

Branch Name:	Information and Communication Technology
Semester/Year:	Semester I / First Year
Subject Title:	Augmented Reality & Virtual Reality
Subject Code:	2ET2080105T
Pre-requisite:	-

Course Objective:

This course covers the development of Virtual/Augmented reality (VR/AR) worlds, including mathematical basis of motion and physics in VR/AR worlds, human visual perception, design practices to enable immersive experiences for users, and development on heterogeneous device hardware.

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCE		SEE		CCE		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction of Virtual Reality: Introduction, Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Virtuality and Immersion, Current trends and state of the art in immersive technologies, developing platforms and consumer devices.	3	11

2	Interactive Techniques in Virtual Reality: Introduction, From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.	4	16
3	Visual Computation in Virtual Reality: Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system.	4	16
4	Augmented and Mixed Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	5	21
5	Multiple Models of Input and Output Interface in Virtual Reality: Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML, Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output -- Visual /Auditory / Haptic Devices.	8	25
6	Application of VR In Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.	3	11

Review Presentation: The student is expected to spend minimum 2 hours per week (as mentioned in the teaching and evaluation scheme) to refer at least two peer reviewed journal papers related to this domain/subject. The student is expected to identify issues/challenges and emerging trends in the domain/subject. Student is supposed to explore various video lectures (E.g. NPTEL) available in the domain/subject. Student is required to make a review-presentation on the work carried out for the same. Recommended sites for journal papers are (1) dl.acm.org (2) springer.com (3) sciencedirect.com (4) elsevier.com (5) ieeexplore.ieee.org (6) scholar.google.co.in (7) scopus.com or similar of similar repute.

Course Outcome:

After learning the course, the students should be able to:

- understand and design of VR/AR technology relates to human perception and cognition
- Ability to design 3D interaction techniques
- Demonstrate understanding of fundamental computer vision, computer graphics and humancomputer interaction techniques related to VR/AR
- Demonstrate insights to key application areas for VR/AR
- Able to create applications of VR to the conduct of scientific research, training, and industrial design.

List of References:

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
4. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
5. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.
6. Grigore C. Burdea, Philippe Coiffet , “Virtual Reality Technology”, Wiley Inter Science, 2nd Edition, 2006.
7. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016
8. Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson Education India, 2016
9. Kent Norman (Ed), Wiley Handbook of Human Computer Interaction, Wiley 2017

E-Resources:

1. <https://www.coursera.org/learn/augmented-reality?ref=hackernoon.com>
<https://hackernoon.com/16-best-resources-to-learn-ar-and-vr-development-in-2019-a4fcee6281c>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand and design of VR/AR technology relates to human perception and cognition	2 Understanding, 6 Creating
CLO2	Ability to design 3D interaction techniques	2 Understanding
CLO3	Demonstrate understanding of fundamental computer vision, computer graphics and human computer interaction techniques related to VR/AR	2 Understanding,
CLO4	Demonstrate insights to key application areas for VR/AR	2 Understanding
CLO5	Able to create applications of VR to the conduct of scientific research, training, and industrial design.	5 Evaluate, 3 Applying, 4 Analyze

Mapping of CLOs with POs & PSOs

Course Learnin g Outcom es	Program Outcomes(POs)												Program Specific Outcomes (PSOs)			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CLO1	M										L		H			
CLO2	M	L	M	H		L			M				L	M		
CLO3	M	M	L	M							L			M		
CLO4			M	L				H	L				L			
CLO5	M	H		M							L			M		

H:High, M:Medium, L:Low