactive tools developed in computer graphics research field with their design rationales and algorithms. Examples include enhancements to graphical user interfaces, authoring tools for 2D drawings and 3D animations, and interactive computer-aided design systems. Rich live demonstrations and course assignments will give you insights and skills to design and implement such tools for your own problems.				
Course Objectives	• To acquaint the Learner with the basic concepts of Computer Graphics • To Learn the Various algorithms for generating and rendering graphical figures. • To get Familiar with mathematics behind the graphical transformations. • To Understand and apply various methods & techniques regarding projections, animation, shading, illumination and lighting.				
Learning Outcomes	• Identify the Basic terminologies of Computer Graphics and interpret the mathematical foundation of the concepts of Computer graphics. • Apply Mathematics to Develop Computer Programs for elementary graphics operations • Illustrate the concepts of windowing and clipping and Apply various algorithms to fill and clip polygons • Understand and Apply the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection • Understand the concepts of color models, lighting, shading models and hidden surface elimination. • Create effective programs using concepts of curves, fractals, animation and Gaming				
Typology of Course	Theory				
Course Outline (Units, Hours, Textbooks, Reference Books)	**Unit 1** **8hrs** Introduction to computer graphics, lines, line segments, vectors, pixels and frame buffers, vector generation, DDA and Bresenham's line and circle drawing algorithms, anti-aliasing, thick lines,character generation: Stroke Principle,				

Starburst Principle, Bit map method, display of frame buffer.
Graphics Primitives: Display devices, Interactive devices: Tablets, touch panels, mouse, joysticks, track balls, light pen etc., Data generating devices: Scanners and digitizers, primitive operations, display file structure, algorithms and display file interpreter, Text and line styles. Introduction, representation, entering Polygons, Polygon filling: Seed fill, Edge fill, scan conversion algorithm, filling with patterns

Unit 2 **12 hrs**

2D Transformations: Introduction, matrices, Scaling, Rotation, homogeneous coordinates, Translation, Co-ordinate transformation, rotation about an arbitrary point, inverse transforms and shear transforms Introduction, segment table, segment creation, deletion, renaming. Image transformations, raster techniques
Windowing and Clipping: Introduction, viewing transforms, 2D clipping, Cohen-Sutherland outcode algorithm, Polygon Clipping, Sutherland-Hodgeman algorithm, Generalized clipping. 3-D Transformations: Introduction, 3-D geometry, primitives, transformations, Rotation about an arbitrary axis, Concept of parallel and perspective projections, Viewing parameters, 3D clipping, 3D viewing transformations

Unit 3 **8hrs**

Introduction, Back-face removal algorithm, Z buffers, scan-line, Painters algorithm, Warnock algorithm, hidden line methods, binary space partition. Light, Color and Shading: Introduction, Diffused illumination, point source illumination, shading algorithm, reflections, shadows, ray tracing, Colour models and tables, shading algorithm, transparency

Unit 4 **12hrs**

Curves and Fractals: Introduction, Curve generation, Interpolation, interpolating algorithms, interpolating polygons, B-Splins and corners, Bezier curves, Fractals, fractal lines and surfaces (With complete mathematical treatment of this unit)

Unit 5 **5hrs**

Development of 3D structures and their projection in various angles. Generation of isometric views from given information of front view, top view and side view and vice versa

Text Books:

1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill publications, 1987, ISBN 0 – 07-100472- 6.
2. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 - 07 - 048677 - 8.

Reference Books

1. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition. Tata McGraw- Hill Publication, 2001, ISBN 0 - 07 - 047371 - 4.
2. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2 nd Edition, Pearson Education, 2003, ISBN 81 - 7808 - 038 -9.
3. F. Hill, "Computer Graphics: Using OpenGL", 2nd Edition, Pearson Education, 2003 ISBN 81 - 297 -0181 - 2.
4. D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition, Pearson Education, 2002, ISBN 81 - 7808 - 794 – 4

Pedagogy	• It includes various methods like mathematical illustration can be made interesting through board work. • Power point presentation and multimedia tools for explaining rendering Programming for creating graphic objects needs an online graphics tools or online C compilers. • The subject expects lots of interaction with the students which allows keeping track of their understanding.
Expectations from Students *	• Students must pre-read the materials covered in previous sessions. • Students must practice programs given in assignments/laboratory session. • Students must solve the problems/numerical given in tutorial session.
Assessment / Evaluation	30 Mid Semester Examination 15 Tutorial 15 Quiz 40 End Semester Examination
Attendance Policy	As per the university attendance policy
Project / Assignment Details *	
Course Material	As Mentioned above in course outline
Additional Information *	

* These are optional fields.

Session Plan

Topic Title	Session No.	Topic & Subtopic Details	Readings, Cases, etc.	Activities *	Important Dates
Unit-1 Introduction to computer Graphics	1	Basic of Computer Graphics, Applications of computer graphics	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-1	Theory class	
	2	Random and Raster scan systems, character generation methods	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-2	Theory class	
Graphics Primitives :	3,4	Graphics input devices, Graphics output devices Data generating devices Graphics software and Standards	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch- 2	Theory class	
	5	Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, antialiasing methods	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-3	Theory class	
	6	Illustration of DDA and Bresenham's line and circle drawing algorithm	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-3	Theory class	

	7,8	Fill area primitives : seed fill,Edge fil,scan-line polygon filling and filling by pattern	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-3	Theory class	
Unit-2 2D transformation	9,10	translation, rotation, scaling, matrix representation, homogeneous coordinates,	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-5	Theory class	
	11	Inverse transform and shear transforms	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-5	Theory class	
	12	Segment table, segment creation, deletion renaming	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-5	Theory class	
	13	Image transformation Raster techniques	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-5	Theory class	
Windowing and clipping	14	Introduction, viewing transforms , 2D clipping	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-6	Theory class	
	15	Cohen Sutherland outcode algorithm, polygon clipping	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-6	Theory class	
	16	Sutherland-hodgeman algorithm Generalized clipping	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-2	Theory class	
3D transformation	17,18	Introduction , 3-D geometry,primitives,3D transformations	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-11	Theory class	
	19,20	Parallel and perspective projections,3D view and 3D clipping	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-12	Theory class	
Unit-3	21	Back face removal and Z buffer algorithm	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-13	Theory class	

	22	Scan line and painters algorithm	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-13	Theory class	
	23	Warnock algorithm, hidden line methods	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-13	Theory class	
	24	Binary space partition , light ,color and shading	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-14,ch-15	Theory class	
	25	Diffused illumination	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-14	Theory class	
	26	Point source illumination and ray tracing	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-14	Theory class	
	27	Shading algorithm	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-14	Theory class	
	28	Transparency	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-14	Theory class	
Unit 4 Curves and fractals	29	Introduction of basic curves and fractals.	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	30	Curve generation	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	31	Interpolation	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	32	Interpolating algorithms	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	

	33	Interpolating polygons	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	34	B-splines and corners	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	35	Bezier curves	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	36	Fractals	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	37,38	Fractal lines and surfaces	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-10	Theory class	
	39	Quiz	----------	Exam	
Unit 5	40,41	Development of 3D structure and their projections in various angles.	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-13	Theory class	
	42,43	Generation of isometric views from inputs: front view, top view and side view	D. Hearn, M. Baker, "Computer Graphics - C Version", 2nd Edition Ch-13	Theory class	
	44	Revision of initial units	-	Theory Class	
	45	Revision of initial units	-	Theory Class	