Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus of DJS23 Honors Program in Immersive Technologies

With effect from the Academic Year: 2024-2025

Proposed scheme for Honors inImmersive Technologies (Academic Year 2024-2025)

Sr.	Course Code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th / Cb	O	P	O&P	Total SEA (B)		
Sem III																
1	DJS23ACH1301	Computer Graphics and Virtual Reality	4	--	--	4	40	--	40	60	--	--	--	60	100	**4**
Sem IV																
2	DJS23ALH1401	C# Programming Laboratory	--	4	--	2	--	25	25	--	--	--	25	25	50	**2**
Sem V																
3	DJS23ACH1501	Augmented Reality and Mixed Reality	3	--	--	3	40	--	40	60	--	--	--	60	100	**3**
4	DJS23ALH1501	Augmented Reality and Mixed Reality Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	**1**
Sem VI																
5	DJS23ACH1601	Game Design and Gamification	3	--	--	3	40	--	40	60	--	--	--	60	100	**3**
6	DJS23ALH1601	Game Design and Gamification Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	**1**
Sem VIII																
7	DJS23ACH1801	Metaverse	4	--	--	4	40	--	40	60	--	--	--	60	100	**4**
		Total	**14**	**8**	**0**	**18**	**160**	**75**	**235**	**240**	**50**	**0**	**25**	**315**	**550**	**18**

Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (mins)
Theory	a. Term Test 1 (based on 40 % syllabus)	15	45
	b. Term Test 2 (on next 40 % syllabus)	15	45
	c. Assignment / course project / group discussion /presentation / quiz/ any other.	10	--
	Total marks (a + b + c)	40	
Audit course	Performance in the assignments / quiz / power pointpresentation / poster presentation / groupproject / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory& Tutorial	Performance in the laboratory and tutorial.	50	

Continuous Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	60	2
	* Computer based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	--	As applicable
Practical	Performance of the practical assigned during the examination andthe output / results obtained.	--	2
Oral & Practical	Project based courses - Performance of the practical assignedduring the examination and the output / results obtained. Based on the practical performed during the examination and on theentire syllabus.	--	2

Prepared by Checked by Head of the Department Principal

Program: Artificial Intelligence & Machine Learning	S.Y. B.Tech	Semester: III
Course: Computer Graphics and Virtual Reality (DJS23ACH1301)		

Prerequisite: Basic Mathematics, C Programming

Course Objectives:

1. The course intends to introduce the students to fundamental knowledge and basic technicalcompetence in the field of computer graphics.
2. The course will introduce the basic concepts of Computer graphics.
3. The course will also acquaint the student with algorithms for generating and rendering graphical models, mathematics for geometrical transformations.
4. The course will also enable students to apply various techniques of projections, shading, illumination and lighting to graphical models.

Course outcomes: On successful completion of this course, learner will be able to:

1. Implement various algorithms to generate lines, circles, curves, fractals, and polygons and colour them.
2. Apply 2D and 3D Transformations, viewing, and projections on a given object.
3. Understand the concept of colour models, lighting, shading, and hidden surface elimination.
4. Understand the fundamentals of Animation, Virtual reality, the related technologies, and describe applicationsof Virtual Reality.

Computer Graphics and Virtual Reality (DJS23AMLHN1C1)		
Unit	**Description**	**Duration**
1	**Introduction to Computer graphics and Output Primitives:** Graphics primitives-pixel, resolution, aspect ratio, frame buffer, refresh rates, DisplayDevices, Bitmap and Vector based graphics, Overview of Coordinate system.Scan Conversion of - point, line using Digital differential analyser & Bresenham's algorithm, circle using midpoint approach and Bresenham. Polygons: Concave, Convex, Inside/Outside Test Area Filling: Scan line Polygon Fill Algorithm, Boundary Fill and Flood Fillalgorithm	10
2	**Two Dimensional and 3D Transformations and Projections**: 2D: Basic Geometrical 2D transformations- Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation, Viewing Pipeline, View Coordinate reference frame, Window to Viewport Transformation, Point Clipping, Line clipping: Cohen Sutherland Algorithm,Liang Barsky Algorithms, Polygon Clipping: Sutherland Hodgeman PolygonClipping and Weiler Atherton, Text Clipping. 3D: Three Dimensional Transformations: Translation, Rotation, Scaling, Rotation about an arbitrary axis Three-Dimensional Viewing Pipeline, Viewing Transformation, Projections: Parallel (Oblique and Orthographic), Perspective.	10

3	**Light, Color, Shading and Hidden Surfaces:** Properties of Light, Color Models - CIE chromaticity diagram, RGB, HSV, CMY Illumination Models, Phong Model, combined diffuse and specular reflections with multiple light sources, Warn Model Shading Algorithms: Introduction to Rendering, Halftone, Gouraud and Phong Shading Hidden Surfaces: Introduction, Back face detection and removal, Algorithms: z buffer, Painter's algorithm, Area Subdivision (Warnock).	10
4	**Curves:** Introduction to curves, interpolation and approximation, BlendingFunction, Bezier and B-spline curves **Fractals:** Introduction, Classification, Fractal Generation- Snowflake, Sierpinski Gasket, Koch Curve, Cantor Middle-Thirds Set, Hilbert Curve,Applications of Fractals.	08
5.	**Animation:** Animation Sequence, Animation Motion Control Methods, Morphing, Warping (only Mesh Warping). **Virtual Reality**: Basic Concepts, Classical Components of VR System,Types of VR Systems, Three-Dimensional Position Trackers, Navigation andManipulation Interfaces, Gesture Interfaces, Graphical Display, Sound displays, and Haptic Feedback. Input Devices, Graphical Rendering Pipeline,Haptic Rendering Pipeline, Open GL rendering pipeline. Applications of Virtual Reality	08
6	**Geometric Modeling:** Virtual Object Shape, Object Visual Appearance. Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies, Physical Modeling: Collision Detection, Surface Deformation, Force Computation. Behavior Modeling.	06
	TOTAL	52

Books Recommended:

Text books:

1. "Reality+: Virtual Worlds and the Problems of Philosophy', WW Norton, ISBN 13- 978-1324050346, 2023.
2. 'Virtual and Augmented Reality", Khanna Book Publishing, ISBN 13 978-9390779000, 2021.
3. "Computer Graphics C Version" Donald Hearn and M. Pauline Baker, 2nd Edition, Pearson Education 2018.
4. "Computer Graphics" Rajesh K. Maurya, , Wiley India Publication, 2018.
5. "Foundations of 3D Computer Graphics", MIT Press, ISBN 9780262017350 (ISBN10: 0262017350), 2012.

Reference Books:

1. "Multimedia Computing Systems and Virtual Reality (Innovations in Multimedia, Virtual Reality and Augmentation)", Taylor & Francis Ltd, ISBN: 978-1032048239, 2022.
2. "Computer Graphics", Samit Bhattacharya, Oxford Publication, 2018.
3. "Virtual & Augmented Reality For Dummies", Wiley, 2018
4. "Computer Graphics", Steven Harrington,McGraw Hill, 2017.
5. "Computer Graphics using Open GL" , F.S. Hill, Stephen M. Kelley, Prentice Hall, 2008.

Online Resources:

1. Computer Graphics - Course (nptel.ac.in)
2. Interactive Computer Graphics | Coursera
3. Introduction to Computer Graphics - Open Textbook Library (umn.edu)
4. https://ocw.mit.edu/courses/6-837-computer-graphics-fall-2012
5. Free Graphics Tutorial - Computer Graphics | Udemy
6. No Slide Title (stonybrook.edu)