Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

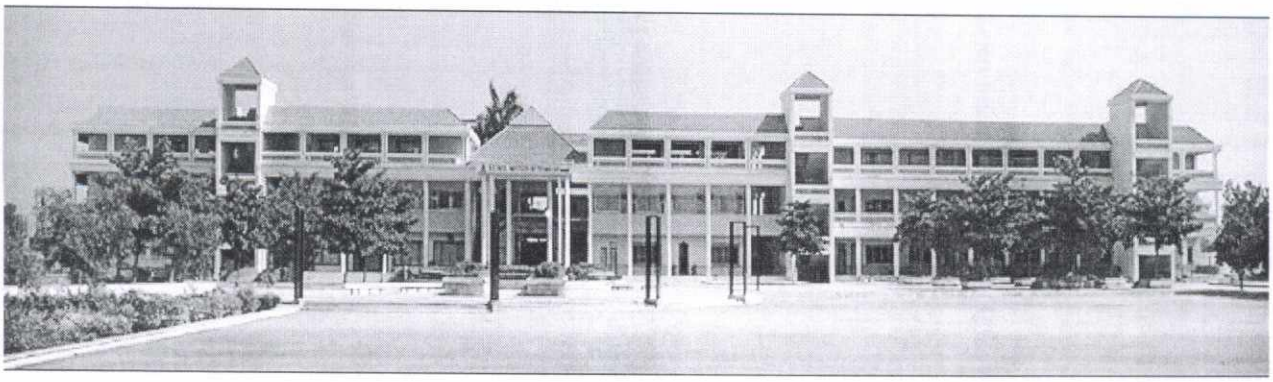
(An Autonomous Institute)

Course Structure and Syllabus

Honors Degree Program in Immersive Technologies

Artificial Intelligence and Machine Learning

With effect from Year 2025-26



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Honors Degree Program in Immersive Technologies (w.e.f. 2025-26)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
Sem-III														
1	H1	RCP23AH1201	Computer Graphics and Virtual Reality	4			25	15	15	15	60	100	4	4
Sem-IV														
2	H1	RCP23AH1251L	C# Programming Laboratory			4	25				25	50	2	2
Sem-V														
3	H1	RCP23AH1301	Augmented Reality and Mixed Reality	3			25	15	15	15	60	100	3	4
	H1	RCP23AH1301L	Augmented Reality and Mixed Reality Laboratory			2	25				25	50	1	
Sem-VI														
4	H1	RCP23AH1351	Game Design and Gamification	3			25	15	15	15	60	100	3	4
	H1	RCP23AH1351L	Game Design and Gamification Laboratory			2	25				25	50	1	
Sem-VIII														
5	H1	RCP23AH1451	Metaverse	4			25	15	15	15	60	100	4	4
			Total	14		8	175			60	315	550	18	

Prepared by:
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Prof. S. P. Shukla
C.O.E.

Prof. Dr. P. J. Deore
Dean Academics/Dy. Director

Prof. Dr. J. B. Patil
Director

R. C. Patel Institute of Technology, Shirpur
SES
Autonomous

Semester - III

Program: Honors Degree Program in Immersive Technologies Artificial Intelligence and Machine Learning	S. Y. B.Tech	Semester: III
Computer Graphics and Virtual Reality (RCP23AH1201)		

Prerequisite: Basic Mathematics, C Programming

Course Objectives:

1. The course intends to introduce the students to fundamental knowledge and basic technical competence 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 completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement various algorithms to generate lines, circles, curves, fractals, and polygons and colour them.	L3	Apply
CO2	Apply 2D and 3D Transformations, viewing, and projections on a given object	L3	Apply
CO3	Understand the concept of colour models, lighting, shading, and hidden surface elimination.	L2	Understand
CO4	Understand the fundamentals of Animation, Virtual reality, the related technologies, and describe applications of Virtual Reality.	L2	Understand

Course Contents

Unit-I — 10 Hrs.

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 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

Unit-II — 10 Hrs.

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 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

Unit-III — 10 Hrs.

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).

Unit-IV — 08 Hrs.

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.

Unit-V — 08 Hrs.

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 and Manipulation 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.

Unit-VI 06 Hrs.

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.

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. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version" , 2nd Edition, Pearson Education 2018.
4. Rajesh K. Maurya, "Computer Graphics", 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. Samit Bhattacharya, "Computer Graphics", Oxford Publication, 2018.
3. "Virtual & Augmented Reality For Dummies", Wiley, 2018
4. "Computer Graphics", Steven Harrington,McGraw Hill, 2017.
5. F.S. Hill, Stephen M. Kelley, "Computer Graphics using Open GL", 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)