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 DJS22 Honors Program in Immersive Technologies

Revision: 2 (2024)

With effect from the Academic Year: 2024-2025

Proposed scheme for Honors in Immersive 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 V																
1	DJS22AMHN1C1	**Computer Graphics**	4	--	--	4	35	--	35	65	--	--	--	65	100	**4**
Sem VI																
2	DJS22AMHN1C2	**Augmented Reality and Virtual Reality**	4	--	--	4	35	--	35	65	--	--	--	65	100	**4**
3	DJS22AMHN1L1	**Augmented Reality and Virtual Reality Laboratory**	--	2	--	1	--	25	25	--	25	--	--	25	50	**1**
Sem VII																
4	DJS22AMHN1C3	**Game Design and Gamification**	4	--	--	4	35	--	35	65	--	--	--	65	100	**4**
	DJS22AMHN1L2	**Game Design and Gamification Laboratory**	--	2	--	1	--	25	25	--	25	--	--	25	50	**1**
Sem VIII																
5	DJS22AMHN1C4	**Metaverse**	4	--	--	4	35	--	35	65	--	--	--	65	100	**4**
		Total	**16**	**4**	**0**	**18**	**140**	**50**	**190**	**260**	**50**	**0**	**0**	**310**	**500**	**18**

Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (hrs.)
Theory	One Term test (based on 40 % syllabus)	35	1
	Second Term test (next 40 % syllabus) / presentation / assignment / course project / group discussion / any other.		As applicable
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory & Tutorial	Performance in the laboratory and tutorial.	50	

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

Continuous Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	65	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	T.Y. B.Tech	Semester: V
Course: Computer Graphics (DJS22AMHN1C1)		

Prerequisite: Basic Mathematics, C Programming

Course Objectives: The course introduces the students to basic knowledge and technical competence in computergraphics. The course will introduce the basic concepts of Computer graphics. The course will also acquaint the student with algorithms for generating and rendering graphical models, and mathematics for geometrical transformations. The course will also enable students to apply various techniques of projection, shading, illumination and lighting to graphical models. Additionally, students will be introduced to the OpenGL graphicsAPI and its rendering pipeline.

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 color them.
2. Apply 2D and 3D Transformations, viewing, and projections on a given object.
3. Understand the concept of color models, lighting, shading, and hidden surface elimination.
4. Understand the fundamentals of animation.
5. Understand the architecture and rendering pipeline of the OpenGL graphics API.

Computer Graphics (DJS22AMLHN1C1)		
Unit	**Description**	**Duration**
1	**Introduction to Computer graphics and Output Primitives:** Graphics primitives- pixel, resolution, aspect ratio, frame buffer, refresh rates, Display Devices, Bitmap and Vector based graphics, Overview of Coordinate system. Scan Conversion of - point, line using Digital differential analyzer & Bresenham algorithm, circle using midpoint approach. **Polygons:** Concave, Convex, Inside/Outside Test, **Area Filling:** Scan line Polygon Fill Algorithm, Boundary Fill and Flood Fill algorithm	08
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, Window to Viewport Transformation, Point Clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithms, Polygon Clipping: Sutherland Hodgeman Polygon Clipping 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,	10

	Gouraud and Phong Shading Hidden Surfaces: Introduction, Back face detection and removal, Algorithms: z buffer, Painter's algorithm, Area Subdivision (Warnock).	
4	**Curves:** Introduction to curves, interpolation and approximation, Blending Function, Bezier and B-spline curves **Fractals:** Introduction, Classification, Fractal Generation-Snowflake, SierpinskiGasket, Koch Curve, Cantor Middle-Thirds Set, Hilbert Curve, Applications ofFractals.	08
5.	**Introduction to Key Frame Animation,** Animation Sequence, Animation Motion Control Methods, Morphing, Warping (only Mesh Warping).	08
6.	**Introduction to OpenGL**: Evolution of OpenGL, Overview of OpenGL architecture, Comparison with other graphics APIs, OpenGL Rendering Pipeline, OpenGL Pipeline, Vertices and Primitives, Clipping and Projection, Rasterization, Texturing and Fog, Framebuffer, Per-fragment Operations.	08
	TOTAL	52

Books Recommended:

Text books:

1. Computer Graphics from Scratch, No Starch Press ISBN-13 : 978-1718500761, 13 May 2021.
2. Learn OpenGL: Learn modern OpenGL graphics programming, publisher Kendall & Wells, 17 June 2020.
3. Rajesh K. Maurya, "Computer Graphics", Wiley India Publication, 2011.
4. James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, "Computer Graphics Principles and Practice in C",2nd Edition, Pearson Publication, 2002.
5. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", 2nd Edition, Pearson Education, 1997

Reference Books:

1. Samit Bhattacharya, "Computer Graphics", Oxford Publication, 2015.
2. F.S. Hill, Stephen M. Kelley, "Computer Graphics using Open GL" Prentice Hall, 2007.
3. Steven Harrington, "Computer Graphics", McGraw Hill, 1983.
4. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V, John Kessenich,Graham Sellers, Dave Shreiner Addison, Wesley Professional Edition: 9th Edition, 2016.

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)