Shirpur Education Society's

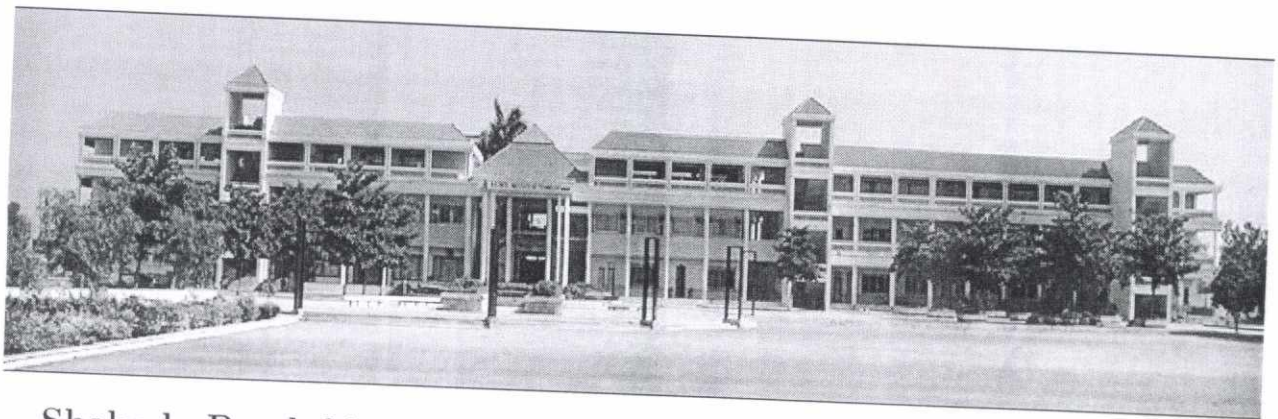
R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Honors Degree Program in Immersive Technologies Artificial Intelligence and Machine Learning

With effect from Year 2024-25



Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Honors Degree Program in Immersive Technologies (w.e.f. 2024-25)

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	RCP23ACH1301	Computer Graphics and Virtual Reality	4			25	15	15	15	60	100	4	4
Sem-IV														
2	H1	RCP23ALH1401	C# Programming Laboratory			4	25				25	50	2	2
Sem-V														
3	H1	RCP23ACH1501	Augmented Reality and Mixed Reality	3			25	15	15	15	60	100	3	4
	H1	RCP23ALH1501	Augmented Reality and Mixed Reality Laboratory			2	25				25	50	1	
Sem-VI														
4	H1	RCP23ACH1601	Game Design and Gamification	3			25	15	15	15	60	100	3	4
	H1	RCP23ALH1601	Game Design and Gamification Laboratory			2	25				25	50	1	
Sem-VIII														
5	H1	RCP23ACH1801	Metaverse	4			25	15	15	15	60	100	4	4
			Total	14		8	175			60	315	550	18	

Prepared by:
Ms. S. P. Salunkhe

Checked by:
Dr. P. S. Sanjekar

Prof. Dr. U. M. Patil
BOS Chairman

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

Semester - V

Program: Honors Degree Program in Immersive Technologies Artificial Intelligence and Machine Learning	T. Y. B.Tech	Semester: V
Augmented Reality and Mixed Reality (RCP23ACH1501)		
Augmented Reality and Mixed Reality Laboratory (RCP23ALH1501)		

Prerequisite: Computer Graphics, Virtual Reality, C# Scripting, Unity.

Course Objective(s):

1. Understand the foundational principles, diverse applications across sectors (including healthcare, retail, and education), and future trends of Augmented Reality (AR) and Mixed Reality (MR), including the role of AI enhancement.
2. Develop practical skills in creating basic AR and MR experiences, encompassing real time data integration, digital content overlay, and spatial mapping techniques, with a specific focus on application within the gaming and entertainment industry's immersive design consideration.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the core concepts, technological foundations, and key differences between Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR), and identify the challenges and opportunities associated with AR and MR.	L2	Understand
CO2	Understand and develop basic AR applications, demonstrating an understanding of software components, content creation tools, and interaction techniques in augmented reality environments.	L2	Understand
CO3	Discover the benefits, limitations, and ethical considerations of implementing AR and MR solutions in fields like healthcare, retail, and education, considering the integration of AI for enhanced functionality.	L4	Analyse
CO4	Determine and explore the impact of AR and MR on the gaming and entertainment industry, analyze the technical and design elements of successful immersive experiences, and discuss emerging trends in this domain.	L3	Apply

Augmented Reality and Mixed Reality (DJS23AH1301) Course Contents

Unit-I — 06 Hrs.

Introduction to Augmented Reality (AR) and Mixed Reality (MR):

Augmented Reality: Definition and Scope, A Brief History, Displays (Multimodal Displays, Spatial Display Model, and Visual Displays), Strong vs Weak AR, Challenges in AR, Applications of AR, the role of AI and machine learning in AR.

Mixed Reality (MR): Definition, types of apps, working of MR, Differentiate between AR, VR and MR, virtuality continuum, structural elements, interactions, UX elements, MR applications.

Unit-II — 05 Hrs.

Building AR and MR Experiences: Creating AR applications, integrating real-time camera feed and overlaying digital content, environmental understanding, and spatial mapping in AR, Augmented Reality Systems, Software Components, Tools for Content Creation, Interaction in Augmented Reality, Augmented Reality Techniques. Object Detection and Tracking in AR/MR. Spatial Mapping and SLAM.

Unit-III — 07 Hrs.

AR and MR in Healthcare: AR/MR for Surgical Planning and Navigation: importance, traditional methods and its limitations, tracking technologies (optical, electromagnetic, or inertial), Integration with 3D models, AI, AR and MR Enhancements: AI Enhanced Image Registration, Guided Navigation, AI-Driven Instrument Tracking, VR for Remote Patient Care and Rehabilitation, Patient Data Analysis and Personalized Treatment using AI. Case studies of AR and MR use in specific surgical procedures (e.g., neurosurgery, orthopaedic surgery).

Unit-IV — 07 Hrs.

AR and MR in Retail: Overview of 3D product models, AR overlays: Virtual try-ons, Product visualization in real-world environments, In-store navigation and information overlays, Interactive product demonstrations. Benefits for Retailers and Customers, Visual Search and Product Recognition using AI, Personalized Shopping Experiences in AR/VR. Virtual Assistants and Conversational Commerce. Enhancing Customer Experience Through AR and MR: The Case of IKEA and Lowe's.

Unit-V — 07 Hrs.

AR and MR in Education: Principles of Interactive Learning Design, Visualizing Abstract Concepts: Exploring examples in STEM (e.g., molecular structures, anatomical models), Humanities (e.g.,

historical reconstructions), and Arts (e.g., interactive art exhibits). Interactive and Engaging Learning, Enhancing Existing Learning Materials: AR Quizzes and Games, Interactive Storytelling and Narratives, Interactive MR Activities: Virtual Object Manipulation, Collaborative MR Design and Building, AR/MR Creation Tools for Interactive Experiences. Case study on Transforming Learning Environments: The Integration of AR and MR at University of Maryland and EngageNY.

Unit-VI 07 Hrs.

Gaming and Entertainment in AR and MR: Primary goal, hardware devices, location-based AR and marker-based AR applications, current state of the AR and MR in Gaming Industry (Mechanics, target audience, and technical achievements), Examples: Beat Saber, HoloLens demos. AR games more addictive or engaging? Comparison with traditional gaming. gameplay immersion in MR environment, trends in gaming and entertainment. Case study on Transforming Gaming Experiences: The Evolution of Pokémon GO and Microsoft's Mixed Reality Gaming.

Augmented Reality and Mixed Reality Laboratory (DJS23AH1301L)

List of Laboratory Experiments

Suggested Experiments: (Any 08)

1. A literature survey on Immersive technology based on IEEE/Scopus-Indexed Publication)
2. Implement a script to display the device's camera feed as the background of the Unity scene.
    - Place a simple 3D object in the scene and ensure it renders correctly on top of the camera feed.
    - Basic user permission requests for camera access.
3. Implement marker-based AR using image tracking techniques.
    - Prepare a set of distinct image markers.
    - Import the markers into Unity and configure them for image tracking.
    - Attach 3D models or animations to the tracked markers.
    - Implement scripts to trigger events or animations when a marker is detected.
4. Environmental understanding and spatial mapping using plane detection.
    - Implement plane detection to identify horizontal and vertical surfaces in the real world.
    - Visualize the detected planes using Unity's debug tools.
    - Allow users to place 3D objects on the detected planes.
5. Build an interactive AR experience with object placement and manipulation.

- Create a library of 3D objects.
- Implement a UI for selecting and placing objects in the AR scene.
- Allow users to rotate, scale, and move the placed objects using touch gestures.
- Add simple collision detection.

6. Develop AR UI overlays to display information and enhance user experience.
   - Create UI elements (text, images, buttons) that overlay the AR camera feed.
   - Implement scripts to display dynamic information based on the user's environment or tracked objects.
   - Create interactive UI elements for user input and control.
7. Design a basic AR game using Unity's game development features.
   - Develop a simple AR game concept (e.g., target shooting, object collection).
   - Implement game mechanics using C scripting.
   - Incorporate UI elements for scoring, timers, and game feedback.
8. Explore the use of 3D product models or educational models in AR (Retail/Education Focus).
   - Import 3D models of products or educational objects (e.g., anatomical models).
   - Implement AR overlays to display product information or educational annotations.
   - Allow users to interact with the 3D models (e.g., rotate, zoom).
   - If using education models, add interactive elements to the model, like displaying information when a part is touched
9. Case study on Location-Based AR and MR.
10. Mini Project: (Any one)

    SDG 15: Life on Land - AR Biodiversity Explorer:
    - Users scan plants or animals with their mobile device.
    - AR overlays display information about the species, its habitat, and its role in the ecosystem.
    - The app highlights threats to biodiversity and encourages users to support conservation efforts.

    SDG 12: Responsible Consumption and Production - AR Product Lifecycle Viewer:
    - Users scan a product's barcode.
    - An AR overlay displays the product's lifecycle, from raw materials to disposal, highlighting environmental impacts.

- The app provides information about sustainable alternatives and encourages responsible consumption.

SDG 3: Good Health and Well-being- AR health education.

- Using AR, create an interactive and engaging educational experience about healthy eating, or exercise.
- For example, scanning food items, and displaying nutritional information, and recommended serving sizes.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books:

1. Kamal Kant Hiran, Ruchi Doshi, Mayank Patel, "Applications of Virtual and Augmented Reality for Health and Wellbeing", IGI Global Scientific Publishing, 2024.
2. Rakesh Kumar, "AR & VR for Gaming and Entertainment", 2024.
3. Indika Wijesooriya, "Mastering Augmented Reality Development with Unity: Create immersive and engaging AR experiences with Unity", BPB Publications, 2023.
4. Jalch Afshar, "Hands-On Augmented Reality Development with Meta Spark Studio: A Beginner's Guide", 2023.
5. "Augmented Reality (AR) in Retail. Opportunities and Challenges for Enhancing Customer Experience: A Case Study on "Westwing" Anonymous", 2025.
6. Vladimir Geroimenko, "Augmented Reality in Education: A New Technology for Teaching and Learning", 2021.
7. Chetankumar G Shetty, "Augmented Reality", 1st Edition, McGraw Hill, 2020.

Reference Books:

1. Frederik Dilling and Ingo Witzke, "Augmented and Virtual Reality in Mathematics Education: International Symposium on Augmented and Virtual Reality", 2022.
2. Bernard Marr, Dennis Kleinman, "Extended Reality in Practice: Augmented, Virtual and Mixed Reality", Gildan MEida Publisher, 2021.
3. Jesse Glover, "Complete Virtual Reality and Augmented Reality Development with Unity", Packt Publishing, 2021.

4. Alan B Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann Publishers, ISBN:978-0240824086, 2013.

Web Links:

1. NPTEL Course: https://onlinecourses.swayam2.ac.in/ntr24_ed76/preview
2. https://www.udemy.com/course/extended-reality-xr-building-ar-vr-mr-projects
3. https://www.coursera.org/learn/ar-technologies-video-streaming
4. https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality technologies-applications-issues
5. https://www.coursera.org/specializations/advanced-app-android