

FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

Father Agnel Ashram, Bandstand, Bandra-West, Mumbai-50.

Department of Information Technology

B.E. (I.T.) (Semester V) (2020-2021)

Lecture Plan

Subject: Computer Graphics & Virtual Reality

Credits: 04

Syllabus:

Course Code	Course Name	Credits
ITDLO5015	Computer Graphics & Virtual Reality	04

Module	Detailed Contents	Hrs
0	Pre-requisite: Knowledge of Mathematics	02
01	Introduction: Display Devices, Bitmap and Vector based graphics, Overview of Coordinate System. Scan Conversion of: point, line using Digital differential analyzer & Bresenham's algorithm, circle using midpoint approach, Curve Generation: Bezier and B-Spline curves. Introduction to fractals: generation procedure, classification, dimension and Koch Curve.	07
02	Area filling: Inside/Outside Test, Scan line Polygon Fill Algorithm, Boundary Fill and Flood Fill algorithm. Basic Geometrical 2D Transformations: Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation and Composite transformation. Three Dimensional transformations: Translation, Scaling, Rotations, Composite.	08
03	Viewing: Introduction, Viewing Pipeline, View Coordinate reference frame, Window to viewport transformation. Three-Dimensional Viewing: 3D Pipeline, Viewing transformation, Projections: Parallel (Oblique and orthographic), Perspective (one Point) Clipping: Point clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky algorithms, Polygon clipping: Sutherland Hodgeman polygon clipping and Weiler Atherton. Text Clipping.	10
04	Animation: Key Frame Animation, Animation Sequence, Motion Control Methods, Morphing, Warping- Mesh Warping.	04
05	Virtual Reality: Basic Concepts, Overview and perspective on virtual reality, Human sensation and perception. Classical Components of VR System, Types of VR Systems, Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces, Input Devices, Graphical Display, Sound displays, and Haptic Feedback. Graphical Rendering Pipeline, Haptic Rendering Pipeline, Open GL rendering pipeline. Applications of Virtual Reality.	09
06	Geometric Modeling: Virtual Object Shape, Object Visual Appearance. Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies	12

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	Physical Modeling: Collision Detection, Surface Deformation, Force Computation. Behavior Modeling. Programming through VRML/X3D: Defining and Using Nodes and Shapes, VRML Browsers, Java 3D, OpenCV for augmented reality	
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Text Books

1. Donald Hearn and M. Pauline Baker, “Computer Graphics”, Pearson Education.
2. R. K Maurya, “Computer Graphics with Virtual Reality”, Wiley India.

Reference Books

1. Grigore Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley.
2. Steven Harrington, “Computer Graphics”, McGraw Hill.
3. Rogers, “Procedural Elements of Computer Graphics”, Tata McGraw Hill.
4. Vince, “Virtual Reality Systems”, Pearson Education.
5. F.S. Hill, Stephen M. Kelley, “Computer Graphics using Open GL” Prentice Hall
6. Samyak Datta, “Learning OpenCV 3 Application Development”, Packt

Assessment:

Internal Assessment for 20 marks:

Consisting of Two Compulsory Class Tests

Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

End Semester Examination: Some guidelines for setting the question papers are as:

- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions, each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus.**
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

Outcomes:

CO1	To list the basic concepts used in computer graphics.
CO2	To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
CO3	To describe the importance of viewing and projections.
CO4	To define the fundamentals of animation, virtual reality and its related technologies.

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CO5	To understand a typical graphics pipeline.
CO6	To design an application with the principles of virtual reality.

CO-PO and CO-PSO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3									3		3	3	2
CO2	3	3	3	3					3	3		3	3	3
CO3	3	3	3	3					3	3		3	3	3
CO4	3	3			3				3	3		3	3	3
CO5	3								3	3		3	3	3
CO6	3		3	3	3				3	3		3	3	3

1-Low correlation (Low), 2-Medium correlation (Medium), 3-High correlation (High)

CO Assessment tools with target

Course Outcome	Direct Methods				Indirect Method
	Test 1	Test 2	Quiz	University Theory Result	
CO1	30%		20%	50%	100%
CO2	30%		20%	50%	100%
CO3	30%		20%	50%	100%
CO4		30%	20%	50%	100%
CO5		30%	20%	50%	100%
CO6		30%	20%	50%	100%

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Lecture Plan:

No of classes Planned:	42	No of Classes taken:	46	
Sr. No.	Topic Planned	Planned Date	Actual Date	Delivery Mechanisms
1.	Display Devices, Bitmap and Vector based graphics	10/07/20	10/07/20	Board + PPT
2.	Overview of Co-ordinate System	13/07/20	13/07/20	Board + PPT
3.	Scan Conversion of: point, line using Digital differential analyzer	14/07/20	14/07/20	Board + PPT
4.	Bresenham’s algorithm	16/07/20	16/07/20	Board + PPT
5.	Circle using midpoint approach	17/07/20	17/07/20	Board + PPT
6.	Bezier curves	20/07/20	20/07/20	Board + PPT
7.	B-Spline curves	21/07/20	21/07/20	Board + PPT
8.	Introduction to fractals, Koch Curve	23/07/20	23/07/20	Board + PPT
9.	Inside/Outside Test, Scan line Polygon Fill Algorithm	24/07/20	24/07/20	Board + PPT
10.	Boundary Fill and Flood Fill algorithm.	27/07/20	27/07/20	Board + PPT
11.	Translation, Rotation in 2D Transformation	28/07/20	28/07/20	Board + PPT
12.	Scaling, Reflection, Shear in 2D Transformation	30/07/20	30/07/20	Board + PPT

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13.	Homogeneous Matrix representation and Composite transformation	31/07/20	31/07/20	Board + PPT
14.	Translation, Scaling, Rotations, Composite in 3D Transformation	03/08/20	03/08/20	Board + PPT
15.	Introduction, Viewing Pipeline, View Coordinate reference frame	04/08/20	04/08/20	Board + PPT
16.	Window to viewport transformation	06/08/20	06/08/20	Board + PPT
17.	3D Pipeline, Viewing transformation	07/08/20	07/08/20	Board + PPT
18.	Parallel (Oblique and orthographic)	10/08/20	10/08/20	Board + PPT
19.	Perspective (one Point)	11/08/20	11/08/20	Board + PPT
20.	Point clipping, Line clipping: Cohen Sutherland Algorithm	13/08/20	13/08/20	Board + PPT
21.	Liang Barsky algorithms	14/08/20	14/08/20	Board + PPT
22.	Polygon clipping: Sutherland Hodgeman polygon clipping	17/08/20	16/08/20	Board + PPT
23.	Weiler Atherton. Text Clipping	18/08/20	17/08/20	Board + PPT
24.	Animation: Key Frame Animation, Animation Sequence	20/08/20	20/08/20	Board + PPT
25.	Motion Control Methods	21/08/20	21/08/20	Board + PPT
26.	Morphing, Warping-Mesh Warping	31/08/20	31/08/20	Board + PPT
27.	Virtual Reality: Basic Concepts, Overview and perspective on virtual reality, Human sensation and perception	01/09/20	01/09/20	Board + PPT

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28.	Classical Components of VR System, Types of VR Systems	03/09/20	03/09/20	Board + PPT
29.	Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces	04/09/20	04/09/20	Board + PPT
30.	Input Devices, Graphical Display, Sound displays, and Haptic Feedback	07/09/20	07/09/20	Board + PPT
31.	Graphical Rendering Pipeline, Haptic Rendering Pipeline	08/09/20	08/09/20	Board + PPT
32.	Open GL rendering pipeline	10/09/20	10/09/20	Board + PPT
33.	Applications of Virtual Reality	11/09/20	11/09/20	Board + PPT
34.	Geometric Modeling: Virtual Object Shape, Object Visual Appearance.	21/09/20	22/09/20	Board + PPT
35.	Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies	22/09/20	24/05/20	Board + PPT
36.	Physical Modeling: Collision Detection, Surface Deformation, Force Computation	24/05/20	25/09/20	Board + PPT
37.	Behavior Modeling	25/09/20	28/09/20	Board + PPT
38.	VRML/X3D: Defining and Using Nodes and Shapes, VRML Browsers	28/09/20	29/09/20	Board + PPT
39.	Java 3D for augmented reality	29/09/20	01/10/20	Board + PPT
40.	OpenCV for augmented reality	01/10/20	05/10/20	Board + PPT
41.	University Paper Discussion	05/10/20	08/10/20	Board + PPT
42.	University Paper Discussion	06/10/20	09/10/20	Board + PPT
43.	Revision		16/10/20	Board + PPT

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44.	Revision		19/10/20	Board + PPT
45.	Revision		20/10/20	Board + PPT
46.	Revision		22/10/20	Board + PPT