GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Computer Applications

Level: Post Graduate

Course / Subject Code: MC03094061

Course / Subject Name: Augmented Reality/Virtual Reality

w. e. f. Academic Year:	2025-26
Semester:	3
Category of the Course:	Elective Group-1

Prerequisite:	Basic knowledge of computer graphics, programming fundamentals, and linear algebra.
Rationale:	This course introduces the foundational concepts and tools used in Augmented Reality (AR) and Virtual Reality (VR). With the increasing use of immersive technologies in various industries, this course provides students with essential theoretical and practical knowledge using open-source platforms. Students will develop interactive AR/VR experiences and understand their application in education, healthcare, gaming, manufacturing, and more. **Pedagogy:** The course will be delivered through a blend of lectures, demonstrations, and project-based learning. Emphasis will be on experiential learning using open-source AR/VR platforms such as AR.js, A-Frame, and Unity with open plugins. Students will engage in hands-on lab sessions and mini-projects to build immersive applications. Regular assessments through quizzes, demos, and peer evaluations will ensure concept clarity and skill development. Collaborative activities and real-world case studies will enhance problem-solving and design thinking abilities.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes	RBT Level*
1	Explain the core concepts and technological components of AR and VR systems.	UN
2	Compare AR and VR platforms and frameworks based on features and usability.	AN
3	Develop basic AR applications using open-source tools like AR.js or Unity with open-source plugins.	AP
4	Create VR scenes and interactive content using tools like A-Frame or OpenXR-based engines.	CR
5	Evaluate challenges and ethical aspects in AR/VR system design and deployment.	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	Introduction to AR and VR: Evolution, definitions, applications; differences between AR, VR, MR, XR; hardware requirements; sensors; displays.	9	20%
2	AR Systems: Marker-based and markerless tracking; AR development tools overview (AR.js, Vuforia with Unity OpenXR plugin); Mobile AR concepts.	9	20%
3	VR Systems: VR devices, tracking and controllers; concepts of locomotion, field of view, immersion, and presence; using A-Frame for VR development.	9	20%
4	Interaction and Design in AR/VR: UI/UX for immersive systems; gestures and interaction models; spatial sound; design guidelines and ergonomics.	9	20%
5	Ethics, Challenges, and Case Studies: Ethical issues, privacy and data security, motion sickness, accessibility; real-world applications and case studies in healthcare, education, etc.	9	20%
	Total Hours:	**45**	**100%**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10%	20%	30%	20%	10%	10%

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

Reference Books:

1. Chetankumar G. Shetty, "Augmented Reality & Virtual Reality", Notion Press, 2022 (Open educational content)
2. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality", ACM Books, 2015
3. Alan B. Craig, "Understanding Augmented Reality: Concepts and Applications", Morgan Kaufmann
4. Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", O'Reilly Media
5. Joseph Hocking, "Unity in Action", Manning Publications (with focus on open-source compatible plugins)

Suggested Course Practical List: if any

To perform followings Lab work:

1	Set up development environment for AR/VR using open-source platforms.
2	Develop a basic marker-based AR application using AR.js.
3	Implement a markerless AR app for Android using Unity and AR Foundation.
4	Create a 3D virtual environment using A-Frame.
5	Add interaction and navigation to the virtual scene.
6	Integrate audio and spatial sound in VR scenes.
7	Experiment with gesture recognition using webcam-based input.
8	Conduct a usability test on designed AR/VR content.
9	Develop a mini-project using either AR or VR frameworks.

List of Laboratory/ Active Learning Assignment: If any

- Weekly coding assignments and tool configuration.
- Individual practical demos.
- Team-based AR/VR experience design project.

Platforms for Hands-on Learning

- AR.js Official Tutorial (https://github.com/AR-js-org/AR.js)
- A-Frame Documentation (https://aframe.io/docs/)
- Mozilla Hubs (Free VR spaces) (https://hubs.mozilla.com/)
- Unity Learn – Free AR/VR Projects (https://learn.unity.com/)
- 8thWall WebAR Demo Playground (https://www.8thwall.com/demos)

- Case Studies Collection: XR for Everyone – Unity Learn (Free) - https://learn.unity.com/project/xr-for-everyone
- Glitch.com – Open A-Frame Templates (https://glitch.com/@aframe)

CO- PO Mapping:

Semester	**Course Name :** Augmented Reality/Virtual Reality							
	POs							
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	2	-	-	-	-	1	-
CO2	2	3	-	2	-	-	1	-
CO3	2	2	3	3	2	-	-	-
CO4	2	3	3	3	3	-	-	-
CO5	2	2	2	1	-	2	2	2

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

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