Year: 2021
Semester: V

1. Name of the Faculty: Dr. Anil Kumar — Course Code: CSEG 3003
2. Course : Computer Graphics — L: 36
3. Program : B. Tech CSE — T: NA
4. Target : Level-1 — P: NA
   C: 3

COURSE PLAN

Target	50% (marks)s
Level-1	40% (population)
Level-2	50% (population)
Level-3	60% (population)

1. Method of Evaluation

UG	PG
Quizzes/Tests, Assignments (30%)	Quizzes/Tests, Assignments, seminar (50%)
Mid Examination (20%)	End semester (50%)
End examination (50%)	

2. Passing Criteria

Scale	PG	UG
Out of 10 point scale	SGPA – "6.00" in each semester CGPA – "6.00" Min. Individual Course Grade – "C" Course Grade Point – "4.0"	SGPA – "5.0" in each semester CGPA – "5.0" Min. Individual Course Grade – "C" Course Grade Point – "4.0"

*for PG, passing marks are 40/100 in a paper
*for UG, passing marks are 35/100 in a paper

3. Pedagogy

- Blackboard
- Presentation
- Class Test
- Quizzes
- Voiceover Presentation & Video lectures
- Assignments
- NPTEL videos
- YouTube videos
- Concept diary (needs to be maintained by students-short and concise notes that include course concepts that he/she has understood)

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4. References:

Text Books	Web resources	Journals	Reference books
1) Computer Graphics- C version, Second Edition, Pearson, Donald D. Hearn and M. Pauline Baker 2) Computer Graphics with OpenGL, Fourth Edition, Pearson, Donald D. Hearn, M. Pauline Baker and Warren Carithers	https://youtube.com/results?search_query=Computer+Graphics+IIT+Madras		1) Mathematical Elements for Computer Graphics, Second Edition, McGraw Hill, David F. Rogers and J. Alan Adams 2) Procedural Elements for Computer Graphics, Second Edition, McGraw Hill, David F. Rogers

GUIDELINES TO STUDY THE SUBJECT

Instructions to Students:

1. Go through the 'Syllabus' in the Black Board section of the website (https://learn.upes.ac.in) in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture Notes section. These are our lecture notes. Make sure you use them during this course.
4. Check your blackboard regularly
5. Go through study material
6. Check mails and announcements on blackboard
7. Keep updated with the posts, assignments and examinations which shall be conducted on the blackboard

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8. Be regular, so that you do not suffer in any way
9. **Cell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.
12. **Online Content:** Over 30% of your syllabus will be covered in fully online mode, Details of which is mentioned in the Syllabus details section.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail to your concerned faculty. Please use an appropriate subject line to indicate your message details.

There will no doubt be many more activities in the coming weeks. So, to keep up to date with all the latest developments, please keep visiting this website regularly.

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RELATED OUTCOMES

1. The expected outcomes of the Program are:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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2. The expected outcomes of the Specific Program are: (upto3)

PSO1	Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques,
PSO2	Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.
PSO3	Able to design, develop and deploy Mobile Applications (Apps) and protocols for Ubiquitous computing.

3. The expected outcomes of the Course are: (minimum 3 and maximum 6)

CO 1	Explore various graphics display devices and use graphical tool OpenGL.
CO 2	Apply scan converting algorithms to create various geometrical shapes.
CO 3	Carry out complex 2D and 3D geometric transformations.
CO 4	Design and develop curves and surfaces of higher order.

4. Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO 2	1	1	2	-	-	-	-	-	-	-	-	-	2	-	-
CO 3	1	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO 4	1	2	2	-	2	-	-	-	-	-	-	-	1	1	-
Average	1	1.8	2	0.4	0.8								1.2	0.2	

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5. Course outcomes assessment plan:

components / Course Outcomes	Assignment	Test/Quiz	Mid Semester	End Semester	Any other
CO 1	√	√	√	√	☐
CO 2	√	√	√	√	☐
CO 3	√	√	√	√	☐
CO 4	√	√	√	√	☐

BROAD PLAN OF COURSE COVERAGE

Course Activities:

S. No.	Description	Planned			Remarks
		From	To	No. of Sessions	
1.	**UNIT -1** **Introduction to computer graphics :** Overview of computer graphics, Raster /Random scan display, Calligraphic refresh graphics , Display Input and output Device(CRT) Introduction to OpenGL GL,GLU,GLUT 3D Viewing Pipeline, Demo of OpenGL code.			4	ONLINE CONTENT (Voice over PPT and Lecture Notes) 1 Synchronous and 3 Asynchronous Quiz 1
2.	**UNIT 2:** **Scan conversion-Lines, Circles and Ellipses. Polygon Filling Algorithms and**			8	6 Synchronous and 2 Asynchronous Lecture (Online Lectures over Blackboard Collaborate and Offline Content via

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	Clipping Algorithms Points & lines: Line drawing algorithms DDA algorithm Bresenham's line algorithm Problems of Aliasing ,end point and clipping lines Circle generation algorithms Ellipse generating algorithm Scan line polygon Flood fill algorithm Boundary fill algorithm Point clipping Line clipping Liang-Barsky line clipping algorithm Cohen Sutherland line clipping algorithm Polygon clipping Sutherland –Hodgman algorithm Weiler-Atherton Polygon clipping Text clipping				Voice Over PPT and Lecture Notes) Test 1
3.	**UNIT-3:** **2D Transformations** Homogenous coordinate system (HCS). Translation Rotation Scaling Shearing Composite transformation Window to viewport transformations Rotation about point Reflection about a line			5	4 Synchronous sessions for Lecture and 1 session for doubt clearance

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4.	**UNIT-4:** **3D Transformations** Translation Rotation scaling Instance Rotation about an arbitrary axis in space reflection through an arbitrary plane polygon meshes			4	3 Lectures on Blackboard Collaborate and 1 OFFLINE Session via Voice over PPt and Lecture Notes Quiz 2
5.	**UNIT-5:** **Curves** Curve Representation, Non Parametric curves Cubic Splines Bezier Curves B-spline curves Rational B-spline curves Curved surfaces Quadric Surfaces Bezier Surfaces fractal – geometry			6	4 Synchronous and 2 Asynchronous Lecture (Online Lectures over Blackboard Collaborate and Offline Content via Voice Over PPT and Lecture Notes)
6.	**UNIT-6:** **Hidden Surfaces** Techniques for Efficient VSD, Depth comparison, Z-buffer algorithm, Back face detection, *BSP tree method, *The Printer's algorithm, Scan-line algorithm, Hidden line elimination, Area sub division methods			5	3 Synchronous and 2 Asynchronous Lecture (Online Lectures over Blackboard Collaborate and Offline Content via Voice Over PPT and Lecture Notes) Test 2
7.	**UNIT-7:** **Color & Shading** Transparency, Shadows, Constant – Intensity shading,			4	3 Synchronous and 1 Asynchronous Lecture (Online Lectures over Blackboard Collaborate and Offline Content via

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	Gouraud Shading, Phong shading, Wireframe –visibility methods, Recursive ray, tracing algorithm , Radiosity model				Voice Over PPT and Lecture Notes)

Synchronous Sessions: Lectures done through Blackboard Collaborate

Asynchronous Sessions: Lectures Content will be uploaded on Blackboard via Voice over PPt and Handwritten Lecture Notes

Sessions: Total No. of Instructional periods available for the course

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SESSION PLAN

UNIT-I

Lecture No.	Topics to be Covered	CO Mapped
1	Detailed Overview of the Course plan: Discussion on mode of delivery i.e. classroom /blackboard. Computer Graphics overview and its various applications	CO1
2	Pixels, Raster and Random scan display, Frame buffers.	CO1
3	CRT, Rasterization, Horizontal retrace and Vertical Retrace. Introduction to various 3D APIs and Introduction to OpenGL.	CO1, CO2
4	Discussion on various Libraries and its Programming syntax. OpenGL Rendering Pipeline and Demo of OpenGL code.	CO1

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SESSION PLAN

UNIT-II

Lecture No.	Topics to be Covered	CO Mapped
1	Overview of point and lines, their equations: Points & lines Line drawing algorithms DDA algorithm	CO2
2	Bresenham's line algorithm Problems of Aliasing ,end point and clipping lines	CO2
3	Circle generation algorithms Ellipse generating algorithm	CO2
4	Introduction to various polygon filling Techniques: Scan Line	CO2
5	Flood fill algorithm Boundary fill algorithm Introduction to Window and Viewport, Point clipping Line clipping.	CO2, CO3
6	Cohen Sutherland line clipping algorithm, with numerical	CO2
7	Liang-Barsky line clipping algorithm with numerical and other doubts related to clipping	CO2
8	Polygon clipping: Sutherland –Hodgman algorithm Weiler-Atherton Polygon clipping Text clipping	CO2

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SESSION PLAN

UNIT-III

Lecture No.	Topics to be Covered	CO Mapped
1	Homogenous coordinate system (HCS). Translation Rotation Scaling	CO3
2	Shearing Composite transformation Window to viewport transformations	CO3 , CO4
3	Rotation about point. Reflection about a line.	CO3
4	Doubt clearing session on Composite transformations and Numerical.	CO3 , CO4
5	Doubt Clearance Session/Pending Topics. **Quiz 1 (Online)**	CO3

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4. Target : Level-1 — P: NA
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SESSION PLAN

UNIT-IV

Lecture No.	Topics to be Covered	CO Mapped
1	3D transformations: Translation Rotation Scaling Instance MID SEM	CO3 , CO4
2	Rotation about an arbitrary axis in space, with numerical	CO3
3	Reflection through an arbitrary plane with numerical	CO3, CO4
4	Polygon Meshes	CO3

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SESSION PLAN

UNIT-V

Lecture No.	Topics to be Covered	CO Mapped
1	Curve Representation(Introduction) : Non Parametric curves, Conic sections, Cubic Splines	CO4
2	Cubic Splines continued from Previous Lecture. Conic Sections(2D-Curves)	CO4 , CO3
3	B-Spline Curve	CO4, CO2
4	Bezier Curves and its Properties.	CO4
5	Bezier surfaces and Fractals	CO4
6	Pending topics and Numerical on the Curves.	CO4 , CO3

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4. Target : Level-1 — P: NA
   C: 3

SESSION PLAN

UNIT-VI

Lecture No.	Topics to be Covered	CO Mapped
1	Techniques for Efficient VSD, Depth comparison, Z-buffer algorithm	CO1
2	Back face detection, BSP tree method,	CO2
3	The Painter's algorithm, Scan-line algorithm,	CO3 , CO4
4	Hidden line elimination, Area sub division methods	CO4
5	Pending topics in VSD: Numerical on VSD Quiz 2 (Online)	CO3

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SESSION PLAN

UNIT-VII

Lecture No.	Topics to be Covered	CO Mapped
1	Transparency, Shadows, Constant – Intensity shading,	CO3, CO4
2	Gouraud Shading, Phong shading,	CO2 , CO4
3	Wireframe –visibility methods Recursive ray tracing algorithm Radiosity model	CO4
4	Class Test	
	END SEM	